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JOINT MULTI-TACTICAL DATA LINK (TDL) OPERATING PROCEDURES

JOINT STAFF
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JOINT MULTI-TACTICAL DATA LINK OPERATING PROCEDURES (JMTOP)

References: See Enclosure B.

1. Purpose. This manual provides planning, guidance, and operating procedures to US forces for the employment of tactical data systems that exchange real-time or near-real-time information through the use of a Tactical Data Link (TDL).

2. Cancellation. CJCSM 6120.01B, 1 March 2000 is canceled.

3. Applicability. The guidance and procedures contained in this manual and its classified supplement are applicable to the Joint Staff, combatant commanders, Services, and Defense agencies.

4. Procedures. See Enclosure A.

5. Additional Copies of Manuals. Joint Staff directorates may obtain a limited number of additional copies of this manual from the Records Management and Automation Support Branch, Room 2B917. Combatant commanders, Services, Defense agencies, and all other holders are authorized to reproduce, print, and stock copies to meet internal distribution requirements.

6. Summary. The JMTOP provides authority, delineates responsibility, establishes procedures, provides guidance, and defines terms for the employment of Command and Control (C2), intelligence, and weapons systems. The JMTOP complements military standards and specifications that establish communications protocols and message standards for data link information exchange, i.e., MIL-STD-6004 (Link 4A), MIL-STD-6011 (Link 11/11B), MIL-STD 6013 (ATDL-1), STANAG 5501 (LINK 1), Interim JTIDS Message Specification (IJMS), and MIL-STD-6016 (Link 16).

7. Releasability. This manual is approved for limited release. DOD components (to include the combatant commands) and other Federal agencies may obtain copies of this manual through controlled Internet access only (limited to .mil and .gov users) from the CJCS Directives Home Page--http://www.dtic.mil/doctrine. Joint Staff activities may access or obtain copies of this instruction/manual/notice from the Joint Staff LAN.

8. Effective Date. This manual is effective upon receipt.

Approved & Secured with ApproveIT
by: JOHN P. ABIZAID, 26 July 2002, 06:23:46

JOHN P. ABIZAID
Lieutenant General, USA
Director, Joint Staff

Enclosures
A -- Joint Multi-TDL Operating Procedures
B -- References
GL -- Glossary

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CHAPTER 1

INTRODUCTION

1.1 General. The Joint Multi-Tactical Data Link Operating Procedures (JMTOP) provides procedures for operators who employ Tactical Data Links (TDLs) for planning, initializing, controlling, and terminating the exchange of real-time and near-real-time tactical data between Tactical Data Systems (TDSs) and defines responsibilities for these functions in non-NATO environments. This document provides authority, delineates responsibility, establishes procedures, provides guidance, and defines terms for the employment of Command and Control (C2), intelligence, and weapons systems. Commanders of forces operating as part of a multinational (alliance or coalition) military command should follow multinational doctrine and guidance ratified by the United States. For doctrine and procedures not ratified by the United States, commanders should evaluate and follow the multinational command's doctrine and procedures, where applicable. Refer to Allied Data Publication (ADatP) 33 for NATO operations.

1.2 Scope. This manual addresses TDL information exchange on the basic interface, consisting of Link 11, Link 11B, and Link 16, and the extended interface, consisting of Link 4A, the Interim Joint Tactical Information Distribution System (JTIDS) Message Specification (IJMS), Army Tactical Data Link-1 (ATDL-1), and Link 1. Chapter 2 describes the TDL interface in terms of interface units and configuration, TDLs, voice coordination nets required for tactical operations, and the JTIDS/Multifunction Information Distribution System (MIDS) network. Chapter 3 delineates the responsibilities for the planning, initiating, conducting and terminating operations that employ TDL communications. Chapter 4 provides the common TDL procedures necessary for planning any TDL interface. Chapter 5 provides interface-operating procedures for real-time information exchange between operators. It also specifies normal procedures to establish, initialize, enter, and change the multi-TDL interface. Chapter 6 provides procedures for the control of aircraft using voice and TDL communications. Chapter 7 describes the interface capability for training using exercise and simulated tracks, and provides procedures for their use.

1.3 Content. This manual contains the following appendices and enclosures:

a. Appendix A, Service Appendices. TAB 1 contains descriptions of TDSs, their interface related characteristics, and detailed technical information

on systems that employs TDLs to establish an automated interface with adjacent systems. Appendix A also contains information such as missions and technical functions; data link capabilities; track reporting (types, position limits, capacities, correlation/decorrelation, identification, track quality); and data filtering. In addition to Link Platform Capabilities, Tab 2 contains Service Specific Procedures and Tab 3 contains a NATO Term Cross-reference Guide.

NOTE: Portions of Appendix A are included in the classified supplement.

b. Appendix B, "OPTASK LINK Message Guidance", directs the user to MIL-STD-6040 OPTASK LINK USER FORMAT.

c. Appendix C, "Link 11 Establishment and Maintenance", provides detailed operational procedures for the establishment and maintenance of the Link 11 interface.

d. Appendix D, "Link 16 Establishment and Maintenance", provides detailed operational procedures for the establishment and maintenance of the Link 16 interface.

e. Appendix E, "Link 11B Establishment and Maintenance", provides detailed operational procedures for the establishment and maintenance of the Link 11B interface.

f. Appendix F, "IJMS Establishment and Maintenance", provides procedures for establishing and maintaining JTIDS/MIDS with respect to IJMS.

g. Appendix G, "Link 4A Establishment and Maintenance" provides procedures for controlling aircraft using Link 4A. This appendix also contains Service Specific Procedures. Appendix G is contained in the classified supplement.

h. Appendix H, "ATDL-1 Establishment and Maintenance" provides procedures for establishment and maintenance of ATDL-1.

i. Appendix I, "Link-1 Establishment and Maintenance", provides procedures for establishment and maintenance of Link 1.

j. Appendix J, "Data Link Interface Operator Fidelity Drills", this appendix describes battle management action fidelity drills and covers the command and alert actions used by C4I battle managers, weapons controllers, air intercept controllers, etc.

k. Appendix K, “Link Management Codes”, this appendix provides a comprehensive list of Data Link Management Codes and Brevity Words.

l. Enclosure B, “References”, lists references and other documents that define interface data standards and engineering design standards.

m. “Glossary” establishes acronyms and abbreviations used in this manual and other selected terms. It provides the standard terminology essential to effective and efficient TDL interface operations. Use of these terms allows common understanding for data and voice coordination.

1.4 Applicability. The Service/Agencies (S/As) of the Department of Defense shall use these procedures when a TDL is established between joint S/A TDSs and/or weapon systems. The S/As are responsible for developing detailed operator procedures applicable to their TDSs and ensuring that those procedures are implemented, and that Service operators are trained in these multi-link procedures. In all cases of conflict between this manual and other publications, this manual takes precedence. Users are requested to inform the Military C2 Standards Division under DISA Interoperability directorate (IN51), via appropriate S/A channels, of all such cases.

NOTE: For NATO operations, the NATO Operational Commander makes the decision which procedures to follow, the CJCSM 6120.01 (series), ADatP-33 or the single link ADatPs.

1.5 Terminology. Link 16 provides an increased capability over previous data links to exchange real-time information. This affords Link 16 the ability to incorporate data elements used in Link 11 and Link 11 B messages in addition to new data elements used in Link 16 messages. To simplify and standardize terminology used in this manual, Link 16 terminology will take precedence and is used throughout this manual.

1.6 Consistency. The JMTOP ensures that differences between data links are as transparent to operators as possible. The capabilities and procedures are specified so they are applicable generally to any link operation; i.e., Link 11 only, Link 11B only, Link 16 only, or interfaces of Link 11, Link 11B, and Link 16, unless otherwise stated. In a multi-Link equipped unit, operators, other than those responsible for link establishment and maintenance, may not know the link source of the displayed information.

1.7 Conventions. The following terminology conventions are used throughout this manual:

a. “Shall” indicates a mandatory procedure that is essential to proper interface operations.

b. “Should” indicates a recommended procedure to be used unless the operational situation dictates otherwise.

c. “May” either indicates an operational or alternative procedure to be considered or an optional capability that is not necessarily implemented in all units.

d. “Can” indicates a capability available for use, if implemented.

e. “Automatically” indicates a function or action that is executed by a TDS computer without operator stimulus or other operator action.

f. “Will” and “is/are” are generally used descriptively for information purposes.

g. “He” means “he or she.”

h. “Operator” is the person entering and receiving tactical information within a TDS conducting military operations. No attempt is made to specify the operator position or title expected to carry out specified actions, because these vary among platforms. Exceptions are made for some specific force authorities and a few examples.

i. “Miles” means data miles unless otherwise specified.

CHAPTER 2

MULTI-TDL INTERFACE DESCRIPTION

2.1 General. This chapter provides a technical description of each TDL, establishes the requirement for each voice coordination net or circuit that supports TDL operations, and defines the general TDL capabilities of each Service TDS.

2.2 Interface Description

2.2.1 Concept. Command, control, and communications systems should be reliable, survivable, flexible, interoperable, timely, and secure. This concept of joint combat operations is supported by the exchange of tactical information between participants on a real-time or near-real-time basis with TDLs. The exchange of real-time tactical information between C2 systems, weapon systems, and intelligence systems provides mutual support, allows coordinated action, and prevents interference between interfaced forces for the efficient and effective application of military force. This concept is applicable at all echelons of military action, whether single service, joint, or combined operations.

2.2.2 Information Exchange. The interface provides for the continuous exchange of information concerning space, air, land, surface, and subsurface tracks. In addition, information on friendly units, the status of weapons and engagements, and other tactical data may be exchanged. Information on the tactical situation for the entire area of operations under the surveillance of the systems involved is provided to the joint commander and his components. The interface also provides commanders with the capability to digitally transmit certain commands to subordinates and requests to other component commanders.

2.2.3 Special Information Systems Support. Special Information Systems (SIS) that interface with C2 and weapons systems via data link can be tasked to provide support through the identification of Essential Elements of Information (EEI). Requests for SIS support should be coordinated with the SIS manager.

2.2.4 Technical Functions. The exchange of data has been designed to support joint operations involving the following technical functions:

a. System information exchange and network management.

b. System position and identification.

c. Space surveillance.

d. Air surveillance.

e. Land surveillance.

f. Surface surveillance.

g. Subsurface surveillance.

h. Electronic warfare.

i. Intelligence.

j. Mission management.

k. Weapons coordination and management.

l. Control.

m. Information management.

2.3 Interface Elements. The interface consists of three elements: Interface Units, data link(s), and voice coordination.

2.3.1 Interface Units (IU). An IU is a TDS that is directly connected by data link(s) to one or more other IUs. Data can be transmitted to or received from other connected IUs. IUs are categorized by the communication function they accomplish as follows:

a. IU. A generic term that applies to JTIDS/MIDS Units (JUs), Participating Units (PUs), and Reporting Units (RUs) providing information on the interface. The term Command and Control Interface Unit (C2 IU) includes PUs, RUs, and C2 JUs, but not nonC2 JUs.

b. JU. A unit communicating directly on Link 16.

c. Command and Control JTIDS/MIDS Unit (C2 JU). A JU with C2 capability.

d. Non-Command and Control JTIDS/MIDS Unit (nonC2 JU). A JU other than a C2 JU.

e. PU. A unit communicating directly on Link 11.

f. RU. A unit communicating directly on Link 11B.

g. Supporting Unit (SU). A unit operating in support of a JU, a PU, or an RU that provides data for the interface but is not specifically identified as a data source and to which data cannot be addressed.

h. Forwarding JTIDS/MIDS Unit (FJU). A JU that forwards data between Link 16 and either or both Link 11/11B.

i. Forwarding JTIDS/MIDS Unit A (FJUA). A unit communicating on both Link 11 and Link 16 while forwarding information between Link 11 and Link 16 participants.

j. Forwarding JTIDS/MIDS Unit B (FJUB). A unit communicating on both Link 11B and Link 16 while forwarding information between Link 11B and Link 16 participants.

k. Forwarding JTIDS/MIDS Unit AB (FJUAB). A unit communicating on Link 16, Link 11, and Link 11B while forwarding information among Link 16, Link 11, and Link 11B participants.

l. Standby FJU (SFJU). An SFJU is an IU designated to assume the FJU function if the FJU is determined to be inactive or otherwise unable to forward on any link to which it is assigned. The SFJU(s) normally participates actively on Link 16.

m. Forwarding Participating Unit (FPU). A PU that is forwarding data between Link 11 and one or more RUs.

n. Forwarding Reporting Unit (FRU). An RU that is forwarding data between two or more RUs.

o. Concurrent Interface Unit (CIU). An IU that originates data simultaneously on more than one TDL; e.g., Link 16, S-Link 16 and Link 11, but does not forward data between the links .

2.3.2 Data Links

2.3.2.1 Basic Interface. Link 11, Link 11B, and Link 16 comprise the basic Multi-Link Interface. The basic interface, employing data forwarding between the Links, enables the full and detailed exchange of tactical information and

orders among all IUs participating in the interface, subject to the limitations of Link 11/11B and IU system implementation. The basic interface is referred to as the "interface" throughout this document and the entire interface planning and operating procedures apply specifically to this interface unless otherwise stated. These TDLs are described below. All of these TDLs are encrypted.

2.3.2.1.1 Link 11. Link 11 is a half-duplex, netted link that normally operates by roll call from a Data Net Control Station (DNCS). Link 11 can also operate in the broadcast mode. The roll call mode of operation used in the Link 11 interface requires that each PU respond in turn while all other stations are receiving. A DNCS initiates the roll call by addressing and transmitting an interrogation message to a specific PU, that then responds by transmitting its data. The DNCS then interrogates the next PU in the prescribed roll call. Link 11 can be transmitted on High Frequency (HF) and/or Ultra High Frequency (UHF) bands. Data speed can be selected from bit rates of 2250 or 1364 bits per second (bps). Dual sideband diversity operation and Doppler shift correction features improve reliability and accuracy of data exchange. Link 11 operates on HF (2-30 MHz) and/or UHF (Line Of Sight (LOS)) (225-400 MHz). Some Data Terminal Sets (DTS) provide the option to select either the Conventional Link 11 Waveform (CLEW) or the Single tone Link 11 Waveform (SLEW). SLEW and CLEW are not compatible waveforms. SLEW, among other enhancements, provides increased propagation and a more powerful Error Detection and Correction (EDAC) algorithm. While the option exists to operate in either CLEW or SLEW, all participants in a given Link 11 net must select the same waveform to achieve connectivity between units.

2.3.2.1.1.1 Satellite Link 11. Some IUs have a capability to transmit and receive Link 11 data via satellite.

a. One unit operates its DTS in the mixed mode (audio and digital data), between the satellite communications (SATCOM) portion and the UHF or HF Link 11 portion of the network. This unit retransmits all data received on the UHF or HF Link 11 interface, including control codes, onto the digital interface (SATCOM). All data received from the digital SATCOM interface is retransmitted on the UHF or HF Link 11 interface.

b. If filtering is necessary, the data filter management rules are to be applied (see paragraph 4.4.3.1).

2.3.2.1.2 Link 11B. Link 11B is a full duplex, point-to-point link that operates with continuous transmissions. Link 11B can be transmitted over a variety of media, such as cable, SATCOM, and single or multi-channel radio links. Data

are transmitted in a serial mode at the basic rate of 1200 bps with optional capabilities of 600, 2400, 4800 and 9600 bps (as available in some systems).

2.3.2.1.3 Link 16. Link 16 is a nodeless, high-capacity, multifunctional, secure, jam-resistant tactical data link designed for the exchange of fixed format and voice messages using the JTIDS Class 2 or MIDS terminal. Link 16 uses the principle of Time Division Multiple Access (TDMA), an architecture that employs time slot interleaving to provide multiple, simultaneous communications nets. Since Link 16 is a UHF system, transmitted messages can only be received by units that are within LOS. However, Link 16 provides a means to relay beyond LOS. All JUs have pre-assigned sets of multiple time slots to transmit their data and to receive data from other units. The time slots of a net can be parceled out to one or more Network Participation Groups (NPG). An NPG is defined by its function and also by the types of messages that will be transmitted on it. This division of the net into functional groups allows JUs to participate only on the NPGs for the functions they perform.

2.3.2.1.3.1 Link 16 Over Satellite Communication Bearers. Certain nations have the requirement and ability to pass Link 16, J-series messages, utilizing satellite technology. These systems as detailed below are presently incompatible both in format and communication bearer. Further information pertaining to the US system can be found in Appendix A. Information pertaining to NATO systems can be found in ADatP-33.

a. Satellite Link 16 (S-Link 16) (USN). The S-Link 16 system employed within the USN utilizes organic UHF SATCOM for the Beyond Line-Of-Sight (BLOS) exchange of Link 16, J-series messages. All Link 16 mission areas except control (air intercept and fighter-to-fighter), voice coordination, system information and net management are supported. S-Link 16 uses the 25 kHz DAMA system working a roll call protocol, the information exchange process is controlled by the S-Link 16 control unit. S-Link 16 is not designed to support Link 16 network to Link 16 network connectivity.

b. Satellite Tactical Data Link (16) (STDL) (UK RN). The STDL system is a near-real-time tactical data link system that uses SHF satellite communications to provide a BLOS enhancement to Link 16 message communications. The STDL system transmits and receives Link 16 tactical data and free text messages. The STDL system may operate in either Broadcast Mode, Group Mode or, subject to use of the Production Universal Modem (PUM) in the SATCOM System, a TDMA Mode of operation. The introduction of Link 16 systems both STDL and MIDS into the RN ships also includes the provision of data forwarding between the various Data Links, as well as Concurrent Operation of those links.

2.3.2.2 Extended Interface. Various other TDLs are used by certain SUs to exchange limited tactical information and directives among themselves and/or with C2 IUs. C2 IUs exercising control over such SUs, or otherwise capable of exchanging data with these SUs, have various means of placing selected information received from SUs onto the interface, as well as sending selected information from the interface to SUs. Thus, these other links are collectively referred to as the "extended interface." This document provides basic information about these links, and certain procedural requirements as necessary to permit the proper integration of SU data into the interface. However, the detailed procedures for interoperation between SUs operating on the extended interface are not included herein, but are included in appropriate System Operators Manuals (SOMs) and other documentation unique to those links. Data management and coordination on the extended interface is normally carried out by the C2 IU exercising control or otherwise exchanging data with the SUs, not the Interface Control Officer (ICO) nor the Force Track Coordinator/Track Data Coordinator (FTC/TDC). The ICO however, remains responsible for planning and tasking of all TDLs (see Chapter 3). The extended interface links currently in use are described below.

2.3.2.2.1 Link 4A. Link 4A is a data link used for automated control of aircraft. Link 4A can be operated as either a one-way or two-way link between a controlling unit and controlled aircraft. Link 4A supports air traffic control, air intercept control, Air Support Operations (ASO), precision course direction, and automatic aircraft landing. Link 4A provides for the exchange of track data and the transmission of orders, commands, and status. Link 4A is a non-secure, serial data link transmitted over UHF radio with a data rate of 5000 bps. The controlling unit can report Link 4A data on to other links. For detailed information on Link 4A, see Appendix G.

2.3.2.2.2 IJMS. IJMS defines a set of messages, their contents, formats, and transfer rules for use with JTIDS/MIDS. IJMS is similar to Link 16 in that it offers nodeless, secure, jam-resistant exchange of fixed format messages, and secure voice utilizing the JTIDS/MIDS TDMA architecture. Because IJMS was developed only for interim use until Link 16 was fielded, the IJMS message set does not support as complete an information exchange capability as Link 16. Command, Control, Communications, Computers, and Intelligence (C4I) systems equipped with JTIDS Class 1 terminals (also known as Electronic Counter Measures (ECM) Resistant Communications System (ERCS) terminal) can operate only on IJMS, not on Link 16. Some C4I systems equipped with Class 2/MIDS terminals can operate on IJMS and on Link 16 concurrently. Network capacity is allocated among the participants by assigning transmit

and receive time slots similar to Link 16. For detailed information on IJMS, see Appendix F.

2.3.2.2.3 ATDL-1. ATDL-1 is a secure point-to-point full duplex data link that operates at the basic rate of 1200 bps with an alternate rate of 600 bps and an optional rate of 2400 or 4800 bps (as available). ATDL-1 supports data exchange between surface-to-air missile systems and a C2 agency. ATDL-1 can be transmitted over a variety of media, such as cable, satellite, and single or multi-channel radio links. For detailed information on ATDL-1, see Appendix H.

2.3.2.2.4 Variable Message Format (VMF). VMF is a bit oriented digital information standard consisting of variable length messages. As digital data VMF messages are not man readable but are designed as a common means of exchanging digital data between combat units at various organizational levels, with varying needs for volume and detail of information, and applicable to a broad range of tactical communication systems. VMF can be operated in a secure or non-secure mode and provides the user with the flexibility to send only required information, on demand, to accommodate bandwidth constrained environments. VMF is media independent and can operate over any digital point-to-point or broadcast capable radio system, since network functions are independent of the textual portion of the VMF message.

2.3.2.2.5 Link 1. Link 1 is a non-secure point-to-point full duplex data link between ground based Air Surveillance and Control (ASACS) units. Transmission is via landline or Tropospheric Scatter at a nominal rate of 1200 bps, although the link may be operated at any multiple of 600 bps if agreed to by the participants. For detailed information on Link 1, see Appendix I.

2.3.2.2.6 Link 14. Link 14 is a one-way HF or UHF radio teletype frequency shift keying encrypted 100 words per minute link on which units equipped with Link 11 or Link 16 may transmit TDS data to units not equipped with a TDL. This provides a limited form of non-real-time situational awareness to these units (Link 14 is updated not more than once per minute). These units are not considered participants in the tactical interface. Therefore, Link 14 procedures are not included herein, but may be found in ADatP-14.

2.3.2.2.7 Link 22. Link 22 is under development and is planned to be a secure, ECM-resistant, medium speed digital data link. Tactical data may be selectively exchanged among Link 22 Units (NUs) within communities of interest, which are defined by functional requirements. Link 22 operates in the HF and UHF frequency bands. All NUs are capable of single network operation; i.e., participation in a single Link 22 network. Some NUs are also capable of

multi-network operation, communicating on more than one network simultaneously. A set of interconnected networks is known as a Super Network. The different networks may use the same media; e.g. HF Fixed Frequency, or may use any combination of media; (e.g. HF and UHF Fixed Frequency), subject to restrictions of mutual interference. When communicating on HF, Link 22 provides gapless coverage up to 300 nautical mile (nm) range. With the UHF medium, direct communications can only take place over LOS range up to 200 nm. To increase geographic coverage, relay of information may be required to extend the effective range of HF communications up to 1000 nm and UHF communications up to 300 nm. The Link 22 system uses a Time Division Multiple Access (TDMA) channel access protocol, whereby system time is apportioned and allocated to participating NUs to provide data transmission opportunities.

2.3.3 Voice Coordination and Control Nets. Voice coordination is essential and considered to be part of the total interface. The following nets should be established to support any interface. However, the actual voice net architecture used is established based on the size and complexity of the TDL architecture it supports. If circumstances demand, different voice net functions may have to be carried out on the same voice circuit. It should be noted Link 16 (16Kb or 2.4Kb) voice circuits should not be used as the transmission medium for any of these voice nets. Not all C2 IUs will be able to monitor Link 16 voice. If a problem causes the loss of Link 16, the loss of Link 16 voice would exacerbate the problem. Comm nets are identified in the OPTASK LINK message.

2.3.3.1 Air Defense Command and Control Net (ADCCN). The ADCCN is a generic term that describes any net providing voice connectivity from the Area Air Defense Commander (AADC) and units under his command. The AADC uses the ADCCN to disseminate changes to the area air defense plan. This includes changes to ATO or TACOPDAT defined positions, responsibilities or status. Examples of information passed over the ADCCN would be Missile Engagement Zone (MEZ) activation or deactivation, cross-boundary engagements, voice reporting of alert status or weapon release conditions, changes to surveillance areas or Track Production Areas (TPA), etc. Senior units will monitor the ADCCN for subordinate units based on operational functional areas. The net should be a covered circuit. Net Control Station (NCS) responsibilities for this net rest with the AADC. ADCCN circuit specifications shall be detailed in the OPTASK COMMS message and its usage may be specified in the ATO/TACOPDAT Special Instructions set or the OPTASK LINK IVCCN set.

2.3.3.2 Data Link Coordination Net (DCN). The ICO uses the DCN to manage and coordinate the entire multi-link interface. This wide area net should, if communications assets are available, be a covered, dial and hold SATCOM circuit with NCS responsibilities carried out by the ICO. If SATCOM is not available a covered HF/UHF net should be used. The ICO uses this net to direct all changes to the OPTASK LINK, to include entry and exit of units, approving filter use, reconfiguration of the interface, changes to the DLRP, frequencies or link duties, etc. All C2 IUs should monitor this net, although, if required, senior commands may guard the net for subordinates. If two or more units need to conduct troubleshooting that is judged to tie up the DCN, they should carry out the troubleshooting on a different frequency/circuit. If the data link architecture is of sufficient size that the ICO has appointed a Link 11/11B manager and a Link 16 manager, separate DCN nets should be established by each manager for their specific data link. The ICO will monitor all DCNs in that situation allowing the Link 11/11B and Link 16 Managers to function as the DNCS agents for their respective nets. If separate Link 11/11B and Link 16 DCNs are established, any FJUs shall monitor both DCNs.

2.3.3.3 Track Supervision Net (TSN). The TSN is used by the FTC/TDC to ensure all data reported on the interface is promptly reported, reported in the correct location, reported by only one unit, and that the reported data is correct. All units that input track data into the joint interface, shall monitor the TSN. This allows the FTC/TDC to resolve problems with multiple units simultaneously using only one communications circuit. If a unit is unable to monitor the TSN a suitable relay shall be established. This net should be a dial and hold SATCOM channel if available or a covered HF/UHF circuit if SATCOM is not available. The FTC/TDC is responsible for NCS functions on the TSN.

2.3.3.4 Voice Product Net (VPN). The VPN provides amplifying Signals Intelligence (SIGINT) information to IUs on a timely basis, and is used to coordinate SIGINT information reported on the interface. Because of the sensitive nature of this net, it must be operated as a closed and secure net. The SIS manager is the NCS for this net.

NOTE: Association of SIS or VPN capabilities with a specific system or platform is classified CONFIDENTIAL.

2.4 Interface Units and Configuration

2.4.1 System Capabilities to Participate. Each TDS that actively participates in the interface is directly tied by TDL to one or more interface units. The configuration of the digital communication paths is dependent on individual system capabilities to interface on one or more TDLs and perform data

forwarding. Table 2-1 indicates system capabilities to participate in the basic and/or extended interface. This data is not comprehensive and provides general guidance only. Specific system capabilities must be determined during the planning process.

2.4.2 Interface Configuration. The communications connectivity between each TDS is known as the interface configuration. The geographic location of each TDS is determined by its assigned mission and tactical situation. Once the geographical location of each TDS is determined, the overriding consideration in selecting an interface configuration is reliable communications. If multiple data links are employed, a unit must be selected to forward data between the IUs that employ different data links. Prudent planning will provide a backup capability within the interface configuration to ensure information flow does not cease if a single unit becomes a casualty. Seniority of units or command relationships will not be a consideration in selecting an interface configuration.

2.4.3 Data Forwarding . Data forwarding is the process of receiving data on one data link and outputting the data in the proper format and protocol of another data link. During the process, information received on one link is translated automatically to appropriate message(s) on other links. Data elements within messages are translated to the appropriate data elements in the corresponding messages. Within this process, data management will be minimized.

2.4.3.1 Data Forwarding Considerations. Figure 2-1 illustrates a typical multi-link interface configuration. A single data forwarder is designated to serve as the interface between the Link 16 network and Link 11 network (as depicted in the upper left portion of Fig 2-1). A single data forwarder is designated to serve as the interface between the Link 16 network and a Link 11B network (one or more connected Link 11B circuits) (as depicted in the lower left portion of Fig 2-1). Separate Link 11 and Link 11B networks may be interfaced to the Link 16 network by separate data forwarders (as depicted by the FJUAB and FPU in the lower right portion of Fig 2-1).

NOTE: Any interface configuration that results in data looping is prohibited.

Table 2-1. System Interface Data Link Capabilities

		BASIC INTERFACE			EXTENDED INTERFACE				
		LINK 11	LINK 11B	LINK 16	Link 4A	IJMS	ATDL-1	LINK 1	VMF
AIR FORCE	ASIT[1]		RU			X			
	CRC/CRE[5]	FPU	FRU	FJUAB	X		X	X	
	E-3 B/C AWACS	PU		JU		X			
	F-15 A/B/C/D/E			JU		X[7]			
	AOC (TBM CORE SYSTEM)			JU					
	EC-130E ABCCC			JU		X[6]			
	RAOC/SAOC (RADIL)	FPU	FRU						
	RADIC	FPU	FRU						
	E-8C JOINT STARS			JU		X[6]			
	RC-135 V/W RIVET JOINT	PU		JU		X[6]			
	CARS (MSCS)	PU	RU	JU					
	C-130E SENIOR SCOUT	PU							
	SENIOR TROUPE	PU	RU						
	PROC	PU[4]							
	IADS	FPU	FRU				X	X	

NOTES:

Specific system capabilities must be determined during the planning process.

PU: Participating unit that communicates on Link 11.
RU: Reporting unit that communicates on Link 11B.
JU: JTIDS/MIDS unit that communicates on Link 16.
FJUA: A JU that forwards data between Links 16 and 11.
FJUB: A JU that forwards data between Links 16 and 11B.
FJUAB: A JU that forwards data between Links 16, 11, and 11B.
FPU: A PU that forwards data between Link 11 and one or more RUs.
FRU: A RU that forwards data between two or more RUs.
X: Denotes link participant.
[1] Forwards data between IJMS and Link 11B.
[2] Forwards data between Link 11/11B and Link 1.
[3] Forwards data between Link 11/11B, ATDL-1, and Link 1.
[4] Receive only.
[5] Forwards data between Links 11/11B/16, ATDL-1 and Link 1.
[6] IJMS capability is limited to the translation capability of the JTIDS Class 2 terminal.
[7] IJMS capability is limited to the translation capability of the MIDS LVT 3 FDL terminal.

Table 2-1. System Interface Data Link Capabilities (Continued)

		BASIC INTERFACE			EXTENDED INTERFACE				
		LINK 11	LINK 11B	LINK 16	LINK 4A	IJMS	ATDL-1	LINK 1	VMF
ARMY	AAMDC (AMDPCS)	PU	RU	JU		X[6]	X		
	ADA Bde (AMDPCS)	PU	RU	JU		X[6]	X		
	THAAD (UOES)			JU		X[6]			
	Patriot ICC (PDB-5, Config 3)	PU	RU	JU		X[6]	X		
	Patriot ICC (PDB-5, Config 2+)	PU	RU	JU		X[6]	X		
	FAAD C2I (ver.5.1)		RU	JU		X[6]			
	FAAD C2I (ver.4E/4R)		RU[4]	JU[4]		X[6]			
USMC	MATCALS		RU		X				
	TACC[2]	FPU	FRU					X	
	TAOC[5,6]	FPU	FRU	FJU	X		X	X	
	TERPES	PU	RU						
	ADCP			JU					
	F/A-18				X				
	EA6B				X				

NOTES:

Specific system capabilities must be determined during the planning process.

PU: Participating unit that communicates on Link 11.
RU: Reporting unit that communicates on Link 11B.
JU: JTIDS/MIDS unit that communicates on Link 16.
FJUA: A JU that forwards data between Links 16 and 11.
FJUB: A JU that forwards data between Links 16 and 11B.
FJUAB: A JU that forwards data between Links 16, 11, and 11B.
FPU: A PU that forwards data between Link 11 and one or more RUs.
FRU: A RU that forwards data between two or more RUs.
X: Denotes link participant.
[1] Forwards data between IJMS and Link 11B.
[2] Forwards data between Link 11/11B and Link 1.
[3] Forwards data between Link 11/11B, ATDL-1, and Link 1.
[4] Receive only.
[5] Forwards data between Links 11/11B/16, ATDL-1 and Link 1.
[6] IJMS capability is limited to the translation capability of the JTIDS Class 2 terminal.
[7] IJMS capability is limited to the translation capability of the MIDS LVT 3 FDL terminal.

Table 2-1. System Interface Data Link Capabilities (Continued)

		BASIC INTERFACE			EXTENDED INTERFACE				
		Link 11	LINK 11B	LINK 16	LINK 4A	IJMS	ATDL-1	LINK 1	VMF
NAVY	E-2C (Group 2 MCU)	PU		JU	X				
	E-2C (Group 0)	PU			X				
	F-14A/B				X				
	F-14D (ACR)			JU	X				
	ACDS BLK 1 (CV/LHD) MODEL 5	PU		FJUA	X				
	AEGIS (CG, DDG) MODEL 5	PU		FJUA	X				
	ACDS BLK 0 (CV/LHD/LHA) MODEL 4	PU		FJUA	X				
	AEGIS MODEL 4	PU		FJUA	X				
	FFG/DD963 MODEL 4	PU							
	LHA/LCC MODEL 4	PU		FJUA	X				
	P-3C MODEL 4	PU							
	S-3B MODEL 4	PU							
	SSN MODEL 4	PU		JU					
	F/A-18				X				
	EA-6B				X				

NOTES:

Specific system capabilities must be determined during the planning process.

PU: Participating unit that communicates on Link 11.
RU: Reporting unit that communicates on Link 11B.
JU: JTIDS/MIDS unit that communicates on Link 16.
FJUA: A JU that forwards data between Links 16 and 11.
FJUB: A JU that forwards data between Links 16 and 11B.
FJUAB: A JU that forwards data between Links 16, 11, and 11B.
FPU: A PU that forwards data between Link 11 and one or more RUs.
FRU: A RU that forwards data between two or more RUs.
X: Denotes link participant.
[1] Forwards data between IJMS and Link 11B.
[2] Forwards data between Link 11/11B and Link 1.
[3] Forwards data between Link 11/11B, ATDL-1, and Link 1.
[4] Receive only.
[5] Forwards data between Links 11/11B/16, ATDL-1 and Link 1.
[6] IJMS capability is limited to the translation capability of the JTIDS Class 2 terminal.
[7] IJMS capability is limited to the translation capability of the MIDS LVT 3 FDL terminal.

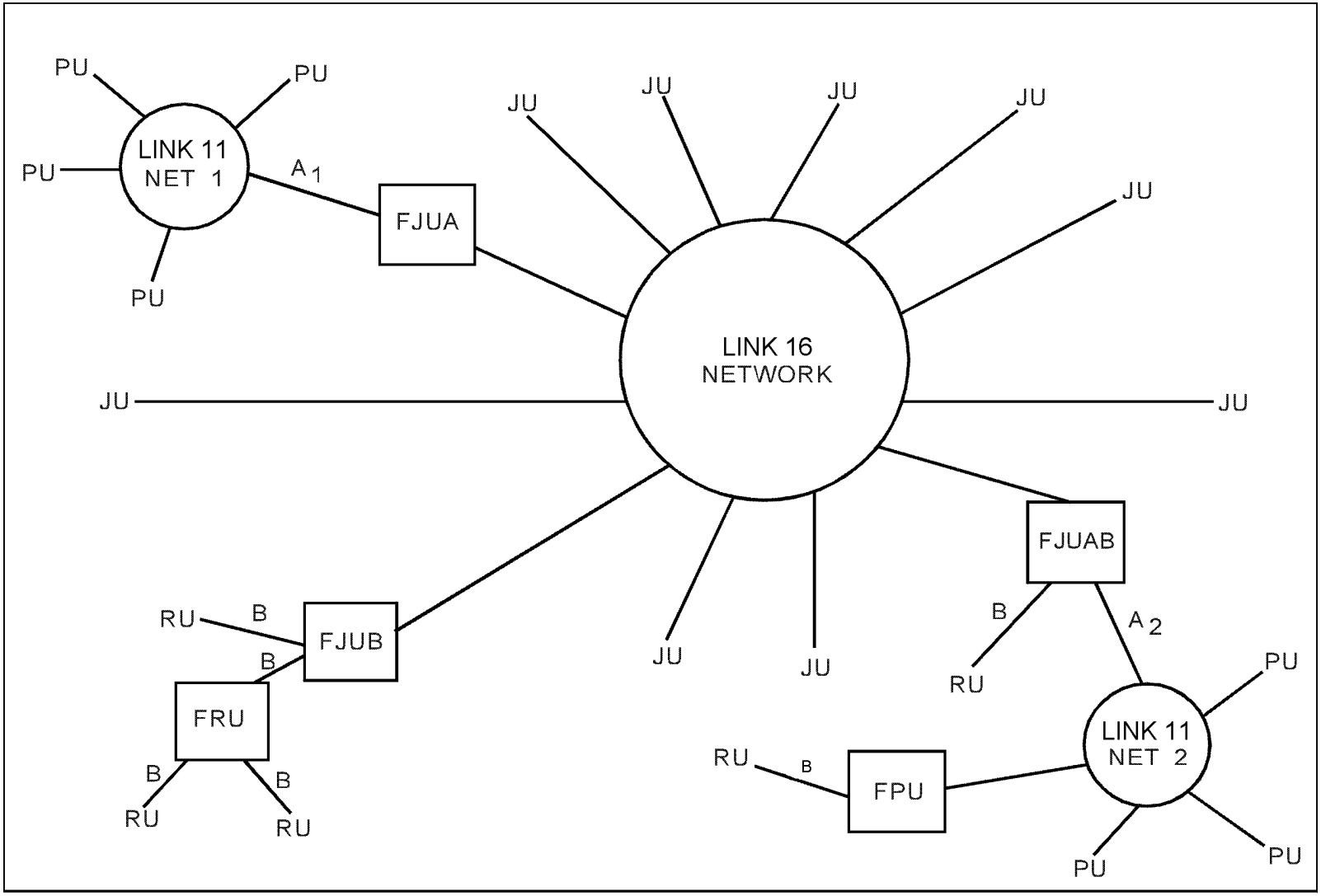

Figure 2-1. Example of a Typical Interface Configuration

2.4.3.2 Data Looping. The resulting interface must be configured to ensure that data loops are not created that allow one or more units to receive the same information from more than one data path. It should also be configured to ensure that a unit does not receive its own data from another source. Uncontrolled data forwarding and concurrent operation may result in data looping. Therefore, CIUs conform to all protocols of each link in which they participate. These units report only local data onto each link. Even though data are not forwarded, a data change on one data link of a common information element; e.g., ID could change the local data of the CIU and will subsequently be reflected on the other data link. Therefore, when a data forwarder is assigned between two data link networks, no CIU should be permitted on these same networks if data looping may occur.

2.5 System Interface Characteristics

2.5.1 Link 11/11B Interface Configuration and Limits. TDSs that implement Link 11 and Link 11B share many common messages. Link 11 units share a common network and must be within radio range of each other to exchange information directly. Link 11 does not forward data among PUs. Link 11B units can be linked together to form a chain or use a single FRU as a hub with multiple RUs linked through the hub. Link 11B communications require a separate, dedicated link between each RU that simultaneously transmits and receives data on two channels, one dedicated transmit and one dedicated receive. When data messages are not being transmitted, each unit transmits a continuous standby signal to maintain time synchronization. Data is exchanged between Link 11 nets and Link 11B through an FPU, which at the same time can act as an FRU between Link 11B units.

2.5.1.1 Link 11/11B Geographic Limits. The ability to transmit and receive position reports in Link 11 and Link 11B is limited by the maximum values that can be accommodated by the data elements within a message. This design provides geographic limitations on the size of an area in which position reports can be exchanged. The TDS design imposes a second limitation. The capability of a TDS to receive, process, and display position information is mandated by the system's defined mission.

2.5.1.2 Data Link Reference Point (DLRP). The DLRP is a fixed geographic point expressed in latitude and longitude. Each PU/RU will reference its System Coordinate Center (SCC) from the DLRP. The DLRP is the geographic center of the Link 11/11B reporting area. If a second Link 11/11B network is established, it may use the same DLRP as the first network (especially when data forwarding occurs and requires a single DLRP), or select a different DLRP

unique to the second network. Each Link 11/11B integrated network has only one DLRP.

2.5.1.3 Coordinates. The SCC specifies a location, measured in minutes of latitude and longitude from the DLRP. A PU or RU may report its position as X and Y coordinates, expressed as miles from its reported SCC. The maximum displacement is 512 miles. Tracks, points, and pointers will be within a 1024 mile square centered on the reporting unit's SCC location. A forwarding unit may report another unit's position if it is within a distance of 1024 miles of the forwarding unit's SCC.

2.5.2 JTIDS/MIDS Operational Capabilities. JTIDS/MIDS is a high-capacity, digital information distribution system; designed to carry Link 16 and provide integrated communications, navigation, and identification capabilities. It facilitates secure, flexible, and jam-resistant information transfer in real-time among the dispersed and mobile units. JTIDS/MIDS combines characteristics designed to overcome many of the limitations common to existing systems by providing for increased system capacity and coverage, improved connectivity, survivability, jamming resistance, and reduced danger of data loss and obsolescence.

CHAPTER 3

RESPONSIBILITIES FOR THE MULTI-LINK INTERFACE

3.1 General. This chapter delineates responsibilities for the initiation, conduct and termination of operations that employ TDL communications. When TDSs are linked together in a digital interface, the individual systems are functionally tied together. Certain actions in any one system are reflected to some degree in all or parts of the other systems IUs. This digital interconnection creates a much higher degree of interoperability than has previously been possible. Each TDS can no longer be considered an autonomous unit that simply exchanges information with other units. Centralized direction and coordination of interface operations is necessary to preclude disruptive conflicts in the information that is exchanged.

3.1.1 Delegation. Multi-Link operations will normally be conducted at the JTF level and below. Responsibility for the joint interface rests with the Commander, Joint Task Force (CJTF). The CJTF will normally delegate the authority for management of the multi-link interface, through the Area Air Defense Commander (AADC), to the Interface Control Officer (ICO). The ICO, through coordination with the Services, is responsible for establishing the initial functions of the interface and joint network as well as subsequent change requirements. Under the authority of the AADC, the ICO may establish region/sector interface control officers (RICO/SICO) responsible for interface management of their assigned region or sector. In joint operations, not involving allied forces, the ICO is referred to as the joint ICO (JICO).

3.2 Combatant Command Responsibilities. The combatant commander is responsible for the deliberate wartime planning process for his assigned area of responsibility (AOR). As part of this process, the commander's concept of operations (CONOPS), operational plans (OPLAN) and/or operational orders (OPORD), may establish a Joint Task Force (JTF); and delegate operational control (OPCON), over forces assigned or attached to the JTF, to the CJTF. Further responsibilities include, but are not limited to:

a. Addressing the TDL requirements to support joint operations.

b. Ensuring the OPLAN/OPORD includes the operational parameters needed to support the development of the multi-TDL interface. This includes developing a new JTIDS/MIDS network design or providing a capability to determine the viability of using a previously developed network design contained in the JTIDS Network Library (JNL), distributed by the JTIDS Network Design Library (JNDL).

c. Ensuring that the theater and JTF crypto managers are cognizant of and coordinate the multi-link crypto requirements with subordinate units.

d. Acting as the JTIDS/MIDS deconfliction authority in accordance with CJCSI 6232.01, (reference b.)

3.3 CJTF Responsibilities. The CJTF will normally assign the functions and responsibilities of the AADC to a component commander, other than the Army component commander. The CJTF will also appoint the Airspace Control Authority (ACA) and the theater cryptographic manager. The responsibilities of these appointees for TDL operations are specified in the following paragraphs. (When a CJTF is not assigned, the combatant commander is responsible for these tasks.)

a. Theater Cryptographic Manager. Ensures that voice and data interface cryptographic requirements are identified and key lists are distributed to operational forces.

b. Airspace Control Authority. Develops the airspace control plan in conjunction with the area air defense plan. Coordinates with component forces to insure operations plans support the conduct of operations throughout the full range of military action, whether employing fully capable and operating command and control systems or greatly degraded command and control systems.

c. Area Air Defense Commander. Develops and promulgates the area air defense plan after CJTF approval.

3.4 AADC Responsibilities. The AADC, subject to the authority of the CJTF, will:

a. Develop, coordinate, promulgate, and monitor the execution of the Area Air Defense Plan (AADP). The AADC will plan for the use and reconfiguration of air defense assets; establish tasks for the integrated air defense system; and develop, coordinate and disseminate a communications plan that connects C2 systems, air and missile defense weapons systems, intelligence systems, sensors and aircraft that satisfies joint interface information exchange requirements.

b. Coordinate with the ACA to ensure that the ACP is integrated with the AADP.

c. Designate the interface control unit (ICU), which performs the ICO functions and regional and sector ICUs as required.

d. Prepare and disseminate the TACOPDAT and the OPTASK LINK messages and changes as required.

e. Act as NCS for the ADCCN.

3.5 Theater Cryptographic Manager. Establishes procedures for:

a. Ensuring that interface cryptographic requirements are distributed to all participants including combined forces.

b. Providing and coordinating the relationship of cryptokeys to JTIDS/MIDS Cryptovariable Logical Labels (CVLLs) with the AADC and ICO.

c. Rekeying crypto devices after loss, suspected loss, or a change in cryptokey due to operational considerations. JTIDS/MIDS has unique capabilities and multiple keys that must be considered.

NOTE: If an FJU suffers a loss, suspected loss, or requires a change to the cryptokey due to operational considerations, cryptokeys for all TDLs involved in the interface may require changing.

3.6 ICO Responsibilities. The ICO will be responsible for the entire interface, including the following planning and execution functions.

3.6.1 ICO Planning Functions. The ICO will perform the following planning functions:

a. Ensure multi-TDL requirements are considered during pre-mission planning for developing multi-TDL architecture. Network planners must know the mission communication priorities, the number and types of TDLs, connectivity and security requirements, and data forwarding requirements.

b. Assist in preparation of the TACOPDAT and the OPTASK LINK messages.

c. Prepare a list of planned participants and supervise the allocation of addresses to interface units.

d. Translate the total track exchange requirements into track number (TN) block allocations.

e. Establish requirements for data forwarding and assign forwarding units, including standbys.

f. Ensure communications are identified to support ADCCN, DCN, TSN, and VPN requirements.

g. Perform the Link 16 manager planning functions or designate the Link 16 manager.

h. Perform the Link 11/11B manager planning functions or designate the Link 11/11B manager.

i. Designate one FTC/TDC to be responsible for control of track data coordination on the multi-link interface. RICO/SICOs designate region/sector FTC/TDCs as required.

j. Specify the link management code list to be used for voice coordination.

k. Authorize conditional link capabilities to be used in the interface (see paragraph 4.4.8).

l. Establish digital data contingency procedures for an unscheduled loss of part or all links. Such procedures require voice exchange of essential data and coordination of this exchange with the remaining digital network capability, if any.

3.6.2 ICO Execution Functions. The ICO will perform the following execution functions:

a. Act as net control station (NCS) for the DCN.

b. Direct changes or corrective actions to the networks to ensure effective information exchange needed to support the changing operational situation.

c. Approve the use of data filters.

d. Approve crypto key changes.

e. Recommend and implement changes to surveillance areas.

f. Implement contingency procedures for an unscheduled loss of part or all digital data links. Such procedures require voice exchange of essential data and coordination of this exchange with the remaining digital network capability, if any.

g. Perform the Link 16 manager execution functions or designate the Link 16 manager.

h. Perform the Link 11/11B manager execution functions or designate the Link 11/11B manager.

i. Monitor and ensure that the JTIDS/MIDS operations comply with civil and any other restrictions on JTIDS/MIDS transmissions in the operating areas. Guidance for the United States and its possessions may be found in CJCSI 6232.01; guidance for other areas requires reference to the appropriate national JTIDS/MIDS guidance (see JMTOP, Appendix D, paragraph D4.3).

3.7 Data Link Manager Responsibilities. Data link managers are responsible for initiation, operation, and termination of data link operations.

3.7.1 Link 16 Manager Functions. The Link 16 manager, under the authority of the ICO:

a. Assists in preparing the Link 16 portions of the OPTASK LINK message.

b. Specifies planning parameters for a network that will best satisfy the requirements and assists in the selection of a network design from the JNL. Plans alternate network as required.

c. Manages assignment of functional network roles.

d. Directs corrective actions when disruptions occur to ensure the effective and efficient exchange of information.

e. Responds to the requirements and direction of the ICO.

f. Monitors and ensures that the JTIDS/MIDS operations comply with civil and any other restrictions on JTIDS/MIDS transmissions in the operating areas. Guidance for the United States and its possessions may be found in CJCSI 6232.01; guidance for other areas requires reference to the appropriate national JTIDS/MIDS guidance (see JMTOP, Appendix D, paragraph D4.3).

g. Coordinates the Link 16 initialization process.

h. Ensures compliance with required interference protection features (IPF).

i. Manages connectivity between JUs including activation/deactivation of relays, and recommending change of JU transmit mode to normal or data silent to the FTC/TDC.

j. Monitors time slot assignments.

k. Manages cryptovariables to ensure proper network security and access.

l. Evaluates Link 16 performance and reports to the ICO on operational effectiveness.

m. When directed by the ICO, perform net control functions as the DNCS for the Link 16 data link.

3.7.2 Link 11/11B Manager Functions. The Link 11/11B manager under the authority of the ICO:

a. Assists in the preparation of the Link 11/11B portions of the OPTASK LINK.

b. Designates changes to the DNCS for Link 11 based on an assessment of which interface unit can best provide net coverage.

c. Coordinates changes to frequencies and channels assigned for interface data links.

d. Coordinates required changes to Link 11/11B configuration with the ICO.

e. Directs corrective actions to ensure effective and efficient exchange of information when disruptions occur.

f. Executes DLRP changes.

g. Coordinates the daily cryptographic modes and key changes during operation of Link 11/11B.

h. Designates changes to the Gridlock Reference Unit (GRU) in Link 11 only or Link 11/11B operations.

i. When directed by the ICO, performs net control functions as the NCS for the Link 11/11B Data Link Coordination Net (DCN).

3.8 FTC/TDC Responsibilities. The FTC/TDC is responsible to the ICO for the accuracy, currency, and quality of track data. The FTC/TDC duties should be assigned to a surveillance unit that is centrally located within the surveillance AOR to ensure the greatest direct access to track data. The FTC/TDC:

a. Assists in preparation of changes to the OPTASK LINK.

b. Acts as NCS for the TSN.

c. Monitors the exchange of track data and related actions.

d. Ensures the effective flow of data and clarity of the tactical picture.

e. Supervises the resolution of interface anomalies such as dual designations, duplicate tracks, identification conflicts, and category conflicts.

f. Transmits change data orders to resolve environment conflicts when required.

g. Coordinates changes in AOR(s) for surveillance as the tactical situation changes.

h. Coordinates the use of data filters.

i. Designates Link 11/11B/16 electronic warfare (EW) data forwarding mode.

j. Designates the inter-link gridlock reference unit (GRU) and directs inter-link GRU changes as required (see paragraph 4.3.3).

k. Coordinates the use and transmission of reference points, lines, and areas.

3.9 SIS Manager Responsibilities. The SIS manager responsibilities and authority are derived from two sources, the National Security Agency (NSA) and the combatant command. NSA may delegate SIGINT operational tasking

authority (SOTA) to the combatant command. In that case, the combatant commander would appoint a SIS manager to carry out the coordination of theater-level intelligence reporting as well as national reporting. If SOTA is not assigned to the combatant command, but is held by NSA, the attached intelligence platforms are responsible for national intelligence gathering and reporting only. The SIS manager, if appointed, is normally a member of the CJTF staff and is responsible for the procedures used and prioritization of the desired SIGINT collection reporting of theater-level intelligence information. On a theater level, the SIS manager is responsible for:

a. Acting as the NCS for the VPN.

b. Coordinating SIGINT collection activities of the SIS participants.

c. Directing the reporting means of intelligence data by message type and link.

d. Ensuring the data acquired from multiple sources is correlated prior to reporting.

3.10 Service Responsibilities. The Service components will operate in the Multi-link interface(s) under the operational control of the CJTF. As a minimum, the Services will:

a. Ensure that tactical data systems employed are compatible and interoperable in accordance with military standards specified for data link operations.

b. Provide material and manpower resources to support the JTF staff as determined by the CJTF.

c. Coordinate with the CJTF and report any internal Service requirements that may affect the operation of the joint interface.

d. Define internal Service coordinating functions to ensure that internal Service operations function efficiently with minimum impact on the joint interface.

e. Ensure Service-unique network capacity requirements are identified in network requests. The Service will distribute the Service-unique network capacity to its participants.

f. Assist in development of the OPTASK LINK message.

g. Prepare and disseminate intra-Service communications orders and plans that support TDL operations to the CJTF.

h. Manage Service-unique Link 16 Participation Groups (PGs) of the joint network.

i. Manage Service-unique data link operations.

j. Prepare and distribute JTIDS/MIDS Network Design Loads (NDLs) for their Service JUs.

3.11 Joint Interface. Figure 3-1, "Notional Joint Task Force Multi-link Organizational Structure," illustrates the centralized direction and lines of authority in the coordination of interface operations.

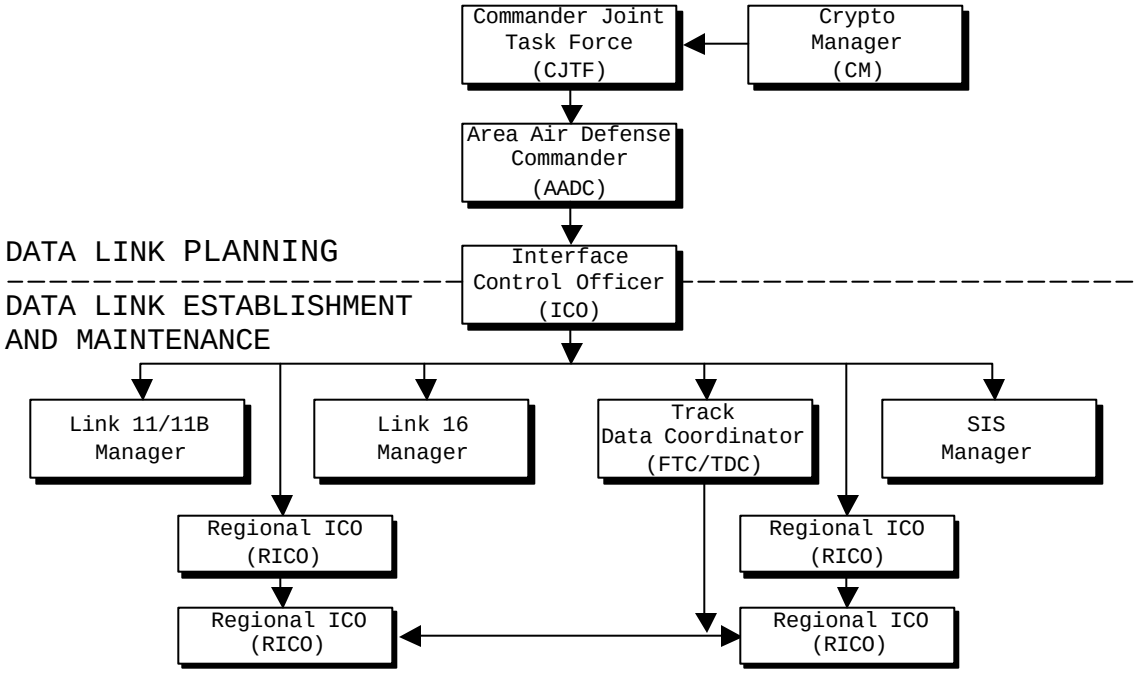

Figure 3-1. Notional Joint Task Force Multi-link Organizational Structure

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CHAPTER 4

INTERFACE PLANNING

4.1 General. This chapter provides the common procedures necessary for planning any TDL interface; i.e., those that are equally applicable to Link 11, Link 11B, or Link 16 or an interface of two or more of those links. It also provides procedures that are unique to the planning of a multi-link interface, such as selection of a data forwarder. Procedures unique to the planning of Link 11, Link 16, or Link 11B are contained in Appendices C, D, and E respectively.

4.2 Tactical Data Link Planning. The planning process essentially consists of evaluating the required information flow and the resulting connectivity requirements, determining which TDL platform assets are available to support the various missions, developing an integrated multi-link network architecture/interface design to satisfy the requirements of the operational commander, and providing the necessary information to the operational units to allow implementation of the multi-link network. Figure 4-1 is a flow chart that depicts the process. The portion of the figure contained within the dashed lines represents the actual functions accomplished by the TDL planners. Where planning functions are specified for the ICO, FTC/TDC, Link 11/11B Manager, or Link 16 Manager in this chapter, these should be carried out as necessary by interface planners on the appropriate staff until such time as the above duties are assigned to a specific command. The portion of the figure outside of the dashed lines contains elements of the joint multi-link planning process that are functions or responsibilities that are not accomplished by the TDL planner, but are still relevant and included as part of the overall multi-link planning process. Functions of JTF multi-link planning include but are not limited to:

a. Maintaining and reviewing the commander's objectives, required information flow, and connectivity requirements.

b. Identifying the TDL-equipped platforms that are available for use in the operation and the TDL and communications capabilities of each platform.

c. Identifying surveillance responsibilities to ensure overlapping sensor coverage.

d. Documenting the locations, planned movements, orbits, etc., of the data link participants in the operation.

JOINT MULTI-TDL AND TACOPDAT

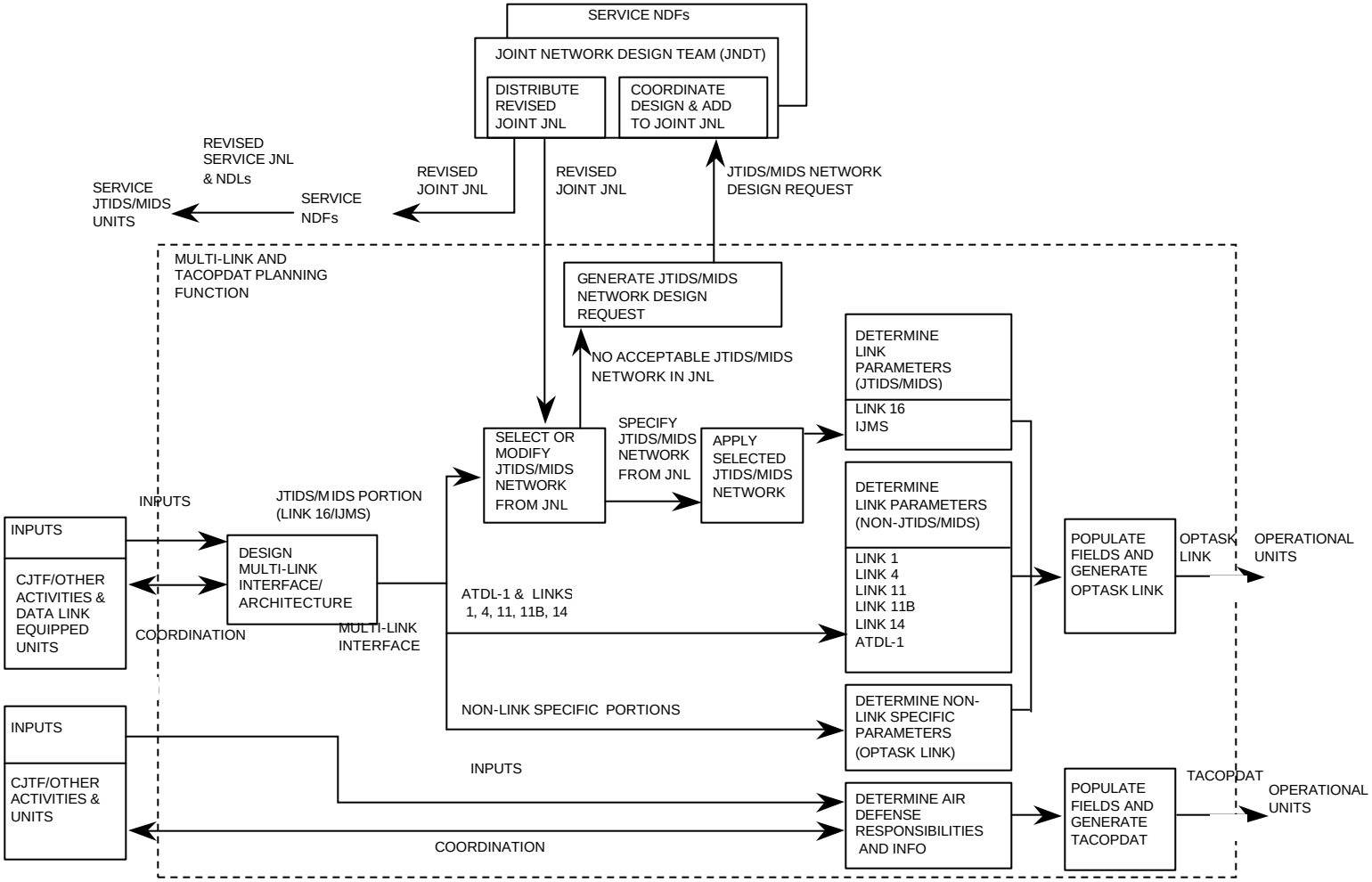


Figure 4-1. Multi-Link Planning Process

e. Establishing a multi-link operations concept for the operation (i.e., major participants, data links required to satisfy the connectivity requirements, anticipated threat, and reporting capacities required by the various participants).

f. Selecting or developing an integrated multi-link network architecture and interface design.

g. Designing and establishing a multi-link voice communications architecture that supports joint theater operations from the CJTF to the IU level.

4.2.1 Planning Inputs and Coordination. Planning inputs originate primarily from the basic plans for the joint or combined operation that the multi-link interface will support. The planner obtains inputs from personnel at operational and headquarters units and the data link-equipped platforms. Also, the planner either already has available or needs to obtain specific documents (or databases) pertaining to the actual operation (e.g., OPLANs) and other reference documents (or databases) with information on C4I system capabilities. The planner performs additional coordination, as necessary, with other JTF activities, with personnel at other headquarters, with the multi-link planning focal point for each component involved in the operation, and with personnel at the data link-equipped platforms involved in the operation. The detailed information needed to design a multi-link interface to support a specific operational requirement depends on the scenario. Typical types of information that are needed by multi-link planners to support the design of a multi-link interface for joint and combined operations are listed in Table 4-1.

4.2.1.1 Surveillance Considerations. Surveillance is normally conducted with overlapping areas to ensure all targets are detected, that systems provide mutual support, and that a catastrophic failure in a single system does not create a gap in surveillance coverage. The assigned surveillance areas for each system are published in the TACOPDAT SURVEIL set. Additionally, surveillance areas may be assigned to airborne surveillance systems in the ATO. Surveillance requirements should be considered when determining unit locations.

4.2.2 Design of the Multi-link Interface and Network Architecture. The key, and by far the most difficult, element of multi-link interface planning is determining the configuration for efficiently interconnecting the C4I and weapon systems using the various TDLs to satisfy the operational

Table 4-1. Typical Required Planning Inputs

TYPICAL REQUIRED PLANNING INPUTS

Details Pertaining to the Operational Environment:

1. Joint and component commanders' plans (e.g., command structure and relationships, mission requirements, and enemy threat assessment).

2. Operational scenario (e.g., geographical AOR, geographical and terrain limitations, forces present, disposition of forces, treaties, host-nation restrictions, political constraints, rules of engagement, tactical operating procedures developed for use of assigned forces that impact interface operations).

3. Identification and prioritization of the IERs by functional area (e.g., air surveillance) and participants.

4. Intra-Service data link requirements that impact on the joint interface configuration.

5. Communications equipment's characteristics, frequencies, or channels available for multi-link use (e.g., HF propagation characteristics for AOR).

6. EW considerations (e.g., expected jamming threat).

7. Cryptographic requirements.

Details on Each TDL Interface Participant:

1. Geographical location.

2. Functional area communities of interest (e.g., surveillance) and operational IERs for each participant.

3. Expected track reporting level and track update rates.

4. Physical capabilities and limitations of each participating data link C4I and weapon system platform that impact planning, such as:

a. Data links implemented.
b. Functional areas implemented for each data link.
c. Data forwarding capabilities, if any.
d. Data grid/display grid limit.
e. Operating range.
f. TN capacity.
g. Communications suite available (for data link traffic and coordination nets).

5. Current problems or degraded capabilities of each platform that would affect its ability to operate at its designed data link capabilities.

Capabilities and Limitations of Available Data Links Impacting Planning:

1. Physical characteristics.

2. Ability to fully support the required functional area IERs.

Information Exchange Requirements (IERs). The configuration of the associated voice coordination nets must also be determined. After the data link interface configuration has been selected, the remaining planning determinations for other prearranged data items can logically proceed. Typical steps followed by multi-link planners to develop a multi-link interface design for joint and combined operations are listed in Table 4-2.

4.2.3 JTIDS/MIDS Planning. Extensive planning is required when employing JTIDS/MIDS. The JTIDS/MIDS network design used for initial operations will normally be pre-planned and selected from a library of JTIDS/MIDS network designs, called the JNL. The JTIDS/MIDS portion of the planning process involves reviewing the library of JTIDS/MIDS network designs, matching the anticipated JTIDS/MIDS-equipped systems to the various designs, identifying the existing JTIDS/MIDS network design to use, and notifying the participating units of the selected design and their assignments in that network design. Detailed planning considerations for JTIDS/MIDS are contained in Appendix D. Planning operations using JTIDS/MIDS include:

a. Reviewing the JNL to determine if available network designs will support the planned operations. The Network Description Summary (NDS) is to provide a description of the operational and essential technical characteristics of the network design to facilitate selection and modification of networks during the Pre-mission Planning process.

b. Selecting the most appropriate network design when available designs exist.

c. Submitting Network Design Requests (NDRs) when no acceptable network design exists.

d. Identifying any required modifications for the selected network design. Table 4-1 identifies the typical planning inputs required.

e. Identifying the JTIDS/MIDS network information as input to building the OPTASK LINK.

f. Identifying the JTIDS/MIDS network information that will impact the building of the ATO/TACOPDAT.

4.2.4 Developing the OPTASK LINK. The OPTASK LINK message provides the detailed instructions necessary to initialize operational data links and provide the means to change existing information as required. The OPTASK LINK covers Link 1, Link 4, Link 11, Link 11B, Link 14, Link 16, IJMS, ATDL-1, S-Link 16, and National Links. MIL-STD-6040 OPTASK LINK USER FORMAT shall be used (available at URL: http://www-usmtf.itsi.disa.mil). Baseline version to be used shall be determined by the operational commander. The detailed OPTASK LINK format and user instructions are contained in MIL-STD 6040 USER FORMATS, which should be referred to when drafting the message. The message drafters shall use accredited message preparation software to ensure that all formatting rules are adhered to and guarantee machine readability by recipients. If the OPTASK LINK does not conform to the rules of MIL-STD 6040, automated systems will not be able to process the message.

4.2.5 TACOPDAT Message Text Format (MTF) Message. The TACOPDAT is used to permit the Joint Force Commander (JFC) to establish and update air defense and anti-air warfare responsibilities in a tactical area. It contains data required to establish an integrated air defense system (e.g., surveillance areas, defense sectors, Combat Air Patrol (CAP) stations, MEZ)s. It is promulgated by the AADC. Additionally, it is used to implement changes to an OPORD. These changes are considered permanent. Temporary changes can be promulgated in a Designated Area Message.

4.2.5.1 TACOPDAT vs. ATO. The TACOPDAT does not task aircraft to specific missions (i.e., CAP, Airborne Early Warning (AEW), Automatic Communications relay (AUTOCAT), or Air-to-Air Refueling (AAR)). The ATO message is used for tasking, whereas the TACOPDAT establishes the locations for stations. For instructions regarding TACOPDAT message construction and formatting refer to MIL-STD-6040, (reference c.)

4.2.6 Navy System TDL Interoperability Report. Navy platforms employ a greater diversity of capabilities than other Services. Each ship within a class of ships may have unique capabilities that are significant to their employment within a joint interface. To determine the specific capabilities of each Navy IU, a System TDL Interoperability Report (STIR) is developed by the Navy Center for Tactical Systems Interoperability (NCTSI) for each interface operation. The STIR provides implementation details for each Navy platform and emphasizes differences between platforms. The STIR should be requested from NCTSI.

4.3 Configuration Considerations. The primary consideration for configuration of a multi-link interface is that all JTIDS/MIDS-equipped units should operate on Link 16 and/or IJMS if feasible, but JTIDS/MIDS-equipped units require

relay when beyond LOS communications requirements exist. The additional interface configuration planning factors required in a multi-link interface are described in the following paragraphs:

a. Data forwarding between TDLs.

b. Concurrent operations by multi-link equipped platforms.

c. Interlink GRU designation.

4.3.1 Data Forwarding. Data forwarding is the process of receiving data on one link and outputting the data in the proper format and protocol of another link. During the process, information received on one link is translated automatically to appropriate messages on other links. Data elements within the messages are translated to the appropriate data elements in the corresponding messages. Data forwarding duty assignments should be published in the Duty fields in all applicable data link segments in the OPTASK LINK.

4.3.1.1 FJU Designation. A unit that forwards between Link 16 and Link 11/ 11B is designated an FJU. Factors to consider in designating an FJU are:

a. Only one unit within a Link 16 network can be designated to forward to a Link 11 net. If more than one unit is designated an FJU, and both units are forwarding to the same Link 11 net, then data looping will occur.

b. Multiple FJUs can be designated if each forwards to a separate Link 11 net or Link 11B unit.

c. Multiple FJUs can be designated if each forwards to a separate Link 16 network. In this case the Link 11 net or Link 11B connects the two separate Link 16 networks.

Table 4-2. Typical Steps in Designing a Multi-Link Interface

TYPICAL STEPS IN DESIGNING A MULTI-LINK INTERFACE

Document the Requirements:

1. Coordinate and obtain information needed to design the interface configuration.

2. Ensure the primary objectives of the interface network are explicitly defined and understood by all force components (Clearly defined purpose(s) and function(s) of the interface assist the planner in addressing the critical factors during the design).

Identify Alternative Configurations:

1. Determine alternative data link communications paths that satisfy the operational IERs. Primary constraints are:
   a. C4I and weapon system capabilities.
   b. Geographic locations of the TDL participants.
   c. Communications equipment and connectivity available.

2. Address operational design considerations. Interface design should:
   a. Be tactically sound and support existing C2 structure.
   b. Use Anti-Jam (AJ) capability consistent with the threat.
   c. Minimize critical nodes.
   d. Minimize forwarding of message traffic.
   e. Be flexible and have alternate or back-up connectivity plans.

3. Match responsibilities, tasks, and priorities with platform and link capabilities.

Compare Alternative Configurations:

1. Consider various aspects in comparison, such as:
   a. Extent that objectives are met and IERs are satisfied.
   b. Data forwarding unit constraints on message traffic.
   c. Reliability.
   d. Flexibility for contingencies (alternate routing, loss of nodes).

2. Make any required trade-off assessments.

Select One Alternative:

1. Choose the optimum interface design and configuration.

2. Provide contingencies for degraded operations.

Determine Configuration of Voice Nets:

1. DCN - for coordinating technical operations of data link terminal equipment.

2. TSN - for track surveillance personnel to maintain a clear tactical picture and to assist units entering or exiting the interface.

3. ADCCN - for coordinating weapons employment and for interface command, control, and coordination.

4. VPN - for voice SIS product dissemination and coordination.

4.3.1.2 Multiple FJUs. If multiple FJUs must be used to meet the operational information exchange requirements, special precautions must be taken in both the planning and execution phases to ensure that the information on all links is accurate and free of conflicting or confusing data and avoids data looping. During the planning phase, it is imperative that only a single active forwarding unit be identified for connectivity between any two or more individual IUs or interconnected groups of IUs. Except for the designated forwarders, each IU will be active on only one link. The designated forwarder(s) must be the only TDL information source established to IUs of other links. As an exception, CIUs may operate on multiple data links providing that data looping will not occur. For planning purposes, SFJUs should be designated, and should be active on Link 16 only unless operational circumstances dictate otherwise.

4.3.1.3 SFJU. An SFJU should be designated whenever an FJU is designated. Some FJUs have an SFJU mode, which should facilitate rapid assumption of the FJU function by alerting an operator in the event that the FJU becomes inactive or degraded on either link.

4.3.1.4 Special Data Forwarding Procedures. An FJU will not forward data on a link that has a data forwarding filter active. Some FJUs are capable of establishing forwarding filters independent of filters established by its host IU. Some FJUs have the capability to forward command messages ordering an engagement action to inactive or silent IUs, as described in paragraph 5.11.1.5.

4.3.2 Concurrent Operations. A CIU is a unit that participates on two or more TDLs at the same time, but not as a forwarder. CIUs transmit locally held tactical data on all links, to the extent that the message standard of each link allows transmission. CIUs comply with all of the protocols and procedures for each link. CIUs should not be allowed to operate in the presence of an FJU without assurance that data looping will not occur. If data looping would occur, normally the FJU will remain operating instead of the CIUs. However the FTC/TDC may decide that the best operational advantage would be for the CIU to remain operating and have the FJU cease forwarding.

4.3.3 Prevention of Data Looping. Data looping occurs when one or more IUs receive the same information via more than one data path. This can cause serious problems for TDSs and operators. Operators should be aware that multi-link configurations incorporating both data forwarding and concurrent operations can result in disruption of the tactical picture unless data looping is prevented. Operational Commanders should consider this impact, together with the operational priorities, when planning the overall multi-link interface configuration; e.g., to prevent data looping, data received from a CIU should not be forwarded.

4.3.4 Interlink GRU. Link 11 and Link 16 data registration methods differ significantly and are specified in Appendices C and D. To ensure that data registration is maintained throughout a Link 11/Link 16 interface, it is essential that a C2 JU, or a CIU, be designated as the GRU for Link 11 gridlock. This effectively aligns the Link 11 and Link 16 grids for track reporting purposes. The primary considerations for designation of the C2 JU or CIU to be used as Link 11 GRU are that they:

a. Should be expected to normally have Reporting Responsibility (R^2) for a large number of tracks. Thus, an airborne C2 JU; e.g., E-2C or E-3 is normally preferable to a surface or land C2 JU.

b. Should have a high RELNAV Geodetic Position Quality (Q_{pg}), which ensures that it is accurately aligned with other JUs. Consideration should be given to shifting the GRU function if the GRU's Q_{pg} degrades to 7. A C2 JU with Q_{pg} less than 4 should not be assigned as Link 11 GRU.

c. Should have a central position to allow easiest gridlock.

4.4 Prearranged Data Items. This section specifies the data items that must be determined and promulgated prior to the establishment of any interface, regardless of which links are used. Each item shall be promulgated in the OPTASK LINK. The technical prearranged data items necessary for establishing each link are specified in Appendices C, D, and E.

4.4.1 IU Addresses. An IU address is a unique TN assigned to each unit in an interface. The TDL planners or the ICO shall assign each IU an address before the IU joins the interface. Numerically equivalent 2-digit, 3-digit, and 5-digit addresses are the same address; e.g., 45_8, 045_8, and 00045_8. Duplicate addresses must not be assigned. The criteria for IU address assignments are:

a. PUs and units with FPU capability may be assigned two different addresses, a Terminal Address (TA) used by the Link 11 hardware to control the information flow and a PU Address used to identify the unit on the interface. Both are assigned an address in the range of 01 through 76_8 although most units are capable of operating with a TA different from the PU Address, some units are not. Therefore, it is standard practice to assign the same number to both the TA and PU Address. When the commander elects to operate a Link 11 net with TAs different from PU Address, units without this capability will experience difficulty participating in the net. Presently, these units include:

(1) Netherlands - P-3C

(2) United States - P-3C, S-3B, E-3.

(3) United Kingdom - E-3D, ASACS Data Link Buffer System (ADLBS).

(4) NATO - E-3A.

(5) Germany - MHQ.

NOTE: To eliminate net participation difficulties when operating with the above units, commanders should ensure all units are allocated the same TA and PU Address.

b. RUs should normally be assigned a 100_8 through 175_8 address by convention. No restrictions prevent the use of a 001 through 076_8 address for the exchange of data. For example, a unit may be assigned as a standby FPU but exchanging data only on the Link 11B link with a two-digit address of 01 through 76_8.

c. C2 JUs may be assigned a 00001 through 77776_8 address except 00077_8, 00176_8, 00177_8, and 07777_8. To allow C2 JUs to properly exchange addressed messages with PUs and RUs, every effort should be made to assign them a 001 through 175_8 address. If not possible, TNs greater than 177_8 should only be assigned to the C2 JUs least likely to exchange addressed messages with PUs and RUs. C2 JUs with command authority, likely to originate handover requests or orders addressed to PU/RUs, must be assigned an address below 176_8. These orders and requests cannot be forwarded to Link 11/11B if the source TN is 00200_8 or greater.

d. An IU capable of Link 11, Link 16 and/or IJMS operations should be assigned a 01 through 76_8 address even if it plans to operate as a C2 JU. This expedites the IU's activation of Link 11 and prevents confusion if their Link 16 capability becomes unusable. For similar reasons, IUs capable of Link 11B and Link 16 operation should be assigned a 100_8 through 175_8 address.

e. NonC2 JUs may be assigned a 00200_8 through 77776_8 address except 07777_8. To facilitate operator recognition all nonC2 JU addresses should be taken from a common block of TNs reserved for that purpose. Because nonC2 JUs are forwarded to Link 11 as surveillance tracks, it is also highly desirable that C2 JU addresses not be greater than 07776_8 to facilitate forwarding and operator recognition.

f. TN 177_8 is the collective address and cannot be assigned as an IU address.

g. Because addresses greater than 177_8 cannot be used on Link 11/11B, FJUs use the pseudo source address 176_8 when forwarding data from a C2 JU whose TN is 00200_8 or greater, but use the host platform IU address for indicating R^2 when forwarding nonC2 JU PPLI reports as tracks on Link 11/11B.

h. An FJUA or FJUAB must be assigned a single 01 through 76_8 address because it participates actively as a PU and a JU and uses a single address for both data links and for data forwarding. For a similar reason, an FJUB must be assigned a 100_8 through 175_8 address. SFJUA, SFJUAB or SFJUBs must also be assigned a 01 through 76_8 or 100_8 through 175_8 address, respectively.

i. TN 77777_8 is used specifically as the network manager address within Link 16 and is not to be allocated for any other purpose

j. TNs 00077_8 and 07777_8 are illegal for any purpose.

k. Table 4-3 summarizes the above IU address assignment criteria.

l. IU addresses should be assigned in the appropriate sets of the OPTASK LINK. For multi-link capable IUs, the same IU address must be assigned in all applicable data sets.

m. Link 4A assigns a unique address to each controlled aircraft to provide a capability for a controlling unit to transmit orders, commands, and track data to specific controlled aircraft. Because Link 4A is transmitted unencrypted the Link 4A address assigned to each aircraft is classified. Link 4A address block assignments are published in the OPTASK LINK Message and in the ATO message. For additional information see the classified supplement to this manual.

n. Each unit reporting on Link 1 will be assigned a unique address. This address is assigned in the OPTASK LINK message and will be two alpha characters (from the characters set A, E, G, H, J, K, L, and M) and three octal numbers ranging from 001 through 777. A unit operating on multiple Link 1 interfaces will use the same address for all Link 1 links. The NATO TN assigned to a track by a NATO unit specifies track origin as the two character alphabetical code. Further details are contained in paragraph 5.5.5.2.

Table 4-3. IU Address Assignment Criteria

IU Type/Function	Legal Range	Preferred Range
PU/FPU	01-76	01-76
RU/FRU	100-175	100-175
C2 JU	00001-77776	00001-00175
NonC2 JU	00200-77776	00200-07776
FJUA/FJUAB	01-76	01-76
SFJUA/SFJUAB	01-76	01-76
FJUB	100-175	100-175
SFJUB	100-175	100-175
Link 11 capable C2 JU	00001-77776	01-76
Link 11B capable C2 JU	00001-77776	100-175
Pseudo Source Address	176	176
Collective Address	177	177
Link 16 Manager	77777	77777

4.4.2 TN Allocation. A TN is used to provide a common reference number for information and orders exchanged within the interface. TNs are used for both digital and voice communications to denote all IUs and/or tactical information reports; e.g., tracks, lines of bearing, fixes, points, lines, and areas exchanged on the interface. TN Allocation is the process of allocating blocks of TNs, prior to the IU's participation in the interface, to individual IUs that may originate any of the above tactical information. TN assignment refers to the computer assignment of a specific TN to a track when originated on the interface. This section only describes TN allocation.

4.4.2.1 General Considerations. There are two major differences between Link 11/11B and Link 16 that require consideration in TN allocation in a multi-link interface. These are:

a. Link 11/11B only allow 4092 TNs in the range 0001 through 7776_8. Link 16 allows 524284 TNs in the numeric range 00001 through 77777_8 and alphanumeric range 0A000 through ZZ777. The Link 11/11B TNs are a subset of the Link 16 TNs. Table 4-4 lists all available TNs on the three links in the correct sequence.

b. Link 11 can be operated in TN Block, TN Pool or TN Block/TN Pool mode, whereas Link 16 and Link 11B can only be operated in the TN block mode. The Link 11 TN Pool mode is used only by US Navy (USN) PUs.

4.4.2.1.1 High and Low TNs. TNs should not be viewed as Link 11/11B TNs or Link 16 TNs. Rather they should be viewed as Low, or High, or data forwarding TNs.

a. Low TNs are those less than 07777_8. These TNs are used for originating tracks on Link 11/11B with the leading zero omitted and Link 16. They are also used by the FJU for forwarding tracks from Link 16 to Link 11/11B if the received Link 16 TN is greater than 07777_8, but in this case are referred to as data forwarding TNs.

b. High TNs are all Link 16 TNs greater than 07777_8. This includes the numeric TNs 10000_8 through 77776_8 and all alphanumeric TNs. These TNs are used only to originate tracks on Link 16. They should normally be allocated only for overflow purposes; i.e., to be assigned only when all Low TNs allocated to a C2 JU are in use, or when Low TN blocks cannot be allocated to all C2 JUs.

c. The block of Low TNs allocated to the FJU for forwarding are referred to as the data forwarding TN block. These TNs are used by the FJU only when a received Link 16 TN is a High TN. (If the received Link 16 TN is a Low TN, it is also used in the forwarded report, with the leading zero removed.)

4.4.2.2 TN Allocation Criteria. Based on the foregoing general considerations, the following criteria are applied when allocating TNs:

a. All C2 IUs capable of originating tracks on the interface must be allocated a TN block, except that USN PUs may be assigned to operate in an allocated Link 11 TN Pool. Allocated blocks and pools should be at least 50 percent larger than the maximum number of tracks an IU, or pool of PUs, may be expected to originate, which will be simultaneously active.

b. It is highly desirable to allocate only Low TNs if feasible.

Table 4-4. Link 16 Track Number Sequence and Use[1]

TN RANGE	NO. OF TNs	TYPE[2]	USE
00000	1	N	No Statement
00001-00076	62	N	PU/FPU/FJUA/FJUAB/C2 JU/CIU addresses
00077	1	N	Illegal (Not Used)
00100-00175	62	N	RU/FRU/FJUB/C2 JU addresses
00176	1	N	Link 11/11B/16 pseudo-source TN
00177	1	N	Collective address
00200-07776	3967	N	Surveillance TNs or JU addresses
07777	1	N	Illegal (Not Used)
0A000-0Z777	12288	AN	Link 16 surveillance TNs
10000-17777	4096	N	Link 16 surveillance TNs or JU addresses
1A000-1Z777	12288	AN	Link 16 surveillance TNs
20000-27777	4096	N	Link 16 surveillance TNs or JU addresses
2A000-2Z777	12288	AN	Link 16 surveillance TNs
.....			
70000-77776	4095	N	Link 16 surveillance TNs or JU addresses
77777	1	N	Link 16 manager address
7A000-7Z777	12288	AN	Link 16 surveillance TNs
A0000-A7777*	4096	AN	Link 16 surveillance TNs
AA000-AA777*	512	AN	Link 16 surveillance TNs
AB000-AB777*	512	AN	Link 16 surveillance TNs
.....			
AZ000-AZ777*	512	AN	Link 16 surveillance TNs
B0000-B7777*	4096	AN	Link 16 surveillance TNs
BA000-BA777*	512	AN	Link 16 surveillance TNs
.....			
BZ000-BZ777*	512	AN	Link 16 surveillance TNs
.....			
ZY000-ZY777*	512	AN	Link 16 surveillance TNs
ZZ000-ZZ777*	512	AN	Link 16 surveillance TNs

Notes:

1 All JUs are capable of receiving all legal TNs described in this table. All C2 JUs that assign TNs are capable of assigning all legal TNs.

2 N = numeric (5 octal numbers, 15-bit or 19-bit; in 19-bit numeric TN, bits 19, 18, 14, and 13 must be 0).

AN = alphanumeric (19-bit, 5 characters; first and/or second character must be letter A-Z (less I and O), last three must be octal numbers).
* (See paragraph 4.4.2.2 f)

c. IUs planning to operate as PUs must be allocated a Low TN block, or assigned to operate in a Low TN Pool.

d. IUs planning to operate as C2 JUs should be allocated a Low TN block, if feasible. If it is not feasible to allocate a Low TN block to all C2 JUs, C2 JUs may be allocated only High TN blocks. If it is not feasible to allocate a sufficiently large Low TN block to accommodate a C2 JU's maximum expected track origination load, a C2 JU may be allocated both a Low and High TN block, if the system can accept both a Low and High TN block. When assigned both Low and High TN blocks, a C2 JU automatically assigns only the Low TNs as long as any Low TNs are available, assigning the High TNs only when no Low TNs are available.

e. The TNs in an allocated Low TN or High TN block must be contiguous and sequential, as specified in Table 4-5.

Table 4-5. Track Number Utilization

	Low TN	High TN	Data Forwarding TN
Value	07776 or less	10000-77776 0A000-ZZ777	07776 or less
Purpose	Track origination on Link 16 or Link 11/11B (with leading zero omitted)	Track origination on Link 16	Data forwarding of High TNs to Link 11/11B

f. The A0000 through ZZ777 TN block can be divided as demonstrated in the partial list at the bottom of Table 4-4. A complete listing of these TN blocks is too voluminous to include in that table. There are 393216 TNs available within A0000 through ZZ777. Any block allocated must be contiguous. For example, if a C2 JU requires a block of 1024 TNs, the requirement could be met by allocating AA000 through AB777 to the JU.

g. A High TN block allocated to a C2 JU must be composed entirely of numeric TNs, or entirely of alphanumeric TNs, not a combination of both.

h. CIUs must be allocated a Low TN block, because CIUs normally originate a track with a single TN on both links simultaneously unless the track is filtered on one link. A CIU should not be allocated a High TN block unless the CIU is expected to originate many tracks, points, or EW data on Link 16 that will be filtered or otherwise not reportable on Link 11.

i. For TN allocation purposes, a FJU's host platform is considered a CIU.

j. An FJU must be allocated a data forwarding TN block, in addition to the Low TN block assigned to its host platform for operation as a CIU. This data forwarding TN block may be contiguous to or separate from the host platform's Low TN block. All platforms capable of forwarding are required to be able to accept non-contiguous data forwarding TN and Low TN blocks.

k. Functionally, an SFJU automatically assumes use of the data forwarding TN block allocated to the FJU from which it assumes the forwarding function. There is no automated method of informing the SFJU of the data forwarding TN block when an FJU shift is desired, and such voice coordination will normally not be feasible. Therefore, any unit assigned as SFJU must enter the FJU's data forwarding TN block when initialized as an SFJU. Alternatively, the SFJU may be allocated a data forwarding TN block separate from that of the FJU, precluding the need to initialize or assume the FJU's data forwarding TN block. However, this would normally be an inefficient TN allocation practice.

l. NonC2 JUs do not originate TNs. Therefore, they are not allocated TN blocks.

m. TN blocks should be allocated in the appropriate sets of the OPTASK LINK. For multi-link capable IUs, the allocated Low TN block must be repeated in all applicable data sets. However, High TN blocks shall only be allocated in the JUDATA set. The data forwarding TN block shall be allocated only in the LPUDATA or LRUDATA set for the FJU's host IU.

4.4.2.3 Link 11 TN Pools. Some PUs are capable of operating in a Link 11 TN Pool. In the TN Pool mode, two or more PUs are allocated the same TN block. The PUs automatically assign and account for all TNs within that block, which is thus effectively a shared Pool of TNs. The use of TN Pools permits more efficient use of the limited number of Low TNs than unique individual TN blocks. However, the following limitations on TN Pools must be considered:

a. PUs not in the TN Pool must be allocated unique TN blocks.

b. A FJU shall not be assigned to operate in a Link 11 TN Pool, nor shall its host platform.

c. A CIU shall not be assigned to operate in a Link 11 TN Pool.

d. Link 16 and Link 11B cannot be operated in a TN Pool mode.

4.4.2.4 Special TN. The Special Track (SPECTRK) set of the OPTASK LINK allows the pre-assignment of special TNs to certain entities; e.g., points, lines, areas, and tracks that may be reported on the interface. Such pre-assignment is particularly useful for rapid operator recognition of commonly encountered objects such as Surface-to-Air Missile (SAM) sites and other points, lines, areas, or tracks, including friendly non-IUs. Normally, a specific C2 IU should be pre-assigned to originate the track, point, line, or area on the interface using the Special TN. Assignment of Special TNs requires manual operator entry of the TN. Some systems do not have the manual TN assignment capability. These systems are identified in Appendix A.

4.4.2.5 ATDL-1 TN. An ATDL-1 TN consists of two alphabetic characters and three octal digits. An ATDL-1 TN derives its two alphabetic characters from the station address of the unit initiating the track and a unique three digit octal number derived from the TN block assigned to the unit. The Hawk BCP/PCP TNs XY001 through XY006 are reserved for the following specific use, where "X" represents the values "A" to "N", "P" and "Q" and "Y" represents the values "A" to "H":

a. XY001 and XY002 are reserved to report Hawk fire sections.

b. XY003 through XY004 are used to report engaged ECM emitters.

c. XY005 through XY006 are used to report center bearings of HPI sector scan or center bearing of the Low Altitude Simultaneous Hawk Engagement (LASHE) zone.

NOTE: The unique address "AA000" is used to indicate No Statement/Unknown. The unique address "QH" is used only as a general address. "QH" is illegal for use as a station address.

4.4.2.6 Link 4A Track Index Numbers. Each controlled aircraft operating on Link 4A will report tracks to its controlling unit by assigning a Track Index Number (TIN) to the track. Each aircraft will maintain its own block of TINs, reusing TINs when the track is no longer reported.

4.4.2.7 NATO Track Numbers (NTN). Each track within the NATO Air Defense Ground Environment is allocated a NTN. NTN's consist of two alpha characters and three octal numbers. The alpha characters are assigned from A, E, G, H, J, K, L and M, and the three digit octal numbers ranging from 000 through 777_8. Each Link 1 site is assigned a fixed alpha character combination, for example KM. The combination AA is reserved for use as Non-NATO Track

Number (NNTN). These NNTN's are, by (NADGE) software functionality, automatically excluded from transmission. Also no buffer systems (e.g., SSSB, CSI) are capable of automatically forwarding NNTN-tracks. The only exception to this is the track identified as Interceptor, which is always transmitted, even when outside the Crosstell Area or altitude-layer. When a NNTN is transmitted, by manual input (Force Tell), the receiving site allocates a NTN of its own NTN-block. For ease of reference to a track, the NTN is to be retained, even when crossing several TPA's.

4.4.2.8 IJMS TNs. The IJMS System Reference Number (SRN) consists of five octal digits and is used to identify all units, tracks, and special points. SRNs 00001 through 00176_8 identify C2 systems. The remaining numbers (except those listed below) are used as identification numbers for nonC2 systems and for the reporting of tracks and special points. SRN 00177_8 is used for the collective address, and SRNs 00000, 00077_8, and 77777_8 are illegal.

4.4.3 Data Filters. Data filters are used to inhibit the transmission of data on a data link or to inhibit data received on a data link from being entered into an IU's database. Some systems do not have a data filter capability. Filters under operator control can be used to:

a. Avoid overloading an IU's database (Receive filter, but this also requires a Transmit filter).

b. Avoid overloading a data link (Transmit filter and/or data forwarding filter).

c. Avoid overloading host Link 16 NPG transmit buffers (Transmit filters).

d. Divide R^2 among IUs based on operating areas or other criteria (Transmit filters).

e. Control transmission and reception of SPI and simulated data (Transmit, Receive, and/or data forwarding filters).

f. Control transmission and reception of data based on treaties, national restrictions, etc. (Transmit, Receive, and/or data forwarding filters).

4.4.3.1 Data Filter Management. Filter management includes the FTC/TDC's direction to insert or delete a filter and reports by individual C2 IUs of filters they have inserted or deleted. If the FTC/TDC does not agree with the insertion of a filter, he has the authority to direct its deletion. The filter

management procedures specified herein apply specifically to Transmit filters and data forwarding filters. An IU may insert or delete a Receive filter after coordination with FTC/TDC. An IU that filters data upon receipt will automatically establish a Transmit filter that duplicates or is more restrictive than the Receive filter, and such Transmit filters are subject to the filter management procedures herein. Data filters may be prearranged and specified in the OPTASK LINK, or specified during operations as the situation dictates. Link 16 Transmit filters and data forwarding filters can be directed or reported via Link 16 using the Filter Management message. Link 11/11B Transmit filters must be prearranged and specified in the OPTASK LINK or managed by voice coordination or changes to the OPTASK LINK. Filters that apply to all units on an interface are set using the OPTASK LINK FORCFLTR segment. Additional filters that apply to only one unit on an interface are set using the OPTASK LINK UNITFLTR segment.

> NOTE: In joint or combined operations with or without multi-link capabilities, any restriction of data posed on the interface shall be coordinated with the FTC/TDC. This restriction does not apply to individual IU Display filters, but does apply to Transmit filters and data forwarding filters.

4.4.3.1.1 Prearranged Filters. The interface planning process must determine filters to be used at the onset of operations and those that are likely to be necessary during operations. All such pre-arranged filters shall be assigned a filter number and promulgated by the data link planners in the OPTASK LINK.

4.4.3.1.2 Non-prearranged Filters. Additional filters may be determined necessary during the course of interface operations by the FTC/TDC or individual IUs. These should be directed or reported via Link 16, if applicable; otherwise, they are directed or reported via voice and/or changes to the OPTASK LINK. All filters directed by the FTC/TDC shall be assigned a filter number. Filters reported by individual IUs shall include the pre-assigned filter number if applicable. Otherwise, the FTC/TDC shall assign a filter number upon receipt of a filter report from an IU.

4.4.3.1.3 Filter Numbers. All filters shall be assigned a filter number to be used for brevity in all reference to the filter. The filter number consists of a number preceded by a letter(s) to indicate the link(s) to which the filter applies (filter unit type), as shown below. The same number may be used in more than one filter number, with different letters. Filter numbers should be specified in the OPTASK LINK, in the first field in the FORCFLTR or UNITFLTR set, as appropriate. Voice coordination is required in addition to filter management

information in the OPTASK LINK. Link 16 provides the capability to support filter management as described in paragraph 4.4.3.1.4.

Filter Unit Type

A = Link 11 Transmit filter.

B = Link 11B Transmit filter.

J = Link 16 Transmit filter.

AB = Data forwarding filter for data forwarded from Link 11 to Link 11B.

BA = Data forwarding filter for data forwarded from Link 11B to Link 11.

M = Transmit filter for all data links in a multi-link interface.

FA = Data forwarding filter for data forwarded from Link 16 to Link 11.

FB = Data forwarding filter for data forwarded from Link 16 to Link 11B.

FAB = Data forwarding filter for data forwarded from Link 16 to Link 11/11B.

FJ = Data forwarding filter for data forwarded from Link 11 or Link 11B to Link 16.

4.4.3.1.4 Link 16 Filter Management. Link 16 allows for directing and reporting fourteen of each of the Filter Unit Types J, FA, FB, and FAB above. If more than fourteen filters of one of these types are required, they must be managed by voice coordination.

4.4.3.1.5 Other Filter Information. In addition to the filter number, the following information should be provided, as applicable, when directing or reporting filters:

a. Reason for filter; e.g., data link or database overload.

b. Type of filter being inserted.

c. Parameters of filter being inserted.

d. Whether it is to be a Transmit or Transmit and Receive filter.

e. If a temporary filter, the estimated time that the filter will be required.

4.4.3.1.6 NonC2 JU Filters. All of the filter capabilities and procedures in this section apply only to C2 IUs. There are no specific requirements for nonC2 JU filters. Any filters used by nonC2 JUs do not require interface coordination. However, nonC2 JUs should keep their controlling IUs informed via voice of any filters used.

4.4.3.2 Data Filter Types. The following defines the various types of transmit and data forwarding filters that may be established. Filter capabilities vary among various IUs. Platform filter capabilities are provided in Appendix A.

4.4.3.2.1 Geographic Filters. A Geographic filter allows an IU to filter data based on geographic location, as shown in Figure 4-2. Maximum and minimum altitude values may also be defined for each filter to describe volumes. Geographic filters also require an indication of whether the filtering is being done inside or outside the defined area or volume, or which side of a line is being filtered. When a receive filter is defined, the associated Transmit filter shall duplicate or, where possible, be slightly larger than the area filtered for reception to avoid dual designations.

4.4.3.2.1.1 Fixed or Slaved Filters. A geographic filter may either be fixed, or be slaved to an IU, track, or point. A slaved filter remains on a constant true bearing and range from the IU, track, or point to which it is slaved, automatically moving with the same course and speed as the IU, track, or point. It is often advantageous to slave a filter to ownship, or to a force reference point such as Position and Intended Movement (PIM), Formation Center, or Disposition Center.

4.4.3.2.1.2 Operational Factors. Operational considerations, (e.g., sensor capabilities, threat orientation or axis, geographical considerations) may dictate the use of geographical filters to establish TPAs, etc.

4.4.3.2.1.3 Filtered Data. When a Geographic filter is inserted and not modified by any of the below filters, all data either inside or outside, as specified, of the area or volume, or the specified side of a line, are filtered, except Force Tell or Emergency data. This could include data otherwise prohibited or discouraged from filtering.

4.4.3.2.2 ID Filters. An ID filter allows an IU to filter data based on ID. In Link 16, the ID transmitted over the interface may be either the actual ID or

the ID assumed for an exercise; e.g., a JOKER would be filtered if a SUSPECT filter were set but not if the FRIEND filter were set.

4.4.3.2.3 Environment Filters. An environment filter allows an IU to filter data based on the Environment Categories of Space, Air, Surface, Subsurface, or Land.

4.4.3.2.4 Reference Point Filters. A Reference Point filter allows an IU to filter all reference points, lines, and areas. Land points are filtered by a Land Environment filter, not a Reference Point filter. General, Air, Surface, and EW Areas Of Probability (AOPs) are filtered by an EW filter, not a Reference Point or Environment filter. However, Under Sea Warfare (USW) AOPs are filtered by a Reference Point filter, but not by a Subsurface Environment filter.

4.4.3.2.5 EW Filters. An EW filter allows an IU to filter all EW information on Link 11/11B and all EW product information on Link 16. However, parametric EW information originated on Link 16 is not affected by an EW filter. Forwarding of EW parametric information to Link 11/11B is inhibited when the FJU is in the Limited (Product) Mode. Transmission of parametric EW information on Link 16 can be inhibited as described in paragraph 5.8.3.1.

4.4.3.2.6 SPI Filters. Data that require special handling within the interface are identified by a SPI. When certain IUs are not authorized to receive SPI data, Security Transmit and Security data forwarding filters must be established for the link(s) upon which such IUs receive data, as directed by appropriate authority. An alert (either Force Tell or Emergency) forces the track or point through Security filters.

4.4.3.2.7 Simulation Filters. A Simulation filter allows an IU to filter simulated data (see Chapter 7). All simulated data can be filtered regardless of other criteria. This includes the filtering of track and IU reports, even those having Emergency and Force Tell alert status. A Simulation filter only filters simulated data. However, if a Simulation filter were used in conjunction with another filter (e.g., air), then only simulated air tracks would be filtered and not other simulated data. To filter both simulated and live data, two separate filters are necessary.

4.4.3.3 Multiple Settings/Multiple Filters. A single filter may have multiple settings, (e.g., Neutral, Air), within a specific geographic area. In this case only neutral air tracks within the specified area will be filtered. When reporting multiple filters, only one filter can be reported at a time, unless those filters are obviously separate; e.g., Air and Land are different environments, and FRIEND and NEUTRAL are separate IDs. Therefore, a single report could report

surface, land, and subsurface being filtered. However, if other settings were reported in the same report (e.g., SPI or an ID), they would have to apply to all the Environments equally or the filters would be reported separately for each circumstance.

4.4.3.4 Data Filter Restrictions. Except for security or mission requirements, filtering of HOSTILE, SUSPECT, and UNKNOWN tracks, and FRIEND Fighter tracks, is discouraged. Except as indicated above, the following data are not filtered:

a. C2 IUs. However, nonC2 JUs are considered as FRIENDS and as such are filtered in the same manner as Friendly tracks.

b. Any track or point having Emergency and/or Force Tell status.

c. Management, status, and associated messages related to a track, point, or IU that is not filtered.

4.4.3.5 Termination of Filters. Transmit filters are terminated by the operator in accordance with paragraph 4.4.3.1 and shall be reported as such on the interface. Since Receive filters inhibit data from entering a system's database, C2 IUs shall treat Receive filter deactivation the same as initiation of surveillance operations; e.g., correlation and minimum wait time before resumption of transmission. See paragraph 5.5.1.

4.4.4 EW Planning Factors. Paragraph 5.8 describes various aspects of EW operations that must be considered in the interface planning process in coordination with the designated EW Coordinator (EWC) and promulgated in the reporting requirements of the OPTASK EW (This information may be disseminated to network participants in the OPTASK LINK GENTEXT/REPORTING INSTRUCTIONS set). These include:

a. Designation of EW nodes.

b. EW IU reporting modes.

c. EW data forwarding mode.

d. EW-to-EW association mode.

e. EW Local Discrete Identifiers (ELDI).

f. Electronic emission control (EMCON) plan.

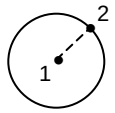
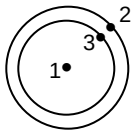
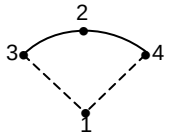
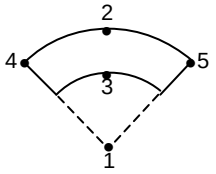
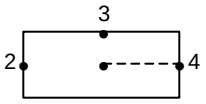
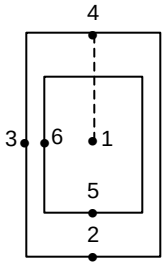
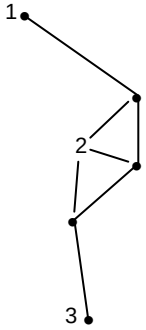
Name	Diagram	Description
Circle		1. Latitude/Longitude - Origin of the circle. 2. Latitude/Longitude - Point of circumference, or radius in nautical miles.
Annulus		1. Latitude/Longitude - Origin of the annulus. 2. Latitude/Longitude - Point on outer circumference, or radius of outer ring in nautical miles. 3. Latitude/Longitude - Point on inner circumference, or radius of inner ring in nautical miles.
Circular Sector		1. Latitude/Longitude - Origin of the circle. 2. Latitude/Longitude - Point on circumference, or radius in nautical miles. 3. Bearing 1 - Start Bearing 4. Bearing 2 - End Bearing (clockwise rotation).
Sector of Annulus		1. Latitude/Longitude - Origin of the annulus. 2. Latitude/Longitude - Point on outer circumference, or radius of outer ring in nautical miles. 3. Latitude/Longitude - Point on inner circumference, or radius of inner ring in nautical miles. 4. Bearing 1 - Start Bearing 5. Bearing 2 - End Bearing (clockwise rotation).
Rectangle		1. Latitude/Longitude - Origin of the rectangle. 2. Latitude/Longitude - Point on perimeter representing length, or length in nautical miles. 3. Latitude/Longitude - Point on perimeter representing width, or width in nautical miles. 4. Axis orientation in degrees - 90º defining a horizontal rectangle.
Nested Rectangle		1. Latitude/Longitude - Origin of the rectangle. 2. Latitude/Longitude - Point on perimeter representing length, or length in nautical miles. 3. Latitude/Longitude - Point on perimeter representing width, or width in nautical miles. 4. Axis orientation in degrees of both rectangles - 0º defines vertical rectangles. 5. Latitude/Longitude - Point on inner perimeter representing length, of length in nautical miles. 6. Latitude/Longitude - Point on inner perimeter representing width, or width in nautical miles.
Line		1. Latitude/Longitude - Describe the initial point in a segmented line. 2. Latitude/Longitude - Describe the additional points that should be joined to form a segmented line or bearing in degrees and range in nautical miles from a preceding point. 3. Latitude/Longitude - Identifies the end point in a segmented line.

Figure 4-2. Geographic Filter Description

4.4.5 Common Reference Points, Lines, and Areas. When a large number of Reference Points are used in common by two or more IUs, Common Reference Points should be established. Also, lines and areas describing operating areas, coastlines, and other geographical boundaries should be established in common among link users to the maximum extent feasible (lines and areas cannot be transmitted on Link 11/11B). Lines and areas are generically referred to as Reference Points also, because they are either defined by a central point or a series of connected points. A Common Reference Point is a point, line, or area that two or more IUs are holding in the same geographic location and that represent the same object or boundary of interest. The use of Common Reference Points can eliminate duplication and reduce display clutter. The ICO will designate the C2 IU to enter and report the Common Reference Point. It is desirable that Common Reference Points be identified as prearranged items in the OPTASK LINK SPECTRK set. Additional Common Reference Points can be readily entered and reported when they are identified during interface operations. Paragraph 5.6 provides detailed procedures for reporting points, lines, and areas. The following information may be specified in the OPTASK LINK for prearranged Common Reference Points:

a. Pre-arranged TN.

b. Type of point, line, or area; e.g., CAP Station, Corridor, Restricted Area.

NOTE: Dynamic information (e.g. Location, Altitude, and Reporting Unit) will be specified in the ATO or appropriate OPTASK.

4.4.6 Adaptable Values. Most of the data elements exchanged via tactical data link have only “fixed” meanings associated with their possible values. These meanings are programmed into the software, displays, and input devices in the various participating TDSs and cannot be changed on an operational basis. However, a few data elements have “adaptable” values. These values have no fixed meanings, but have been reserved for definition on a case basis for each interface operation. This enables operational planners to ensure that the meanings that are most pertinent to a specific operation can be exchanged via data link among all concerned IUs. The data link planners in concert with the appropriate commanders should define the adaptable values to be used in each interface operation in the 1MANCODE set of the OPTASK LINK. The following provides general criteria for selecting meanings for adaptable values. Listed below are data elements that have adaptable values and specific criteria for each.

4.4.6.1. Reporting Adaptable Values. Planners must determine the reportable fixed values of the data elements that have adaptable values and the implementation thereof by planned interface participants. Some units only implement fixed values, some units only implement adaptable values, some implement both. When the same value is on both the adaptable and fixed lists, then some units will transmit the adaptable value and some will transmit the fixed value.

4.4.6.2 Determining Adaptable Values. Adaptable value meanings should be kept as brief as possible to facilitate pre-operational entry into IU databases, as well as operator reference. Some systems can enter the adaptable value meanings into their database, whereas others only enter the value and the operator is required to look-up the meanings.

4.4.6.3 Assigning Adaptable Values. The procedures for assigning adaptable values are dependent upon whether the data element is reported in an Intelligence message or a Surveillance (track) message. Use of the Intelligence message does not necessarily mean the information was derived by intelligence sources; i.e., other than traditional surveillance sources. Therefore, an adaptable value in the Intelligence message need not be limited to use for intelligence reporting.

4.4.6.4 Nationality/Alliance (NAT/ALL). This data element allows the reporting of the specific nationality, or more generally the alliance if the nationality is not known, of a track. NAT/ALL can only be reported in the Intelligence message. There are approximately 93 defined fixed nationalities and three alliances (NATO, United Nations, and International Red Cross).

4.4.6.4.1 NAT/ALL Adaptable Values. NAT/ALL values 1 through 28 (NAT/ALL-1 through NAT/ALL 28) are adaptable values. They should be assigned meanings in the OPTASK LINK using the two-letter country codes defined in references d, e, and f, Enclosure B, if possible, to facilitate preoperational entry into IU databases.

4.4.6.4.2 Example of Use of NAT/ALL Adaptable Values. Joint operations are being conducted in the Persian Gulf area. The AADC determines that Iraq (Country code = IZ) is a reportable fixed NAT/ALL value, but some platforms do not transmit or receive it. Iraqi aircraft are expected to be encountered. The AADC also knows that ships from the United Arab Emirates (Country code = TC) will be operating with friendly forces, but the United Arab Emirates is not a reportable NAT/ALL. The AADC may attempt to overcome the above operational reporting limitations by specifying in the OPTASK LINK:

NAT/ALL-1 = IZ

NAT/ALL-2 = TC

4.4.6.5 Activities. There are two levels of Track Activity for which adaptable values are definable. These are the overall primary activity or mission of a track (or land point), and the specific activity in which the track or point is currently engaged. These are referred to as Activity and Activity Amplification. Reportable activities are dependent upon environment. As an example of the difference between the two levels, "AAW" is an Air Activity, whereas Weapons Release Imminent is an Air Activity Amplification. Activity and Activity Amplification are equally reportable on all links, but adaptable surveillance derived activities cannot be reported on Link 11/11B. Up to 12 adaptable values also may be defined for each activity level for each environment. Further guidance for promulgating adaptable Activities in the OPTASK LINK follows:

a. Activity (ACT) 1 through 12: A single list of adaptable Activities should be specified for each environment, independent of whether Activity is derived by Intelligence or general surveillance methods. However, planners need to consider that general surveillance-derived adaptable Activities cannot be reported on Link 11/11B. Specify Environment dependent adaptable Activities in the OPTASK LINK as follows:

(1) Air: AIR ACT 1-12.

(2) Space: SPACE ACT 1-12.

(3) Surface: SURF ACT 1-12.

(4) Subsurface: SUB ACT 1-12.

(5) Land: LAND ACT 1-12.

b. Activity Amplification (ACT AMP) 1 through 12: ACT AMP is reportable only in the Intelligence message. Specify Environment dependent adaptable ACT AMPs in the OPTASK LINK as follows:

(1) Air: AIR ACT AMP 1-12.

(2) Space: SPACE ACT AMP 1-12.

(3) Surface: SURF ACT AMP 1-12.

(4) Subsurface: SUB ACT AMP 1-12.

(5) Land: LAND ACT AMP 1-12.

4.4.6.6 Specific Types Reported in the Intelligence Message (Link 11/11B). Link 11/11B allows definition of many adaptable meanings for the Specific Type of a track as determined by sources independent of surveillance track reporting responsibility. These adaptable Specific Types cannot be transmitted on or forwarded to Link 16. They are dependent upon the Environment and General Type of the track. The Air and Land Environment include both fixed and adaptable Specific Types, but surface and subsurface Specific Types are only adaptable. Missile Specific Types are reportable separate from the Air Environment. Table 4-6 summarizes the Link 11/11B adaptable Specific Type reporting capabilities, with the abbreviations to be used in the OPTASK LINK or Intelligence section of OPORDS to define the meanings.

4.4.6.7 Surface Missile Types. Link 16 allows Surface C2 JUs to report their onboard inventory of specific types of surface missiles (e.g., SM-2 (ER), TOMAHAWK, HARPOON), whereas Link 11/11B only allows reporting surface missiles as Medium or Long-range (Short-range, i.e.; point defense missile inventory is not reported on the interface). Link 16 also provides seven adaptable values for Surface missile types, to be used in the event Surface C2 JUs in the interface have missiles on board that are not in the fixed Surface Missile Type list. The Navy planners should compare the implementation of Surface Missile Types with known missile capabilities of Surface C2 JUs planned to participate in the interface and define adaptable Surface Missile Types as SMT-1 through 7 in the OPTASK LINK if necessary to allow reporting all significant surface missiles (other than point defense). Adaptable Surface Missile Types are not forwarded to Link 11/11B, because the FJU does not know whether to categorize them as Medium or Long-range.

4.4.7 Other Operationally Defined Lists. Three other data elements are exchanged via links that can be tailored to the requirements of a particular operation, or operationally defined for more general purposes on a continuing basis; e.g., for a theater of operations, for a deployment. They are distinguished from the adaptable value lists in that these data elements are completely adaptable; i.e., they have no fixed meanings. These data elements are:

a. Local Discrete Identifiers (LDI).

b. Special codes.

c. Mission correlators (Link 16 only).

4.4.7.1 Intelligence and EW (Link 16 only) Local Discrete Identifiers. LDIs are decimal numbers from 1 through 4094 that may be defined by an operational commander for any desired purpose related to Intelligence reporting or EW operations. Separate LDI lists may be defined for Intelligence and EW, or a single multipurpose LDI list may be promulgated. Intelligence LDIs (ILDI) can be reported on all links, but EW LDIs (ELDI) are limited to Link 16 only. Further guidance for ELDIs and ILDIs is contained in paragraphs 5.8.2.4 and 5.9.1.9, respectively.

NOTE: LDIs are not the same as the platform Discrete Identifier (DI) codes used by USN. The DI codes are octal numbers and are a form of special code.

4.4.7.2 Special Codes. Special codes are more general in nature than LDIs and of a different form. They are octal numbers that may be defined for any purpose desired by an operational commander. Three different Special Code lists may be defined, known as Special Code 1, 2, and 3. Special Codes 1 and 3 lists may be defined in the OPTASK LINK GENTEXT/ INTELLIGENCE LOCAL DISCRETE IDENTIFIER or elsewhere for any purpose, but are available in Link 16 only. The OPTASK LINK should specify “Special Code 2 = USN DI Codes,” when USN C2 IUs are in the interface.

NOTE: The Special Code 2 list is always used by USN for platform DI codes that allow very specific identification of non-friendly ships and aircraft. These DI codes can be reported on all links.

4.4.7.3 Mission Correlators (Link 16 Only). A Mission Correlator (MC) is a unique decimal number between 1 and 255 assigned as an optional capability to all JUs participating in a specific overall mission. An MC allows the identification and isolation of the associated JUs.

4.4.7.3.1 MC versus Mission Number. The MC is not synonymous with the mission number assigned to a specific aircraft or flight of aircraft. Mission numbers are assigned in the ATO, Daily Air Plan, or TACOPDAT, and normally do not have the same simple numeric form as MCs. MCs are only reportable on Link 16, and mission numbers are only reportable on Link 11/11B. The MC may be the same for numerous mission numbers. For example, one MC could be assigned to a nonC2 JU strike mission and the supporting nonC2 JU aircraft for that strike; i.e., pre- and post-strike tankers, CAP aircraft, EW support aircraft, and the Forward Air Controller (FAC) aircraft. A single MC

could be assigned to all JUs in a Naval battle group, with additional MCs assigned to uniquely identify JUs within task units, task elements, etc., of the battle group.

4.4.7.3.2 Reporting MCs. Assigned MCs are reported by JUs in their PPLI messages. A JU can be assigned up to eight different MCs, depending upon system implementation. Through display filtering, all the JUs assigned the same MC, and thus participating in the same mission, battle group, etc., can be identified.

4.4.7.3.3 Assigning MCs. MCs may be assigned during the course of operations by appropriate operational commanders or other personnel. For example, an air controller may assign an MC to a flight of nonC2 JU aircraft he is controlling. However, to do so, the controller's unit must have been allocated a block of MCs for this purpose in order to avoid the confusion that would arise if JUs on separate missions were assigned the same MC. MCs can only be assigned to JUs, not tracks or other IUs.

> NOTE: When assigning MCs, remember MCs cannot be forwarded to or reported on Link 11/11B.

4.4.8 Conditional Capabilities. Certain interface capabilities, called Conditional Capabilities, may be authorized for use only if all IUs or C2 IUs in the interface have implemented them; otherwise, their use can create significant interoperability problems. The ICO must ascertain if these conditions are met. The OPTASK LINK reporting responsibilities GENTEXT/REPORTING REQUIREMENTS set shall specify whether or not each of these capabilities are authorized for use. The ICO must also monitor for changes in these conditions; e.g., interface entry or exit by a non-implementer. Each of these capabilities is described elsewhere in this document, including details of the limiting conditions. They are summarized in Table 4-7, with reference to the governing paragraph and a brief description of the limiting condition.

4.4.9 Additional Planning Factors. The following describe certain other factors that should be considered during planning for interface operations. They may be specified in the OPTASK LINK or by other means, either prior to operations or during the course of operations as appropriate.

4.4.9.1 Contingency Procedures for Non-digital Data Exchange. The partial or complete loss of the data link interface is always a possibility. To ensure that operations are not affected by prolonged outages, contingency procedures are required for exchanging data in a non-digital form. These procedures must

provide for voice exchange of essential data and the interfacing of the voice exchange with any remaining digital interface. Specific voice procedures and manual tell formats are contained in paragraphs 5.11.7 and 5.11.8. Considerations for developing contingency procedures are:

a. Selecting data to be reported manually (by voice) that is essential to current operations. The volume of data handled manually will be considerably less than that handled by automated data links. Therefore, priorities should be established to prevent voice net and operator saturation.

b. Designating voice circuits to be used for manual reporting. The voice coordination nets used in conjunction with data link operations can be used for this purpose. Care must be exercised to ensure that the volume of voice traffic does not interfere with the control and coordination of any remaining digital interface.

c. Designating certain IUs still active on the data links to provide the interface between voice reporting and the remaining digital interface. Designated IUs manually enter voice-reported tracks onto the interface and report selected interface tracks via voice, exercising great care to ensure against creating dual designations.

4.5 Service-Unique Planning Factors.

4.5.1 Variable Track Quality (VTQ). Some maritime platforms have a capability to manually enter a maximum TQ value, between 3 and 6, to be assigned by that IU to any track, regardless of whether the unit is operating on Link 11/11B or Link 16. This capability, commonly referred to as “Dial-a-TQ,” allows the ICO or FTC/TDC to direct IUs with less accurate sensors to limit their TQ to ensure that the most accurate positional data is reported on the interface. It also provides a means of biasing R^2 toward the GRU when necessary to ensure that the GRU reports a sufficient number of tracks to allow proper gridlock.

Table 4-6. Link 11/11B Adaptable Specific Types

Specific Type	Adaptable Value Codes
Air	
Fighter/Interceptor	F/I-1-31
Fighter-Bomber/Attack	F-B/A-1-31
Bomber	BMB-1-31
Helicopter	HL-1-31
Attack Helicopter	AH-1-31
Drone/RPV	D/R-1-31
Support	SUP-1-31
Civil	CIV-1-31
Patrol	PAT-1-31
AEW	AEW-1-31
Other	OTH-1-31

Specific Type	Adaptable Value Codes
Surface	
Aircraft Carrier	CVX1-62
Destroyer	DDX1-62
Cruiser	CGX1-62
Frigate	FFX1-62
Patrol	PXX1-62
Mine Warfare	MWX1-62
Amphibious	AMX1-62
Support	AUX1-62
Tanker/Oiler	AOX1-62
Fishing Boat	FSH1-62
Merchant	MER1-62
Other	OTR1-62

Specific Type	Adaptable Value Codes
Subsurface	
Attack	SSX1-62
Cruise Missile Launcher	SSGX1-62
Ballistic Missile Launcher	SSBX1-62
Other	SSOX1-62

Specific Type	Adaptable Value Codes
Land	
SAM Site	SAM-1-31
AAA Site	AS-1-31
GCI Site	GC-1-31
ECM Site	ES-1-31
Air Base	AB-1-31
Trap	TR-1-31
Dummy	DU-1-31
Command Center	CC-1-31
SSM Site	SS-1-31
Point Target	PT-1-31
Field Artillery Site	FA-1-31
Troop Concentration	TC-1-31
Convoy/Vehicle	CV-1-31
Other	OT-1-31

Specific Type	Adaptable Value Codes
Missile	
Antiair	AW1-62
Antisurface	ASF1-62
Antisubmarine	USW1-62
Other	OTR1-62

Table 4-7. Conditional Link Capabilities

Capability	Reference	Condition
Emitter numbers from other than NATO emitter database (NEDB)	5.8.2.2	New emitter number indicator (ENI) must be approved and recognized by all C2 IUs.
Correlate Message	5.10.1.1	If all C2 JUs implement; not used in interface with Link 11/11B. See procedures in Chapter 5.
Simulated Tracks	7.3	All IUs must recognize.
Simulated IUs	7.3.3	All IUs must recognize.

4.5.1.1 Maximum TQ Values. Although 7 is the maximum TQ reportable on Link 11/11B, TQs up to 15 are reportable on Link 16. The Link 16 TQs 8-15 require much greater positional accuracy than Link 11/11B TQ 7, and the higher Link 16 TQ values are only achievable by C2 JUs with very accurate sensors and navigation. Thus, R^2 will naturally tend to migrate toward the C2 JUs with the most accurate track data, and Dial-a-TQ will not normally be advantageous in a multi-link interface. However, directing certain C2 JUs with less accurate sensors to limit their TQ to 6, or lower, may be advantageous. An example might be when the platforms with the most accurate sensors must operate as PU/RUs.

4.5.1.2 Specifying VTQ Settings. VTQ settings may be specified for some IUs in the OPTASK LINK in the GENTEXT/REPORTING REQUIREMENTS set during operations as the situation dictates.

4.6 ICO Communication Planning Considerations

4.6.1 ICO Planning Responsibilities. This section delineates the required data link communications technical planning factors that must be considered in preparation for joint and allied data link operations. Both technical and tactical considerations of data link communications are essential elements of data link planning. The primary theater data link voice communication circuits that shall be established and maintained are DCN, TSN, ADCCN, and VPN.

4.6.1.1 ICO Planning Considerations. The ICO must consider all joint communication tools that are available to support joint integrated operations. Reliable voice communications with higher echelon commands is just as important as voice communications with IUs. The ICO will coordinate with the appropriate commanders in planning data link operations. Distributive planning tools are essential for proper planning and execution. Circuits include but are not limited to voice, data and VTC capabilities; i.e., Global Command and Control System, Theater Battle Management Core Systems (TBMCS), STU III STEL, KY-68, EHF, and the SIPRNET/NIPRNET. Reliable communications require a high state of material readiness and strict adherence to standard communications concepts and procedures. When planning a voice communications architecture, consider the degree of control required. Highly centralized control requires rapid reliable communications throughout the operation, while decentralized control is effective even when communications are unreliable.

4.6.1.2 Voice Requirements. The ICO should provide the appropriate commander with voice communications requirements via the AADC by priority at the earliest possible time to facilitate establishing theater Link voice communication nets.

4.6.1.3 Communications Plan. The communications planner generates a communications plan (Appendix K) to the OPLAN and OPORD that includes the data link voice and data requirements. The ICO will extract information from the communication plan for inclusion in the OPTASK LINK DALKFREQ set.

4.6.1.3.1 ICO Communications Section. The communications planner will submit a ICO communications section in the ATO Special Instructions (SPINS). In addition to the SPINS, the ICO should identify specific voice requirements for each circuit in the OPTASK LINK IVCCN set as soon as possible. The SPINS, although comprehensive, could contain conflicts between data and voice frequencies. The ICO shall ensure the communication section of the SPINS is well organized.

4.6.1.4 OPTASK LINK Message. The ICO as well as the IUs have a responsibility to coordinate with each other during OPTASK LINK production, dissemination, and implementation. Voice communications factors the ICO must consider in developing the OPTASK LINK message are:

a. What is the overall guidance from the OTC/AADC regarding the interface?

b. What inputs have been made by the IUs regarding their needs for

specific types of data link information?

c. What are the voice communications capabilities and limitations of the IUs with respect to achieving the joint interface goals?

d. How can the IUs contribute toward achieving the goals of the theater data link voice communication interface?

e. Are there any special considerations necessary for one unit or platform or type of platform?

f. Have IUs provided written input concerning voice communications requirements to the ICO to be used in producing the OPTASK LINK message?

4.6.2 ICO and RICO/SICO Planning Considerations. When the AOR is divided and two or more RICO/SICO(s) are designated, communications connectivity between each of the RICO/SICO(s) and the ICO should be identified. The ICO should solicit information from each designated RICO/SICO concerning the technical parameters that affect their IU voice system operation. These inputs include organic and non-organic communications media available:

a. Ground mobile forces satellite communications (GMFSATCOM) access.

b. HF.

c. UHF LOS.

d. EHF.

e. SATCOM.

f. JTIDS/MIDS voice 2.4/16kbps capability.

g. VHF.

h. SHF voice.

i. SHF data (TBMCS/SIPRNET). See NOTE below.

j. SINCGARS (FM voice).

NOTE: TBMCS provides a direct link with the Air Control Order for planning and dissemination of ATO. SIPRNET provides a direct PC-to-PC

classified Internet connectivity with unified combatant commanders, component commanders, and specific Service commands; i.e., COMFIFTHFLT, COMSIXTHFLT etc. Information includes home pages and E-mail capability.

4.6.2.1 Drafting Communications Requirements. The ICO should produce a draft OPTASK COMMS/OPTASK LINK message that can be reviewed for completeness and applicability by all designated RICOs/SICOs and IUs if feasible prior to final release. Additionally, the ICO should have a timely feedback link summary reporting system for all IUs. This link summary report can improve the overall quality of joint voice connectivity not just data link interface. Voice information in the link summary report should include voice circuits employed for link operations; i.e., circuit designation, frequency, crypto keymat and recommendations to improve voice connectivity.

4.6.3 Voice Architecture Employment Considerations. The ICO should consider that although a joint voice communication interface plan may meet the necessary technical requirements and should work, there are many factors outside the theoretical limits of equipment that impact the architecture. Taken separately, these factors may have minimal impact, but in combination, they detract significantly from voice performance of communications capabilities, equipment limitations, and a threat assessment. Sound in-depth planning and control by the ICO are imperative and should be continually provided as interface evolves and matures.

4.6.3.1 Joint Communications Architecture. In addition to diagramming a joint data link architecture, the ICO should diagram the joint voice architecture of all data link participants that includes primary and secondary voice paths. By drawing out the voice configuration options, the ICO and participants can visualize what is happening to the voice interface. The ICO should be assigned as the single agency for joint data link voice architecture changes, coordinating with the designated RICOs/SICOs. Without proper coordination, integrity of the interface may significantly degraded. Additional considerations:

a. Exploring the reconfiguration and relocation of ground communications and antenna systems to improve reliability of voice communications between surface and airborne platforms.

b. Using the AUTOCAT capability as a radio relay when required.

c. Using secure telephone systems, although not a tactical circuit, as a means to communicate point-to-point with individual IUs. This allows the ICO to establish communications with IUs that do not have an extended capability.

d. Using range extension communications assets on the ground. The ranges and distances covered and the speed of movement reinforces the air-land operations requirements for range extension and the ability to perform C2 on the move.

e. Since HF voice communications can be difficult to maintain in a large AOR, using more suitable voice communication systems to interface with all participants, i.e., SATCOM (UHF/SHF/EHF), and JTIDS/MIDS voice. However, not all IUs have these capabilities.

4.6.4 Voice Procedures. Short precise communications are required. Communications brevity and the standard use of code words described in this document continue to be major hurdles to effective execution of data link operations. ICO and all IU's shall ensure service unique jargon is minimized.

CHAPTER 5

INTERFACE OPERATING PROCEDURES

5.1 Introduction. This chapter provides the operational procedures for establishing and maintaining a multi-link interface and for real-time information exchange between operators in an interface utilizing Link 11, Link 11B, ATDL-1, Link 4A, Link 1, IJMS, and/or Link 16. It also describes the information that can be exchanged via the multi-link interface. The information exchange capabilities and operating procedures are generally applicable to any interface regardless of the specific link(s) utilized. Link 16 terminology is used as the standard throughout. However, necessary differences between individual link procedures and terminology and unique inter-link procedures are noted for understanding and proper interoperation.

5.1.1 Inter-link Information Transfer. Information and capabilities unique to Link 16 are annotated with "Link 16 only" in this chapter. Procedures contained in this manual are applicable to operations using Link 11, Link 11B, and Link 16. When data forwarding is used to exchange information between tactical units, information may be lost due to the difference in message capabilities between the links. This information loss can be significant when translating from Link 16 to Link 11/11B. The Link 16 message standard has capabilities that greatly exceed the capability of Link 11 and Link 11B. Procedures and capabilities are grouped by functional areas and presented as follows:

a. Multi-link Interface Establishment (see paragraph 5.2).

b. Multi-link Interface Maintenance (see paragraph 5.3).

c. IU Reporting (see paragraph 5.4).

d. Space, Air, Surface, and Land surveillance (see paragraph 5.5).

e. Point, Line and Area reporting (see paragraph 5.6).

f. USW operations (see paragraph 5.7).

g. EW Operations (see paragraph 5.8).

h. Intelligence Reporting (see paragraph 5.9).

i. Information Management (see paragraph 5.10).

j. Weapons Coordination and Management (see paragraph 5.11).

5.2 Multi-link Interface Establishment. In addition to the link-independent and multi-link planning factors specified in the previous chapter, Appendices C, D, and E specify other planning factors that are unique to the establishment of Link 11/11B and Link 16. When multi-link operations are planned, Link 11/11B and Link 16 should be initially established separately and independently, as specified in the OPTASK LINK. Each link should be successfully established before data forwarding begins. Attempts to interface degraded links are likely to disrupt operations. The process for establishing the multi-link interface is shown in Table 5-1 and described below.

5.2.1 Interfacing Link 11/11B to Link 16. The ICO shall control the establishment of the multi-link interface. The Link 16 and Link 11/11B Managers shall report to the ICO when their respective links have been established. Due to the anticipated higher track qualities being reported from Link 16, the normal means of affecting data forwarding will be to stop the Link 11/11B units from reporting tracks, while receiving tracks from Link 16. The Link 11/11B IUs would be directed to drop or to execute local correlation on their local tracks that correlate with the remote tracks, and then to recommence track reporting. The specific procedures for multi-link establishment differ based on whether a FJUA or FJUB is performing the forwarding role.

5.2.2 Preparation for a Multi-link Interface. If a CIU is present prior to establishment of the multi-link interface, it should be designated as the GRU for Link 11. The ICO can organize, coordinate, and direct the execution of Fidelity Drills prior to the operational activity or the start of the exercise. See Appendix J for Data Link Interface Operator Fidelity Drills.

5.2.3 Activating the Link 16 to Link 11 Interface. If a FJUA is employed as the data forwarder, the following steps occur:

a. DNCS continues to poll all PUs.

b. CIUs turn off Link 11.

NOTE: If the E-3 is the DNCS, switch the role to another PU. The E-3 cannot continue performing as DNCS when it goes radio silent.

c. All PUs go radio silent.

Table 5-1. Multi-link Interface Establishment

Sequence	Link 11	Link 11B	Link 16
1	Conduct equipment checkout and setup. Enter OPTASK LINK data and any other prearranged data items.		
2	Establish Link 11 DCN.	Establish Link 11B DCNs.	Establish Link 16 DCN.
3	Establish Link 11 IAW Link 11 procedures.	Establish Link 11B IAW Link 11B procedures.	Establish Link 16 IAW Link 16 procedures.
4	FPU(s) commence Link 11/11B data forwarding. PU/RUs resolve dual designations.		
5	Link 11 Manager report Link 11/11B established to ICO.		Link 16 Manager report Link 16 established to ICO.
6	CIUs cease participating on Link 11. Link 11 manager directs PUs to go radio silent. NOTE: DNCS continue to poll all PUs.	RUs directly tied to the FJUB go to LTD mode if possible, or turn off Link 11B when directed by the Link 11 manager.	
7	FJU(s) commence data forwarding. PU/RUs resolve dual designations by dropping local tracks and report to the ICO when ready to become active.		
8	PUs go active when directed by the ICO.	RUs switch to FTD when directed by the ICO.	

d. The designated JU goes active on Link 11 as a FJUA (Duty 823).

e. PUs resolve dual track designations and report ready to the ICO.

f. PUs go active as directed by the ICO.

5.2.4 Establishing Gridlock. Unless a CIU was designated the GRU prior to multi-link establishment, then a C2 JU should be designated as the Inter-link GRU, IAW paragraph 4.3.4. In this case, Link 11 must be the directed silent link, and a GRU shift to the C2 JU must be directed by the FTC/TDC for all PUs. If a satisfactory gridlock does not exist, after data forwarding to Link 11 begins, the Link 11/11B manager should direct a gridlock on the inter-link GRU. All PUs must remain Radio Silent for at least 60 seconds after the gridlock is initially executed. This should provide sufficient time for PUs to achieve gridlock and perform correlation of reported tracks before going active.

5.2.5 Activating Link 16 to Link 11B Interface. If a FJUB is employed as the data forwarder, the following steps occur:

a. The FJUB is active on Link 16 only.

b. The remaining Link 11B links are left intact.

c. The FRU/RU will establish the Link 11B to the FJUB in the Limited Transmission of Data (LTD) mode. The FJUB will be in the Full Transmission of Data (FTD) mode.

d. The FRUs/RUs will resolve all dual designations by dropping local tracks that correlate with remote tracks.

e. The FRU/RU will switch the Link 11B link to the FJUB to the FTD mode. Some Link 11B units will automatically switch to the FTD mode after a preset time delay.

5.3 Multi-link Interface Maintenance. Procedures for maintenance of the individual links in an interface are generally unique for each link and are provided in Appendices C through I. This section provides guidance for certain aspects of maintaining a multi-link interface. These are:

a. FJU transfers (see paragraph 5.3.1).

b. Link Quality Monitoring (see paragraph 5.3.2).

c. Data Registration (see paragraph 5.3.3).

d. Link Management Codes (see paragraph 5.3.4).

5.3.1 FJU Transfers. Continuous operation of an FJU is critical to successful multi-link operations. As a general rule, loss of the FJU function for more than 60 seconds will result in the loss of remote tracks, R^2 shifts, and a failure to transmit and receive orders, commands, and alerts between the different links. There are currently no automated procedures for transferring the FJU function to the assigned SFJU. Thus, operator monitoring of FJU status by the ICO, FJU, and SFJU is essential. The following are the procedures for transferring the FJU function:

a. The ICO and appropriate operators in the FJU and SFJU must monitor the Link 11/11B and Link 16 status (active/inactive and communications quality) of the FJU, as well as the overall quality of the interface tactical picture. Individual link quality monitoring provisions (i.e., Link 11 Reception Quality (RQ) and Link 16 Network Participation Status (NPS)) are used to monitor the FJUs link status.

b. When designated as the SFJU, some C2 JUs automatically monitor the active/inactive status and communications quality of the FJU on Link 11/11B and Link 16. When the FJU is detected to be inactive or severely degraded, an operator alert is provided in the SFJU.

c. When either the manual or automatic FJU monitoring procedures above indicate an FJU shift is or may be required, immediate voice coordination between the ICO, FJU, and SFJU on the DCN is essential. If the FJU has been determined to be inactive on either link and cannot be contacted immediately, the SFJU may assume the FJU function, or the ICO may direct the SFJU to assume the FJU function without prior voice coordination with the FJU. However, prior voice coordination between the FJU and SFJU is always preferable and mandatory if the FJU has only been determined to be degraded, but not inactive on either link.

d. The FJU and SFJU should time synchronize the shift of the FJU function, if possible, by use of a countdown, on-the-mark, or similar procedure. This ensures minimal disruption of the interface tactical picture. Several seconds, or even minutes, may be required before the SFJU successfully establishes it's transmit function on the new link and is ready to assume FJU responsibilities.

e. After a transfer of the FJU function, the ICO must expeditiously designate a new SFJU. The ICO also must announce the assignment of the new FJU and SFJU to all interface participants via the DCN.

5.3.2 Link Quality Monitoring. Provisions for monitoring the status and quality of participants on Links 11/11B and Link 16 differ considerably and are described in Appendices C, D, and E. In a multi-link interface, the Link 11/11B Manager and Link 16 Manager are responsible for monitoring the status of PU/RUs, and JUs, respectively, and directing changes in status and link configuration accordingly. It is also beneficial for the ICO to monitor the status of all IUs to be able to expeditiously direct changes to the overall interface configuration when required.

5.3.3 Data Registration. Data registration is a condition of correct relative alignment between local and remote track positional data. Optimum interface data registration occurs when all IUs hold their locally derived track positional data at the same geodetic position as the remote positional data for the same interface tracks. Geodetic position is defined in terms of latitude, longitude, and altitude. The exchange of accurate track positional data is fundamental to the operation of an interface. IUs that receive these reported tracks are required to attempt to correlate these tracks with local data. The correlation process is degraded when either the remote or local positional errors increase. Remote and/or local track positional errors may result in dual designations.

5.3.3.1 Data Registration Error Sources. Sources of error in data registration that occur in each participating IU are identified in this section. The magnitude of the errors varies according to the characteristics and configuration of each IU. For example, a land-based unit that reports its position derived from a geodetic survey will provide more accurate positional data than an airborne unit with limited navigational capability. Units that have access to Global Positioning System (GPS) data can be expected to provide more accurate positional data than those that do not. The positional accuracy of reports sent by each unit is a combination of the accuracy of their unit position, their sensor accuracy and alignment, and a factor of their data processing algorithms. The primary sources of error in data registration are:

a. Geodetic position (navigation) error.

b. Sensor alignment errors.

c. Data processing (computer system algorithm) inaccuracies.

d. Remote unit errors.

5.3.3.2 Inter-link Data Registration. Link 11, Link 16 and Link 11B use significantly different methods for maintaining data registration as specified in Appendices C, D, and E. Gridlock is used on Link 11, Site Registration is used on Link 11B, and remote IU registration is used on Link 16. Gridlock and Site Registration require each PU/RU to account for its known errors upon transmission of its track reports, whereas remote IU registration requires each JU to account for all other IU's errors upon reception of their track reports. Furthermore, there is no requirement for Link 11/11B and Link 16 to use common grids, nor for the FJU to adjust forwarded track reports to account for differences between the two links. These differences could create significant errors in positional data exchanged between PUs, RUs, and JUs. However, the errors are normally minimized or negated under the following conditions:

a. Assignment of a C2 JU as the Link 11 GRU. This has the effect of aligning the Link 11 and Link 16 grids, as long as the GRU maintains a high JTIDS/MIDS Q_{pg} (4 or more).

b. Use of GPS by most IUs. This tends to make most reported positions extremely accurate geodetically. However, direct Gridlock may be unfeasible for widely dispersed PUs using GPS as a position reference.

5.3.3.2.1 Data Registration Test Procedures. Registration tests should be conducted when establishing a new interface, whenever land-based radar is moved, and whenever resolution of registration problems becomes necessary. These tests identify the source, type (position or azimuth), and approximate magnitude of the registration error, and may be conducted using either air contacts of opportunity or scheduled air services. This test should be used when conditions indicate that a single IU or multiple IUs may have a sensor or unit registration problem. This procedure can be conducted concurrently with operations during low levels of link activity. Specific procedures for performing the data registration test are shown in Table 5-2. Table 5-3 provides a suggested format for evaluation of the test results.

5.3.3.2.2 Data Registration Monitoring and Adjustment (DRMA) Procedures. Each IU participating in the surveillance function and having the capability to initiate or assume R^2 for surveillance tracks will have the capability to perform data registration. These IUs will be capable of making periodic adjustments IAW the following generalized criteria:

Table 5-2. Data Registration Test

Step	Action
1	FTC/TDC: Coordinate with other IUs to ensure that all IUs have completed all internal checks, alignment, IU registration, gridlocking, etc., prior to test.
2	FTC/TDC: (1) Select three or four tracks for common tracking. Use following criteria: (a) Each contact squawking mode II. (b) Contacts widely dispersed in range and bearing as viewed by most IUs. (c) Contacts should be selected in each quadrant around an IU suspected of having bearing problem or a contact that is headed toward or away from the subject IU. (2) Direct the IUs participating in the registration test to establish dual designated tracks on the designated contacts. (3) Designate different IDs to be used by each IU; e.g., IU #1 FRIEND, IU #2 UNKNOWN. (Use IDs that will provide different symbol displays.) IUs: Establish dual designated tracks for FTC/TDC with the ID specified for their IU. Maintain precise tracking on each contact and do not correlate with other IU tracks.
3	IUs: (1) Record bearing and x/y difference between local and corresponding remote tracks for each of the designated contacts. Report completion to FTC/TDC. (2) Evaluate test results. FTC/TDC: After all IUs report completion, terminate the data registration test. Direct that all IUs drop track on designated tracks.
4	FTC/TDC: Advise all IUs of test results and/or conclusions. IUs: Compare FTC/TDC conclusion with local data and provide an affirmative or negative response. IU(s) identified as transmitting data that are out of registration, take corrective action.

Table 5-3. Interface Registration Test Evaluation

Unit/ Track ID	Contact _____ Designated Track _____					Contact _____ Designated Track _____					Contact _____ Designated Track _____					
	TN	x/y	Brg	Difference x/y	Difference Brg	TN	x/y	Brg	Difference x/y	Difference Brg	TN	x/y	Brg	Difference x/y	Difference Brg	
Own Unit/		/		/			/		/			/		/		
/		/		/			/		/			/		/		
/		/		/			/		/			/		/		
/		/		/			/		/			/		/		
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/		/		/			/		/			/		/		

Track ID - Track ID assigned by FTC/TDC.
x/y - Coordinates of track TN relative to own unit in data miles.
Brg - Bearing of track TN relative to own unit in degrees.
Difference - Subtract remote data from local data or measure directly from display using local track as reference. Clockwise angles are positive.

Evaluation Procedures:

1. For each remote unit listed above, compare the x/y difference for each contact with that of the other contacts and determine if magnitude and sign are consistent. A consistency in excess of 3 data miles for either x or y coordinate is an indication of a registration positional error that is being generated by that unit.

2. Compare all bearing differences and determine if there is a consistency in magnitude and sign. A consistency in excess of 1 degree indicates own unit has a registration azimuth error.

a. IUs will have the capability to perform monitoring and adjustment of data registration procedures using automatic or manual means.

b. Data registration monitoring and computing should be performed with minimal interference with, or curtailment of, normal data system operation.

c. Results of data registration monitoring and adjustments will be available for operator consideration.

d. The procedures required to minimize the data registration errors are:

(1) Geodetic registration. (Link 16)

(2) Positional data registration. (Link 11/11B)

(3) Sensor registration.

(4) Data processing accuracy.

(5) Remote unit registration.

5.3.3.2.3 Geodetic Registration. Geodetic registration is defined as a process in which a JU monitors its reported geodetic positional data and may include periodically adjusting the data with information derived from active participation in the JTIDS/MIDS RELNAV function. Geodetic registration begins with the JUs capability to determine and maintain accurate positional coordinates in terms of geodetic latitude, longitude, and altitude.

5.3.3.2.3.1 Application of JTIDS/MIDS RELNAV Data. Monitoring of relative geodetic position may be provided by active participation in the JTIDS/MIDS RELNAV function during net operations. Through active participation in the JTIDS/MIDS RELNAV function, highly accurate adjustments to the reported geodetic position are obtainable. The JTIDS/MIDS terminal will provide JTIDS/MIDS RELNAV adjustments to the host platform for latitude correction (LATC), longitude correction (LONC), and altitude correction (HC). These correction factors should be periodically applied to the unit's latitude, longitude, and altitude.

5.3.3.2.4 Positional Data Registration. Positional data registration within the Link 11/11B interface is exchanged in reference to the SCC of each IU. The SCC is reported to other units as differences of latitude and longitude from a prearranged DLRP. The DLRP is a fixed point changed only by using the procedures in paragraph C3.2.8. There is only one DLRP per net and all IUs

report respective SCCs relative to that point. After an IU has reported its SCC position, all subsequent tracks, points, and pointers are reported relative to the respective SCC. If a position is being forwarded, the forwarding unit recomputes all positional data and reports the data referenced to its SCC. The SCC that is being reported on Link 11 may be a moving point with a new location being reported each time the IUs report a new set of data within the interface. Link 11B units report their SCC positions only during initialization and re-initialization procedures or when requested.

5.3.3.2.5 Sensor Registration. Sensor registration is the process of determining and maintaining the correct alignment of the sensor elements used for the measurement of a tracked object's position. Monitoring is accomplished by comparing the geodetic position of a remote unit reported in the IU positional messages and the remote unit's position observed through active local sensors. This procedure requires that each IU periodically monitor the remote units and, through analysis techniques, calculate the mean correction variations in terms of difference in azimuth expressed as ?AZ, difference in elevation expressed as ?EL, and difference in range expressed as ?R.

5.3.3.2.5.1 Sensor Correction Factors. Sensor registration will be performed periodically, and calculated correction factors will be applied to the sensor's data to compensate for sensor alignment differences. Usually, sensor data are smoothed through a digital filter such as a recursive Kalman filter, and sensor alignment adjustments are made at this stage of sensor data processing. Each IU participating in the surveillance function will have the capability to monitor sensor registration using remote unit IU positional messages and local sensor returns. Periodically, the IU will adjust sensor registration IAW the following criteria:

a. Remote IUs used in the sensor registration process may be selected either manually or automatically.

b. A design goal is to have the sensor registration process detect and correct sensor errors so that the azimuth and elevation angle errors shall not exceed 1/2 degree and range errors shall not exceed 100 meters for land units or 200 meters for surface and air units.

5.3.3.2.6 Remote IU Registration. Remote IU registration is the procedure for determining data registration corrective values by comparing remote tracks received from a selected remote IU to local data and applying corrective values to positional data received from that IU. For Link 11/11B, the designated reference unit is referred to as the Data Registration Reference Unit (DRRU)

and is designated by the ICO as a prearranged data item. The land-based unit with the most central location and the best common track coverage will normally be designated as the DRRU. The DRRU may be changed, as circumstances require. Each IU that has a capability to initiate or assume R^2 for real-time surveillance tracks will have a capability to periodically monitor its data registration relative to a selected IU and to make periodic adjustments IAW the following criteria:

a. Either automatic or manual selection of the DRRU or other remote IUs for monitoring and adjustment of data registration will be used.

b. The periodic performance of the remote IU registration procedure for selected units will be automatically conducted at least once per monitor interval. Although continuous automatic DRMA is desirable, general guidance for the maximum time between DRMAs is as follows:

(1) Fixed Land Units - 4 hours.

(2) Mobile Surface Units - 1 hour.

(3) Air Units - 15 minutes.

c. The mean translation and rotational registration errors and correction values will be computed automatically using a minimum of three common tracks with TQ equal to or greater than 4 for at least six update cycles. Azimuth separation should be at least 45 degrees.

d. The execution of the remote IU registration should be performed without interference with or curtailment of normal data system operations.

e. Results of remote IU registration will be available for operator appreciation in the form of the most recently computed mean translational error -- difference in X and Y (data miles) -- and the mean rotational error-- difference (degrees of azimuth) -- for each IU designated for remote IU registration.

f. An operational goal is to make the remote IU registration function detect and adjust registration errors before they exceed 2 miles in Link 16, 3 miles in Link 11/11B for X and Y, and 1/2 degree of azimuth for Link 16, and 1 degree in azimuth for Link 11/11B.

g. When unresolved problems exist, the unit experiencing the registration problem will advise the FTC/TDC and other units affected. The

FTC/TDC will direct and coordinate the conduct of the interface registration test as necessary.

5.3.4 Link Management Codes. Link Management Codes are brevity words or letters used for voice coordination of link management actions on covered or uncovered voice nets. In Appendix K, table K-1 provides Brevity Words from ACP-165. Table K-4 provides Link Management Codes for all links, except Link 14 (BEAVER Codes) that can be found in ADatP-14. Procedures for specification and use of Link Management Codes are described in Appendix K. The ICO should specify any exceptions to the following procedures in the OPTASK LINK in the 1MANCODE set.

5.4 IU Reporting. All IUs automatically report their position and movement, identifying information, and platform and system status information on the interface periodically. This information is generally entered and updated automatically via electronic interfaces within each IU depending on individual system design and generally requires little or no operator action. This section describes the IU information exchanged and also provides procedures for:

a. FJU forwarding of nonC2 JUs as air tracks.

b. Assumption of R^2 for an inactive IU.

c. Reporting inactive IU and non-IU platform and system status.

5.4.1 IU Identifying Information. IUs identify themselves as follows:

a. Platform: The general type of platform; e.g., Fighter, AEW & C, Aircraft Carrier, Cruiser, C2 Center, Battalion Operations Center.

b. Specific Type (Link 16 only): The more specific type of platform; e.g., F-14, F-15, E-3, ship class (e.g., TICONDEROGA), PATRIOT, TACC, TAOC.

c. Activity: The IU's current primary activity. Generally requires operator update, but some Activities may be automated in nonC2 JUs. A few nonC2 JU Activities are forwarded to Link 11/11B as ID AMP for the Air Track.

d. Strength: Normally single for C2 JUs. NonC2 JU aircraft can report individually or the flight leader can make a single consolidated PPLI report for the flight, reporting the specific number of aircraft (2-12, including flight leader). NonC2 JU strength is forwarded to Link 11/11B as Size (Single, Few (2-7), or Many (8 or more)) for the air track (see paragraph 5.5.6.6).

e. Identification Friend or Foe/Selective Identification Feature (IFF/SIF): The codes inserted in unit's transponder if so equipped (see paragraph 5.5.6.9b).

f. Mission Correlators (Link 16 only): A unique decimal number assigned to JUs so that platforms can be associated with a specific mission (see paragraph 4.4.7.3).

5.4.2 Weapon System Availability. IUs report their inventory of operational weapons systems available for employment as described below.

5.4.2.1 Surface and Land Missile Systems. IUs report missile status as follows:

a. Link 11/11B units report their total number of all medium range and long range missiles held. These missiles are classified as Surface-to-Air (SAM), Surface-to-Surface (SSM) or Air-to-Surface (ASM) missiles. Some Link 11/11B units can further breakdown their missile holdings as specified in Table 5-4.

Table 5-4. Link 11/11B Reportable Missile Ranges

Type	Missile Range		Missile (example)
SAM	Long	Total >50nm	
		Short <100nm	SM-2(MR), Patriot, THAAD
		Medium 100-150nm	SM-2(ER), SM-2(IV)
		Long >150nm	
	Medium	Total 10-50nm	Aster, Sea Dart, Hawk
SSM	Long	Total >75nm	
		Short <200nm	Harpoon 1D, Otomat
		Medium 200-300nm	Tomahawk
		Long >300nm	Tomahawk
	Medium	Total 15-75nm	Harpoon 1, Harpoon 1C, Exocet
ASM	Long	Total >100nm	ALCM
	Medium	Total 40-100nm	Harpoon

b. Surface C2 JUs may report their inventory of each of the onboard specific missile types on Link 16. However, these can only be reported on or forwarded to Link 11/11B as indicated above. Surface C2 JUs can also report up to seven adaptable Missile Types, as specified in paragraph 4.4.6.7. However, these cannot be reported on or forwarded to Link 11/11B.

c. Surface IUs also report the number of Fire Control Systems (FCS) available to control each of the missile types reported.

d. A missile system is considered unavailable if either the number of FCS available or operational missile inventory for that missile type is zero (0) or if specifically reported as "out of action."

e. The status of self-defense weapons (e.g., missile systems) is not reported on the interface because they are not considered force defense weapons.

f. The status of ships' USW weapon systems, except Light Airborne Multipurpose System (LAMPS) helicopters, is not reported on the interface.

5.4.2.2 Aircraft Weapon Systems

a. (Link 16 only) NonC2 JU aircraft can report their onboard inventory of the specific weapon types such as AIM-7 SPARROW, AIM-9 SIDEWINDER, AIM-54 PHOENIX, AGM-88 High-Speed Anti-Radiation Missile (HARM), and advanced Medium-range Air-to-Air Missile (AMRAAM AIM-120).

b. The above are forwarded to or reported on Link 11/11B as the simple presence or absence of an all aspect capable (e.g. SPARROW, AMRAAM), rear aspect capable (e.g. SIDEWINDER), or multiple-intercept capable (e.g. PHOENIX) missile capability for the air track.

c. (Link 16 only) NonC2 JU aircraft can report whether they are able to perform their mission, have a low fuel state, or are gun capable, meaning their cannon is available for at least one pass for combat purposes.

d. USW aircraft can report the onboard inventory of depth bombs, torpedoes, and missiles, categorized as either conventional or special, as well as rockets.

5.4.3 Equipment Status (Link 16 Only)

a. Link 16 provides a capability for JUs to report the status of various equipment. Shipboard equipment is reported as Operational, Degraded, or Nonoperational. Aircraft and land-based equipment is reported as Operational, Non-operational, or Off. If no status is reported for equipment that is thought to be installed in the reporting JU, no assumption about the operational status shall be made. Voice coordination or other means are required to ascertain equipment status in these cases.

b. The status of each band (A through M) of Electronic warfare Support (ES), and Electronic Attack (EA) equipment, as well as Radio Direction Finders, Chaff, and Infrared Decoys, are reported as Up, Degraded, or Down.

c. The status of aircraft UHF, VHF, AM, and FM, radios is reported as On, Off, or Non-operational.

NOTE: USW aircraft may transmit limited status information on Link 11.

5.4.4 Communications Information. IUs report the following information regarding their current communications employment: (Complete NPG listing is in Appendix D.)

a. (Link 16 only) JTIDS/MIDS Voice Channels A and B: The dial up Net Number (0 through 126) of up to two JTIDS/MIDS secure voice channels on which the JU is participating (assigned transmission time slots). No indication of the purpose of the nets is reported via link but should be included in the OPTASK LINK.

b. (Link 16 only) Link 16 Control Channel: The Link 16 air control NPG dial up Net Number (0 through 126) being used by a C2 JU to control aircraft, or by a nonC2 JU to be controlled. JUs can only operate on one Link 16 control channel at a time.

c. (Link 16 only) Link 16 Fighter-to-Fighter NPG Net Number: The Link 16 (fighter-to-fighter) net number (0 through 126) being used for fighter-to-fighter communications. A fighter only reports this Net Number when it is actively participating in the fighter-to-fighter net, as described in paragraph 6.8.

d. Voice Call Sign and Link 4A Address: Some IUs only exchange this information during the digital handover process, whereas others report it periodically.

5.4.5 Fuel Status. IUs report their fuel status as follows:

a. Fighters can report their fuel status in terms of pounds of burnable fuel remaining onboard or as Time to BINGO. NonC2 JUs provide their own fuel status; however, on Link 11/11B, the controlling unit only provides the fuel status.

b. (Link 16 only) NonC2 JUs can report the amount of fuel they have available for offloading, or "giving," to another aircraft. C2 JUs may also report this data for tankers and other aircraft they are controlling, when known, and it is received by fighters as an aid in planning air to air refueling.

c. USW aircraft do not report fuel status. However, they report their scheduled time remaining on station as an indication of their availability.

5.4.6 Flight Deck Status (Link 16 Only)

a. Surface C2 JUs capable of landing aircraft report the status of their flight deck as Ready, Foul, or Closed. For ships other than aircraft carriers, this is the status of the helicopter platform, if so equipped. If no flight deck status is held for a ship, this shall not be interpreted to mean that the ship does not have a helicopter platform. In such cases, the existence and status of a helicopter platform must be ascertained by other means.

b. C2 JU aircraft carriers also report their Landing Approach Condition, as CV Recovery Case I, II, or III (see Table 6-3).

5.4.7 Airfield Status (Link 16 Only)

a. A C2 JU can report airfield status on the Data Link and provide runway information, weather and airfield support available.

b. Runway information includes active and secondary runway direction, length in meters, status, GCA/ILS precision approach aids, lighting, barriers, braking action, visual range, etc.

c. Weather includes wind speed, gust and direction, cloud cover and height, visibility, base weather and wind shear indicator.

d. Airfield support includes capability to rearm with specific munitions, nitrogen and liquid oxygen.

5.4.8 Forwarding NonC2 JUs as Tracks. IU addresses must be below 177_8 on Link 11/11B. However, nonC2 JU addresses must be 00200_8 or above. Therefore, nonC2 JU PPLI reports are automatically converted to track reports by the FJU for forwarding to Link 11/11B. The track has the same TN as the nonC2 JUs assigned address provided it is below 07777_8. The FJUs host platform has R^2 for the track. Air nonC2 JUs weapon and fuel statuses are also forwarded for the air track.

5.4.9 Reporting Inactive IUs

a. C2 IUs automatically attempt to correlate received IU reports with local sensor data. Where correlation is found, a separate track is not reported unless the correlating C2 IU holds the IU as inactive, or a received PPLI report indicates the IU is radio silent. If the IU is held as inactive, radio silent, or position quality is zero, the correlating C2 IU automatically attempts to assume R^2 for the IU and report it as a surveillance track with the same TN as the IU address and an ID of FRIEND.

b. (Link 16 only) When a C2 JU assumes R^2 for an inactive IU, it automatically sets a PPLI TN/ID Indicator in the track reports, indicating that the TN is the IU's address and the FRIEND ID is based on previous receipt of PPLI reports from the IU. A PPLI IFF/SIF Indicator may also be set to indicate that some or all IFF/SIF mode codes reported for the track are based solely on PPLI reported IFF/SIF, not own unit interrogations. Display of these indicators provides added confidence in the event an ID or IFF/SIF conflict is reported for the track.

c. (Link 16 only) When a JU reports a network participation status of TDS Failure, its JTIDS/MIDS terminal is normally still able to transmit PPLI data and the JU is still considered active.

d. (Link 16 only) If a JUs Q_{pg} equals zero, some systems will automatically start reporting the IU as a local track using the same TN and the PPLI TN/ID indicator set IAW paragraph b above. In the absence of this automatic function, and if no other C2 Unit commences reporting the IU, the operator should manually initiate track reporting on the IU.

e. If an IU returns to an active status after another IU has assumed R^2 for it, the R^2 IU automatically ceases reporting but does not drop the track. All

IUs automatically accept self-reported information from active IUs over track reports.

5.4.10 Friendly and Non-IU Platform and System Status Reporting. With the exception of controlled aircraft status, as specified in paragraph 5.11.5.1, the platform and system status information described in this section shall not be reported for other IUs that have become inactive or silent on the interface, nor for friendly non IUs which have no data link capability. It is considered that such data could not be entered and maintained current by the reporting IU without excessive operator and TDS burden. Thus, its utility would be minimal and risky.

5.5 Air, Surface, Land, and Space Surveillance Operations

a. Surveillance consists of searching for, detecting, identifying, and keeping track of objects within the search volume of the force. Various sensors, including several kinds of radar, IFF, sonar, ESM, and others, are used to detect the objects.

b. This section specifies the procedures for reporting of Air, Surface, and Land Tracks; and summarizes the information that is reported. Link 16 provides a capability to support Land Surveillance in the same manner as Air and Surface Surveillance, including the sharing of R^2 for real-time Land Tracks based on TQ. The same type of information reportable for Air and Surface tracks is also reportable for Land Tracks and Points. A Land Point is a stationary Land Track with no TQ. Essentially, the Link 11/11B Special Point capability has been separated in Link 16 into Land Tracks and Points, which are actual physical objects of military interest, such as tanks and headquarters, and Reference Points, which are imaginary points used for stationing, such as CAP Stations and Marshall Points. Many new Land Track platforms have been defined. Most of these are reportable only on Link 16, and are forwarded to Link 11/11B only as Supporting Units if the ID is FRIEND, as Enemy Points if HOSTILE or SUSPECT, or as Reference Points otherwise.

c. This section also specifies the procedures for reporting of Space Tracks. Currently, the only Space Tracks for which procedures have been addressed are Theater Ballistic Missile (TBM) Tracks. Generally, procedures governing ballistic missile surveillance are the same as those governing air surveillance. Areas that differ are identified below.

5.5.1 Initiation of Surveillance Operations

a. Prior to transmission of surveillance data, a C2 IU must receive all active remote tracks available on the interface. To prevent dual designations, C2 IUs must inhibit track reporting until correlation has been attempted on all remote tracks. The C2 IU must then compare the received tracks with local data to determine commonality, to monitor and adjust data registration, and to eliminate dual designations. These processes are performed automatically in most C2 IUs, but generally require some degree of operator intervention.

b. When correlation is completed, the C2 IU may commence operating in the normal transmit mode. The minimum wait before reporting Air and Surface Tracks is 12 seconds and for Land Tracks is 48 seconds. This may be either an automatic or manual function.

c. When initiating an entire interface, the FTC/TDC should consider specifying the order of entry for all C2 IUs capable of reporting Surveillance Tracks. Normally, it would be appropriate for the IU expected to have the largest track load to transmit its surveillance tracks first while other IUs remain silent.

d. Normally, most surveillance data will be received within 20 seconds. In some cases, operational necessity may dictate that all or several C2 IUs begin transmitting on the interface prior to expiration of the minimum wait time. However, it should be recognized that this could result in severe disruption of the surveillance picture and could last for an extended period of time until all units have resolved correlation between local and remote tracks.

e. Data Update Requests (DURs) should be used to obtain data that are not reported frequently (e.g., points, engagement status, EW data) prior to transmitting on the interface. Some systems automatically initiate DURs prior to transmitting, but operator initiation is required in others. DUR procedures are contained in paragraph 5.10.9.

5.5.2 Track Coordination. Track coordination is the responsibility of the FTC/TDC/Environmental FTC (Duty 80 through 82). It primarily consists of determining tracking and reporting responsibilities between C2 IUs. The responsibility for reporting contacts not already reported on the interface rests with every C2 IU. Thus, the existence of a video return representing the position of a track without an associated symbol is a clear mandate to enter a new track and commence tracking. Any track being reported by another IU (remote track) that correlates with local video (local track) is made a common track (by operator or automatic action) unless the track is outside the C2 IU's

assigned sector or the C2 IU is near track saturation. Making a remote track common will not affect its position on other IUs' displays unless the C2 IU making the track common assumes R^2.

5.5.2.1 Tracking Responsibility. Each C2 IU has certain surveillance and tracking responsibilities. Some of these are inherent in other responsibilities, and some are assigned by higher authority.

5.5.2.1.1 Controlled Aircraft. Each C2 IU is responsible for tracking all aircraft under its positive or advisory control. Normal R^2 rules are applied to controlled tracks; therefore, a C2 IU without control may be the R^2 unit unless otherwise specified by the FTC/TDC. When an active IU (e.g., a nonC2 JU) is under the tracking C2 IU's control, no dynamic or descriptive information is entered, but the presence of the appropriate radar return in association with the IU symbol is monitored closely. Any significant discrepancy between the self-reported and radar positions must be resolved.

5.5.2.1.2 Hazards to Navigation. IUs controlling aircraft must also track and monitor objects near the aircraft they control to ensure awareness of hazards.

5.5.2.2 Correlation

a. Correlation is the analysis of track reports to select those representing the same object. Correlation must be done anytime there are reports from different IUs, from different sensors, or from different times. This process is normally accomplished automatically by C2 IUs, but may also be accomplished manually by the operator.

b. When tracking manually, the operator correlates the radar return on the current scan with those received on the past three or four scans on the same radar. Local tracks shall not be reported to the interface until a correlation with a remote track has been attempted and failed, or an operator action has been taken to selectively release that track for reporting.

c. When attempting to correlate a received track with a local track, the following criteria should be applied:

(1) Position: The closer the received report is to local data, the stronger the correlation. Position comparison should include altitude for Air Tracks.

(2) IFF/SIF: Common IFF/SIF data provides a strong correlation comparison. Although a Mode II code is normally unique to one aircraft,

operators should be aware that the same Mode II code is sometimes assigned to multiple aircraft.

(3) Motion: A received report that also has the track traveling on the same course and speed as local data provides a strong correlation.

(4) Other data: ID, Platform, etc.

d. Some R^2 IUs make an automatic correlation check periodically on each track for which it has R^2. This check includes all active IUs, remote tracks and, in some systems, other local tracks. When a new remote track is received, it must be checked for correlation with local tracks.

e. When a correlation is executed, systems combine the two tracks into a single track.

5.5.2.2.1 Correlation Restrictions for Reported Tracks. The distance at which automatic and/or manual correlation is prohibited is a system option. However, two reported tracks shall not be correlated automatically or manually if any of the following conditions exist:

a. The two tracks have different Environments.

b. Either track is a Subsurface track.

c. The two tracks have different basic IDs. For this purpose, the basic IDs are friendly (FRIEND or ASSUMED FRIEND), enemy (HOSTILE or SUSPECT), and neutral (NEUTRAL). However, a NEUTRAL and an ASSUMED FRIEND may be correlated. A PENDING track may be correlated with any ID.

NOTE: On Link 11/11B, NEUTRAL is treated as friendly. Additionally, both tracks are to have the same ID. The exception to this rule is if either track has an ID of PENDING. The ID of the other track is to be maintained.

d. The two tracks have different nonzero IFF/SIF Mode II codes.

e. Either track is the subject of a pending Environment, ID, or IFF/SIF difference resolution action. In these cases, the correlation may be performed after the difference is resolved, unless any of the above restrictions apply to the resulting Environment, ID, or IFF/SIF.

f. Either track is already being considered for correlation with another track.

5.5.2.2.2 Operational Contingency Constraints (OCCs). When an operator determines that two tracks correlate and none of the above restrictions apply, and own IU has R^2 for one of the tracks, it is normally preferable that the track which own IU is reporting be dropped. This eliminates the need for voice coordination (the track can still be locally tracked in order to maintain accurate positional data for own unit engagements). However, a track shall not be dropped due to correlation if any of the below OCCs apply. In these cases, the correlating IU operator should request the other IU involved to drop its track, unless it also has an OCC. If both tracks have an OCC, the correlation shall not be executed until one of the OCCs no longer exists. These OCCs are checked automatically by systems performing automatic correlation before correlation recommendations are made to the operator.

a. The track is currently engaged; i.e., has an engagement status of assigned, tracking, firing, partially effective, or heads up, either as the target or the engaging unit.

b. The track is the subject of a pending command that has not yet been executed.

c. The track is a controlled track.

d. The track has a Force Tell or Emergency status.

e. The track is paired to another track or point.

f. The track is an active or inactive IU.

g. The track has a local system constraint that inhibits dropping.

h. The track is a real time local IFF/SIF derived track.

5.5.2.3 Decorrelation

a. Automatic decorrelation checks are performed for each local track that is a common track; i.e., local track that is correlated with a remote track.

b. The distance at which automatic decorrelation occurs is a system option. If decorrelation results in two tracks that have matching nonzero Mode II IFF codes, an operator alert may be generated. If the local track has a

different nonzero Mode II IFF code than is reported for the track, an automatic decorrelation will occur in most units.

c. Upon completion of decorrelation, the local track is declared a new detection and reported over the link with a new TN. The occurrence of numerous decorrelations is usually the result of poor or improper tracking.

5.5.2.3.1 Actions Following Decorrelation. The following actions are normally performed automatically upon decorrelation without operator action. However, operators must be aware of these actions, and some operator action may be required. In each case, the operator may decide to inhibit or reject a recommended decorrelation instead of allowing the actions indicated to be taken.

a. If the old TN is the subject of an engagement reported by own IU, either as the target or engaging track that engagement is broken and a new engagement reported for the new TN. However, if the old TN is a nonC2 JU conducting an engagement, its TN must not be changed, and the engagement is not broken.

b. If own IU controls the old TN, control of the old TN is terminated, and commencement of control of the new TN is reported. However, if the old TN is a nonC2 JU, its TN must not be changed, and own IU continues reporting control of the old TN. In this latter case, the controller must carefully assess the situation, since he will probably be controlling the aircraft without local sensor data. Thus, he may prefer to inhibit decorrelation.

c. If the old TN is the subject of a command originated by own IU or addressed to own IU, and the command has not yet been WILCOed, pertinent data for both the old and new TN are displayed to the operator. The reply Will Comply (WILCO) or Cannot Comply (CANTCO) is relative to the old TN only, but as a remote track vice a local track.

d. If the old TN has a Force Tell or Emergency status that was initiated by own IU, it is terminated and the appropriate status reported for the new TN.

e. If the old TN is paired or associated by own IU, the pairing or association is terminated, and a new pairing or association established for the new TN.

f. If the old TN is involved in a handover, either as the aircraft being handed over or as the target of an engagement being conducted by that

aircraft, the decorrelation is delayed until the handover process is completed or terminated.

5.5.2.4 Real-Time Track Reporting

a. Real-time track reports are based on track data derived from sensors integral to the reporting IU. For this purpose, aircraft controlled via Link 4A or Link 16 are considered integral sensors of the controlling IU. If target reports are received by data link from controlled aircraft, they are eligible to be reported as real-time tracks in the same manner (with the same constraints) as local data. Real-time tracks are always reported with positional data automatically extrapolated to the time of report transmission.

b. When sensor contact is interrupted, real-time track reporting continues for a period of time and will normally have an indication of reduced TQ. The original reporting IU automatically continues reporting and reducing TQ until another C2 IU assumes R^2 (see paragraph 5.5.4). If no other C2 IU assumes R^2, the real-time track should be dropped unless it is deemed tactically significant to maintain the track on the interface as a Non-real-time Track (NRT).

c. In the case of friendly aircraft, an operator may elect to continue real-time track reports after sensor inputs are lost. The duration of such continuance shall be based on reasonable operator certainty that the track reports are accurate and that the loss of sensor contact will be of short duration. A good example of such a situation would be a Close Air Support (CAS) aircraft that is conducting an attack below the radar horizon. On the other hand, when a strike aircraft proceeds beyond the radar coverage for more than a short period of time, it should normally be dropped or re-designated as a NRT.

5.5.2.5 NRT Reporting. NRTs are distinguished from real-time tracks by TQ. NRTs always have TQ set to zero (0), whereas real-time tracks always have TQ greater than zero (0). NRT reports are used for known or suspected contacts if any of the following conditions exist:

a. The track data originated from other than a TDS or an aircraft controlled by data link.

b. The track data have been relayed from another system by other than a digital data link.

c. The track data have been derived from other than sensors integrated with own unit's TDS.

d. The track data was originally derived from integrated sensors, but no sensor contact has been received for an extended period of time.

5.5.2.6 Handling of Information Requiring Special Processing. Data flagged with the SPI must receive special handling. Data flagged in this manner requires higher than normal security considerations. Operators are always alerted to the SPI status of a track. The display, transmission, receipt, and forwarding of such data is governed by security filters and requirements as follows:

a. All information about SPI tracks, including the existence of the track, is considered SECRET IAW national requirements. Data printouts containing SPI information must be marked SECRET IAW local security procedures.

b. SPI information shall not be transmitted on, or forwarded onto, uncovered nets or discussed on uncovered voice nets. Therefore, SPI tracks shall not be uplinked on Link 4A or transmitted on Link 1.

c. All C2 IUs capable of originating or forwarding SPI information have a security filter capability. However, operators must be aware that Force Tell and Emergency alerts cause SPI data to pass through security filters.

d. When a C2 IU assumes R^2 for a SPI track, the SPI status will automatically be cleared unless the R^2 unit is the source of the SPI data, or the operator takes action to retain SPI IAW national requirements.

5.5.2.7 Passive Tracks. Passive tracks are tracks that have been derived by passive detection means; e.g., ES or acoustic triangulation, with a sufficiently accurate position, course, and speed to be reported as a real-time track with a TQ greater than 0. In this case the EW or USW system developing the track fixes is considered an integral sensor.

5.5.2.8 Invalid/Runaway Tracks. Symbols that are not associated with a valid return are referred to as invalid tracks. When the symbol has an exceptionally high speed and escapes the general notice of the reporting IU, it is referred to as a runaway track. It sometimes happens that the tracking IU drops such a track or otherwise modifies it to correct the runaway condition and the change is not received by all units. In this case the receiving IU should drop the remote runaway track. When the next valid report is received from the tracking IU, it will again be displayed in its proper position.

5.5.3 Ballistic Missile Data Exchange. Ballistic Missile Tracks and Points are managed and reported on the interface using the applicable procedures discussed in all sections of this chapter. Several unique reporting procedures are discussed in this section.

5.5.3.1 Track Reporting. Ballistic Missile Track reports provide position data, velocity, and error estimate data. These reports also include a time tag to the nearest whole second and are not extrapolated by the C2 IU to time of transmission. The track report also includes a TQ field that is comprised of a measure of reliability of the track report. This reliability is calculated from the positional and velocity variance in the missile covariance matrix and a value that varies the dependence of the computed TQ on the velocity errors of the track (delta t). The default value is 6 unless otherwise directed by higher authority. The Operationally Determined TMDVAR set in the OPTASK LINK Message should not be used. A track report is not initiated on the object if the predicted time to impact is less than 16 seconds or its altitude is less than 8 miles (48000 feet) from the estimated impact point.

5.5.3.2 Launch Point Reporting. Reference Points are used to:

a. Report the actual or expected Launch Point. A time function is provided to allow reporting of past, present, or future launch points. Launch Points can be related to a ballistic Missile Track. The positional accuracy of the data is defined, as an area within which there is a 95 percent probability that the point is located.

b. A missile launcher will be reported as an Air, Surface, Subsurface Track or a Land Track or Point. The launcher may be associated with a Launch Point.

c. The unit initiating the launch point retains R^2 on the point until it is relinquished. A unit assuming R^2 for the Ballistic Missile Track need not assume R^2 for the related launch point.

5.5.3.3 Impact Point Reporting. Reference Points are also used to report the actual or expected Impact Point and time of impact. Impact Points can also be related to a ballistic Missile Track. The C2 IU with R^2 for the ballistic Missile Track also has R^2 for the related Impact Point. The positional accuracy of the data is the same as for Launch Points.

5.5.3.4 Lost Track. A ballistic Missile Track is considered lost when the R^2 IU does not receive any local sensor data (e.g., out of sensor field of view) since the

last transmitted update, or the R^2 IU uses own criteria to determine that the track is lost. When this occurs, the track will continue to be reported with data held at the time of last sensor contact. The track will continue to be reported periodically unless another IU assumes R^2 or the estimated time of impact has passed. R^2 can be assumed of a lost track by a unit with a lower TQ within 5 of the last reported TQ. The number 5 is the default value unless otherwise directed by higher authority. The Operationally Determined TMDVAR set in the OPTASK LINK Message should not be used.

5.5.4 Reporting Responsibility

a. The primary objectives of the reporting function are to report new tracks and to maintain them with the best data available within the interface. All C2 IUs are responsible for reporting local tracks that cannot be correlated with remote tracks being received from another C2 IU. When a local track is correlated with a remote track, it is referred to as a "common" track.

b. The C2 IU first entering a track reports it immediately on the interface, unless the track is filtered or otherwise inhibited from transmission. The IU keeps the track current with automatic periodic updates. To resolve the need to minimize the volume of tracks reported while allowing for own IU tracking of all contacts, automatic procedures are used to ensure that only one C2 IU reports a track, while all other IUs tracking the same track withhold their reports. The reporting C2 IU is said to have R^2 and is referred to as the R^2 IU. The objective of the interface R^2 rules is to ensure that there is only one R^2 IU for each track throughout the interface and that this R^2 IU has the best positional data on the track.

c. The R^2 rules for Air, Surface, and Land Tracks are listed below. These rules are executed automatically in all C2 IUs capable of reporting tracks. They are provided here only to enhance operator understanding of interface operations.

(1) A C2 IU reporting an Air, Surface, or Land Track is presumed to have R^2 for that track. An R^2 IU may relinquish R^2 upon receiving a remote track report for that track, except that an R^2 IU for a real-time track does not relinquish R^2 upon receiving a NRT report.

(2) In determining which C2 IU reports a track, a measure of track positional accuracy, termed (TQ), is used. JUs use TQ of 1 through 15 for real-time tracks, with higher values requiring greater positional accuracy. A value of 0 represents a NRT. A C2 IU assumes R^2 on a common track if its local TQ at the time of transmission exceeds the received TQ by two or more.

On Link 11/11B a TQ of 7 may assume R^2 over a TQ of 6. PUs and RUs are limited to a maximum TQ of 7. Therefore, R^2 tends to migrate to C2 JUs in a multi-link interface.

(3) An IU assumes R^2 for a ballistic Missile Track if its local TQ at or before time of remote time tag exceeds received TQ by 1 or more.

(4) An IU reporting a ballistic missile as a lost track is assumed to hold a TQ of 5 less than reported, e.g., if an IU is reporting a lost track with a TQ of 15, an IU tracking the ballistic missile may assume R^2 with TQ of 11.

(5) A C2 IU assumes R^2 if it has locally derived real-time data on a NRT.

(6) A C2 IU assumes R^2 if it has not received a remote report on a common track for approximately 40 seconds.

(7) An IU assumes R^2 for a ballistic Missile Track if it has not received a remote report on a locally held track for 25 seconds. This rule only applies when the last remote report was received with the track still being reported as tracking (in the field of view).

(8) A C2 IU receiving a Drop Track message on a common track assumes R^2 at the next opportunity to transmit the track if local reporting eligibility remains and a remote report has not been received on that track.

(9) A C2 IU without R^2 for a NRT assumes R^2 for that track when the track is locally updated by a new NRT report.

(10) Some C2 IUs automatically assume R^2 for a common track when the R^2 IU is determined to be inactive, Radio Silent, or have a TDS Failure.

(11) An R^2 IU retains the responsibility until it is relinquished IAW the above rules or until the track is dropped.

d. When a multi-link interface consisting of Link 16 and Link 11 and/or Link 11B is operating, some C2 JUs may have addresses of 00200_8 or higher. The PUs and RUs do not recognize these as valid unit addresses so the FJU will substitute the pseudo source address of 176_8 for the actual unit address. This pseudo source address indicates that the source of the data forwarded to Link 11/11B is a C2 JU with a high unit address.

5.5.5 Track Numbering. A TN provides a common reference for all actions taken with respect to a track, whether by data link, by voice, or other means. Paragraph 4.4.2 provided the procedures for allocating TN blocks to C2 IUs prior to interface operations. This section provides procedures for ensuring that the same TN is always held by all IUs for a given track and use of that TN in non-link communications and for manually assigning TNs.

5.5.5.1 Common Track Number (CTN)

a. The CTN is the TN to be used by all IUs for voice communications about a track. In a Link 11/11B interface or in a multi-link interface with only Low TNs allocated, a track can have only one TN, and that is the CTN. However, when High TNs have been allocated to C2 JUs in a multi-link interface, a track originated on Link 16 with a High TN must be assigned a Low TN by the FJU for forwarding to Link 11/11B. The FJU then automatically informs all JUs of the Low TN assigned, as depicted in Figure 5-1. Thus, all IUs hold the Low TN. Whenever a track is held with both a High TN and a Low TN, the Low TN shall be used as the CTN for all voice communications about the track.

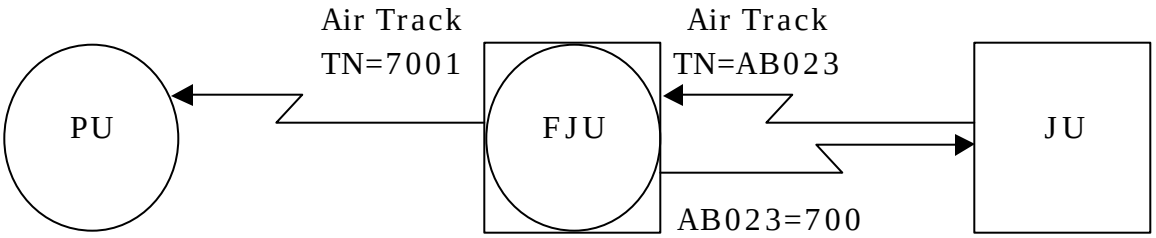

Figure 5-1. CTN Reporting by FJU

b. C2 JUs have the capability to initiate a CTN Request when the CTN is not held and is needed for voice communications. If only a High TN is held for a track, the C2 JU operator should request the CTN before using voice. Most FJUs respond automatically to a CTN Request. If this request has negative results, or if the CTN Request capability is not available, the operator should use the High TN for voice coordination but must recognize that PUs and RUs might not hold the High TN.

c. As extensive use of CTN generates traffic load and sometimes confusion, it is recommended to only assign Low TNs as far as possible, IAW paragraph 4.4.2.2.d.

5.5.5.2 NATO Track Numbers (NTN) Description

a. Link 1 NTNs are assigned to all tracks being reported by Link 1 sites and/or Link 1 equipped buffers. NTN's consist of two alpha characters (termed a Bi-graph) and three octal numbers. The alpha characters are assigned from A, E, G, H, J, K, L and M, and the three digit octal numbers ranging from 000 through 777_8. Each Link 1 site or buffer is assigned a fixed alpha character combination. Buffer systems that forward track data from Link 11/11B, IJMS or Link 16 to Link 1 allocate NTNs from their assigned NTN-block before transmitting the data on Link 1. When a site or buffer receives Link 1 data, it will, if applicable, forward this data on other Link 1 channel with the same original NTN, to support Track Continuity and ease of reference. When a site or buffer forwards Link 1 data to Link 11/11B, IJMS or Link 16, a TN, SRN or Link 16 TN will be assigned. The NTN will also be reported in the appropriate message format (e.g. M2/M82, T1, J3.2.). The NTN-combination AA, called a Non-NATO Track Number (NNTN), will not be transmitted on a Link 1 channel. Within most systems NNTNs are automatically excluded from being transmitted. In case a track with a NNTN is transmitted, by manual input (Force Tell), the receiving site will change the NNTN into one of its own NTNs. In addition, a S14 Management message is generated and transmitted to change the NNTN in the new NTN at the sending site. If a buffer receives a NNTN, the same sequence will occur and the track, with a NTN from the buffer NTN-block, will be forwarded if applicable. Due to the limited number of Bi-Graphs available, the first 2 characters tend to be repeated within an AOR by units geographically separated. This may lead to NTN conflicts where tracks transit from one TPA to another. The ICO shall be aware of these issues and be prepared to issue instructions to change NTNs where necessary.

b. The NTN is to be used in all voice communications with Link 1 sites.

5.5.5.2.1 NTN Requests. If an operator in a C2 IU desires to communicate by voice with a Link 1 site about an air track for which the IU does not hold a NTN, he should request the NTN using the interface NTN request capability. The IU that holds the NTN and has the first transmission opportunity after receipt of the request responds automatically. If no response is received, the requesting IU must assume the track has not been forwarded to Link 1.

5.5.5.3 IJMS TNs. The IJMS System Reference Number (SRN) consists of five octal digits and is used to identify all units, tracks, and special points. SRNs 00001 through 00176_8 are used as identification numbers for C2 systems. The remaining numbers (except those listed below) are used as identification numbers for nonC2 systems and for the reporting of tracks and special points.

SRN 00177 is used for the collective address, and SRNs 00000, 00077_8, and 77777_8 are illegal.

5.5.5.4 ATDL-1 TNs. A combined alphabetic and octal numbering system is used on ATDL-1 to denote all units and all tracks (air, jam strobes, and points). TNs are represented by XY000 through $XY777_8$ where X is alphabetical character A through N, P or Q (four bits) and Y is an alphabetical character A-H (three bits). $XY000_8$ is the ATDL-1 TN of a station address, except $AA000_8$ that is used to indicate NS/UNK. XY001 through $XY777_8$ are ATDL-1 TNs. QH is used only as the general address. AA and QH are illegal for use as station address. ATDL-1 TNs received by a C2 IU are associated with or assigned a TN for exchange on the interface between tactical data systems.

5.5.5.5 Link 4A. Link 4A tracks are reported to controlling units as TINs. The controlling unit will correlate the backlinked track with local tracks. If a correlation exists the TN will be associated with the TIN and reported to the Link 4A controlled aircraft. If no correlation exists, a new TN will be assigned by the controlling unit to the track associated with the TIN, and reported.

5.5.5.6 Manual TN Assignment

a. C2 IUs should have the capability to manually assign TNs within or outside of their allocated block. Normally, this capability is used to maintain TN continuity for tracks/points of special interest, such as surveillance of a high-value track. Other uses for manual TN assignment include sensor loss of a track and the subsequent acquisition of the same contact, or decorrelation of a track followed by manual TN assignment to retain an original TN.

b. Operators assigning manual TNs should be aware of TN block allocations and should coordinate the manual TN assignment by voice, if feasible. The selection of a TN for manual assignment must ensure the TN is not currently in use. Manually assigning a TN that is in use will create a duplicate TN situation.

5.5.6 Track Identification. The following describes the identifying information that can be reported for Air, Surface, Space, and Land tracks, in addition to the environment, position, course, and speed. Procedures for interface resolution of differences in identifying data held by two or more IUs are contained in paragraph 5.10.4.2.

a. Standard ID. The standard IDs and their definitions are:

(1) UNKNOWN: An evaluated track which has not been identified.

(2) ASSUMED FRIEND: A track which is assumed to be friend because of its characteristics, behavior, or origin.

(3) FRIEND: A track belonging to a declared friendly nation.

(4) NEUTRAL: A track whose characteristics, behavior, origin, or nationality indicate that it is neither supporting nor opposing friendly forces. (A NEUTRAL track is reported on Link 11/11B as a friend, with an ID AMP of NEUTRAL. Such a track shall be considered a NEUTRAL, not a FRIEND, for all operational purposes.)

(5) SUSPECT: A track that is potentially hostile because of its characteristics, behavior, origin, or nationality.

(6) HOSTILE: A track declared to belong to any opposing nation, party, group, or entity, which by virtue of its behavior or information collected, such as characteristics, origin, or nationality, contributes to the threat to friendly forces.

b. Pending: Tracks that have not been subject to the identification process but that are available for reporting may be reported with a status of PENDING.

5.5.6.1 Platform. Indicates the general type of platform of the track; e.g., Fighter, Cruiser, Tank.

5.5.6.2 Activity. Indicates the overall current primary activity or mission of the track; e.g., CAP, USW, targeting, etc. Activity should not be used to indicate a design capability of a platform; its use should be limited to reporting the activity or mission in which the platform is known or suspected to be currently participating. Up to 12 adaptable Activities particularly appropriate to the current operation can also be prearranged, as specified in paragraph 4.4.6.5. More specific information about the immediate activity of a track may also be originated by Intelligence sources, as described in paragraphs 4.4.6.5 and 5.9.1.3.

5.5.6.3 Specific Type. Indicates the type of the track more specifically than the platform; e.g., E-3, Type 42 Class Destroyer, F-14, Main Battle Tank. May be assigned by Surveillance personnel (Link 16 only) or by Intelligence sources.

Operators must be alert to ensure that conflicting combinations of Platform and Specific Type are not reported.

5.5.6.4 NAT/ALL. Indicates the specific Nationality or Political Alliance of the track; e.g., Libya, NATO. NAT/ALL is reported only in intelligence messages. Up to 28 adaptable NAT/ALL(s) appropriate to the theater of operations can also be prearranged, as specified in paragraph 4.4.6.4.

5.5.6.5 Special Interest

a. Tracks may also be identified as being of Special Interest. This designation is generally independent of the track Environment, ID, and other identifying information. The reason for the special interest is normally not specifically reported on the interface, but should be reported by voice if deemed necessary. The only Special Interest reporting capabilities available on Link 11/11B are the designations of air FRIEND tracks as KILO and air SUSPECT tracks as ZOMBIE. Because of these Link 11/11B limitations, the following limitations on use of the Special Interest designation are necessary:

(1) An Air SUSPECT track shall not be designated special interest unless it meets the criteria for a ZOMBIE (see Glossary). Any special interest air SUSPECT track received shall be considered a ZOMBIE.

(2) A Surface SUSPECT track shall not be designated Special Interest unless it meets the criteria for a TRAVELLER (see Glossary), the surface equivalent of a ZOMBIE. Any Special Interest Surface SUSPECT track received shall be considered a TRAVELLER.

(3) An Air FRIEND track shall not be designated Special Interest unless it meets the criteria for a KILO (see Glossary).

b. The Special Interest designation is independent of setting a Track Alert on a track and does not force the track through filters.

5.5.6.6 Strength. The Link 16 term “Strength” replaces Link 11/11B terms, “Raid Size” and “Size” for Air and Surface Tracks, respectively. In addition to Single, Few (2-7), and Many (8 or more), C2 JUs can report the specific number of vehicular objects comprising a TN, as a number between 2 and 12. These are reported on or forwarded to Link 11/11B as either Few or Many.

5.5.6.7 Altitude. Air track altitudes up to 204k feet are reportable on Link 16, but only up to 127k feet on Link 11/11B. Operators should be aware that a

track that has an altitude greater than 127k feet is forwarded to Link 11/11B with an altitude of unknown.

5.5.6.8 Retransmission of Remote Identification Information. Some C2 IUs have the capability to automatically store and retransmit the Platform, Activity, and/or Specific Type received from remote sources, when locally derived information is not available and own IU assumes R^2, even when own IU does not implement the remote information. This prevents the loss of that information by implementing IUs. This can result in a unit reporting information that is not available for local display.

5.5.6.9 IFF/SIF Reporting

a. Modes I, II, III, and IV IFF/SIF information is used by systems and operators as one factor in determining ID. The R^2 IU reports IFF/SIF information associated with a specific TN. All other C2 IUs are responsible for monitoring IFF/SIF data on the TN and reporting differences IAW paragraph 5.10.5. IFF/SIF information may be updated or cleared by any C2 IU.

b. The Mode II IFF/SIF code sent by an aircraft is normally unique to that aircraft; however, two or more aircraft flying in close proximity may result in an erroneous IFF/SIF code being received. In these cases, different IUs may receive different IFF/SIF codes from the same track. To minimize tracking discrepancies, normally only one aircraft in a flight should squawk IFF/SIF. The actual code being received should be reported on the interface rather than the code that was pre-assigned to the flight leader. This is necessary to preclude automatic trackers from generating additional tracks for the actual code received.

c. IFF/SIF codes generated by automatic detection and tracking systems must be tactically evaluated for validity before transmission on the interface. This is accomplished automatically by some systems, by comparison with a pre-entered list of valid codes. This must be accomplished manually by other IUs. A track shall not be assigned an ID of ASSUMED FRIEND or FRIEND based on an automatic detection and tracking generated Mode II code until the code has been tactically evaluated.

d. When a track for which valid IFF/SIF data were held subsequently fails to respond to interrogations, the track continues to be reported with IFF/SIF data until an operator takes a manual IFF/SIF Clear action.

5.5.6.10 Track Termination

5.5.6.10.1 Drop Track Report. The Drop Track Report is used by an R^2 IU to report that it ceased to report a track, point, or EW data. In addition, when an IU becomes inactive, the forwarder automatically transmits a Drop Track Report on the inactive unit. Tracks and points that are dropped by a Drop Track Report are then reported by other C2 IUs that hold local data and are eligible to assume R^2.

5.5.6.10.2 Track Purging. Purging is the removal of a TN and its track data from an IU's database without transmission of a Drop Track Report. Some IUs automatically purge remote tracks after a specified time interval has elapsed without a track report. However, this automatic purge may be overridden by operator action to prevent purging a specific TN. Some IUs also override the automatic purge if a track meets predefined criteria such as Track Alerts, Engagement Status, Pairings, etc.

5.6 Reference Points, Lines, and Areas

a. Reference Points are points used for common reference among IUs. Paragraph 4.4.5 provides the procedures for specifying Common Reference Points in the OPTASK LINK. This section provides the general procedures for reporting Reference Points, including lines and areas.

b. Link 16 also provides a new capability to report lines and areas of any description. Lines and areas are included under the general term reference point, because they are defined either by a single center point or a series of connected points. The term “Points” used in this section means “Reference Points, Lines, and Areas” unless otherwise indicated.

c. The term “Special Point” is being replaced by Reference Point and Land Track/Point.

d. USW Points are of a different nature than Reference Points, and procedures are provided separately in paragraph 5.7.6.

5.6.1 General Points. Most points have specific meanings and are intended for specific tactical purposes. The reporting of general points without a specific meaning should be avoided, because this will normally contribute little to the tactical picture and may create confusion requiring excessive voice coordination. However, when necessary to report a reference point and no specifically defined point is appropriate, a General Hazard Point, General Reference Point, General Line, or General Area may be reported. The specific

intended use of such points must always be provided by voice or other means to all C2 IUs, except that PU/RUs need not be informed of the use of Lines and Areas because they are not forwarded to Link 11/11B.

5.6.2 Point Reporting Responsibility

a. The C2 IU initiating a point has R^2. Points are automatically transmitted periodically on Link 16, but not on Link 11/11B. Points do not have TQ, and R^2 is not shared in the same manner as for tracks. However, when a point report has not been received for several periodic update intervals, or when the C2 IU with R^2 goes inactive, an operator in a C2 JU is alerted. The operator may assume R^2 for the point TN, if deemed necessary, to ensure the point remains active and is not purged by other IUs. However, for a Link 11/11B only interface, the operator should normally not assume R^2 from an active PU/RU. In this case, the point has probably not been updated due to the Link 11/11B rule. The last C2 IU to report a point has R^2 for the point.

b. The R^2 rules for ballistic missile launch points and impact points are summarized below:

(1) Any C2 IU may initiate a report of an actual ballistic missile launch point or impact point. The originator of the report retains R^2 on the point until it is relinquished.

(2) The C2 IU initially reporting a ballistic missile track may initiate an impact point report and may initiate a report on a related launch point. R^2 for the related impact point report will remain with the C2 IU having R^2 for the ballistic missile track.

(3) A C2 IU assuming R^2 for a ballistic missile track need not assume R^2 for the related launch point. A C2 IU no longer holding R^2 on the ballistic missile track may continue to report the related launch point.

(4) A unit, by operator action only, may assume R^2 for a missile launch point if:

(a) a Drop Track Report message is received,

(b) the R^2 unit is declared inactive, or

(c) no periodic update is received for three consecutive update intervals.

5.6.3 Reporting Areas and Lines (Link 16 Only)

a. The capability to report areas and lines of any geometric description is a valuable new operational capability. It should be used to report Corridors, Buffer Zone Boundaries, Search Areas, Submarine Patrol Areas, and other areas and lines of tactical significance to the force. General Lines and General Areas may be particularly useful for reporting an Air Defense Identification Zone (ADIZ), Fire Support Coordination Line (FSCL), operating areas, and the like when it is desirable to ensure that a common picture of the tactical theater of operations is shared.

b. Areas can be reported as either a regular or irregular shape. Regular shapes are circles, ellipses, squares, and rectangles, each defined by a single center point, major and minor axes up to 248 miles long in 4-mile increments, and an orientation bearing. Entering a series of connected points can approximate irregular shapes, including all lines. Figures 5-2 and 5-3 illustrate examples of areas and lines that may be reported on Link 16.

c. Corridor lines and all areas can be assigned minimum and maximum altitudes. One example is an operating area in which live firing is to be conducted. This example could be defined as a volume from surface to the maximum ordinate of the weapons to be fired, plus a safety factor. Such an area reported via link could assist controlling IUs to keep aircraft clear.

d. The FTC/TDC should designate an appropriate C2 JU that has a graphics display capability to enter and report each line or area for the interface. This relieves operators in other C2 JUs of the burden of entering many points separately and ensures that a common picture is shared.

e. For technical reasons, every other point of a multi-point line or area is automatically assigned a different TN for link transmission. Most systems display only the initial TN to operators, and that is the TN to be used for all voice coordination and other actions concerning the line or area. If multiple TNs are displayed, the operator must determine which TN represents the initial point. As a general rule, the lowest sequential TN should be the initial point. Figure 5-2 shows only the initial TN displayed. Figure 5-3 illustrates the display of all TNs. FS001 would be used for reference.

f. Force Tell may be set on a multi-point line or area. A multi-point line or area may be dropped.

5.6.4 Areas of Probability (AOP)

a. The use of AOPs in USW and EW interface operations is described in paragraphs 5.7 and 5.8 respectively. It is also possible to report an AOP associated with an Air, Space, Surface, or Land Track, or an independent AOP. The most common use of this capability is to indicate the area in which a NRT is probably located, or an area of probable enemy activity. AOPs shall not be reported for real-time tracks, because TQ serves the same purpose.

b. An AOP associated with a NRT is automatically assigned a different TN than the track. The association of the TNs, if not reported automatically, should be reported by operator action. The associated AOP should either be slaved to the NRT or assigned the same Course and Speed as the track.

c. (Link 11 only) The source of an AOP derived by other than USW or EW means is reported as either estimated by reporting unit or intelligence, if applicable.

5.6.5 Friendly Weapon Danger Areas (FWDA)

a. Ships capable of launching torpedoes that can engage surface targets (e.g., Mk 50), may report FWDAs associated with the torpedo run. FWDAs are normally rectangular, extending an appropriate safety margin either side of the intended torpedo track. The torpedo track may also be reported on the interface either in lieu of a FWDA or in association with a FWDA.

b. FWDAs are originated automatically upon anti-surface capable torpedo firing by some ships, but may require operator initiation in others. The time of FWDA deactivation is also reported, based on the expected duration of the torpedo run. FWDAs are automatically terminated by the reporting unit at the end of the FWDA duration with a Drop Track report. The FWDA should be manually dropped by the reporting unit prior to the end of the FWDA duration by the transmission of a Drop Track report if the torpedo run ends before that time. If this time cannot be determined, a default time of 155 minutes shall be added to the Effective Commencement Time (ECT) without receipt of a Drop Track Report.

c. Ships should remain clear of active FWDAs.

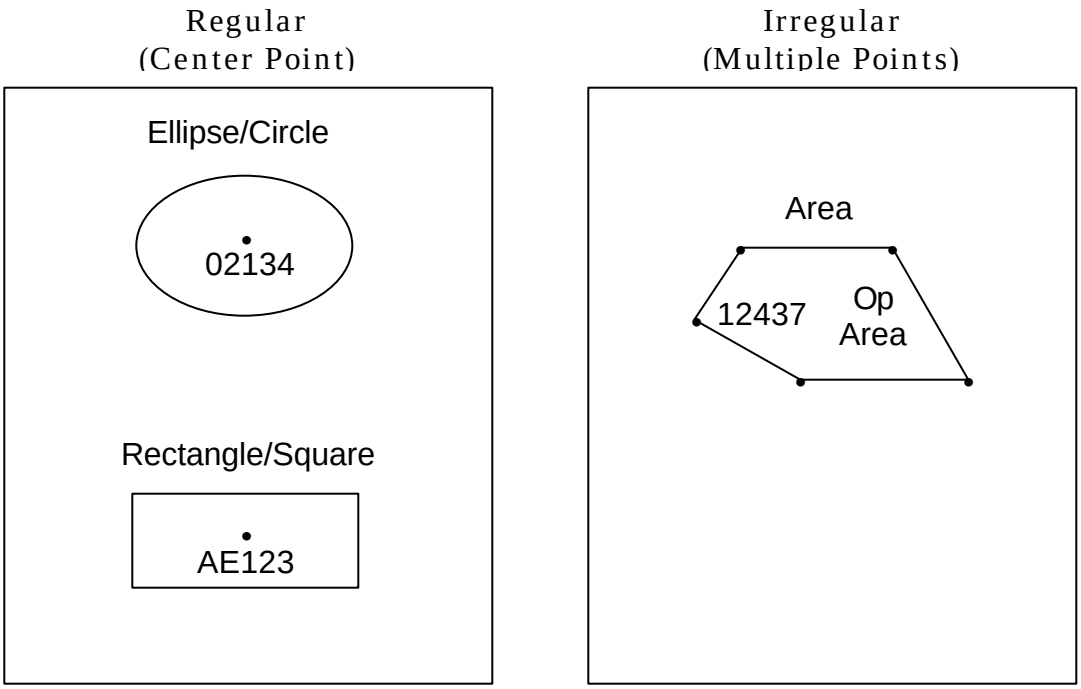

Figure 5-2. Examples of Areas

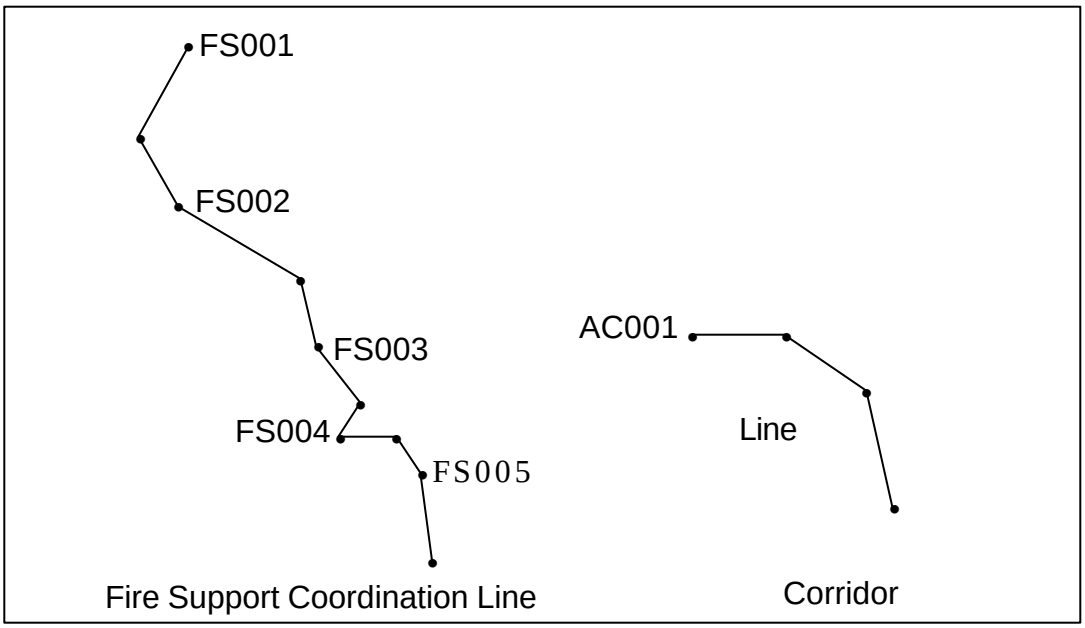

Figure 5-3. Examples of Lines

5.6.6 Moving and Slaved Points. A point, line, or area may be caused to move on displays either by assignment of an independent course and speed or by being slaved to another moving point or track.

5.6.6.1 Independent Moving Points. An independent moving point moves at an assigned course and speed, independent of other link tracks and points. This capability is particularly useful for reporting the force Position and Intended Movement (PIM) for the information of all IUs. PIM is reported by reporting one or more PIM Points, as applicable. Each PIM Point is assigned an activation time, which is the time the force will arrive at the point and a course and speed, which is the base course and speed that will be assumed by the force upon arrival at the PIM point. Submarine Position and Intended Movement (SIM) may be reported in a similar manner. Examples of other points for which independent course and speed are particularly useful are Formation Center and Disposition Center.

5.6.6.2 Slaved Points

a. A Point may be slaved on either a True or Relative bearing to another point or track being reported on the interface. A slaved point automatically remains on the specified bearing from the related point or track and moves with the related point or track. This capability is particularly useful for causing stations within the force, such as CAP Stations and Picket Stations, to move with the Formation Center, Disposition Center, or PIM, as appropriate.

b. A line or area defined by a single center point may be slaved in the same manner as a point. However, for technical reasons, a line or area defined by multiple points cannot be slaved when transmitted on the link. Some TDSs allow the operator to slave such lines and areas, and the TDS then automatically assigns the course and speed of the related track or point to the slaved point for link transmission and updates the slaved point whenever the related track or point changes course or speed. The slaved relationship of such points is not obvious to receiving operators, and voice coordination may be required to clarify the tactical picture. For example, an irregularly shaped screen station slaved to the Formation Center.

5.6.7 Point Times. Various times may be reported for points. Except for PIM and SIM Points as described above, moving points are always reported in their current location, independent of the time associated with the point. The following times may be associated with points:

a. Time of Establishment: The time the reported position for the point was established. This may be a time prior to transmission on the interface.

b. Activation Time: The time the point will become effective for operational use. Except for PIM and SIM Points, a moving point must not be assigned an activation time in the future. If desirable to report such a point in advance, it should be initiated as a stationary point with an activation time, then commence moving at the activation time.

c. Deactivation Time: (Link 16 only) The time the point will no longer be operationally effective. Points are not automatically dropped or purged at the deactivation time, thus requiring operator action to remove them from the interface and displays.

d. Arrival Time: (Link 16 only) The time that the assigned friendly unit(s) is scheduled to arrive at the point. Reporting of scheduled arrival time is for information only and does not constitute direction to the assigned units. These times should not be assigned to a point unless the identification of the assigned unit will be cleared to recipients.

e. Departure Time: (Link 16 only) The time that the assigned friendly unit(s) is scheduled to depart the point. Reporting of scheduled departure time is for information only and does not constitute direction to the assigned units. These times should not be assigned to a point unless the identification of the assigned unit will be cleared to recipients.

5.6.8 Emergency Points. Emergency Points are used to mark the location of a potential or ongoing Search And Rescue (SAR) operation. The following Emergency Points are reportable on the interface:

a. Down aircraft.

b. Man-in-water.

c. Ditching.

d. Bailout.

e. Distressed vessel.

f. General emergency.

5.6.8.1 Emergency Point Initiation

a. Any C2 IU gaining knowledge of the location of an emergency condition that may require SAR operations can initiate an Emergency Point. However, because many C2 IUs are likely to learn of an emergency condition nearly simultaneously, operators should inspect their display carefully before initiating a new Emergency Point. If it appears that another IU has already initiated a point for the same emergency, then the operator may elect to report additional or different information about the same TN. The last IU reporting an Emergency Point TN assumes responsibility for continued reporting of the point and automatically updates the point periodically.

b. Some airborne nonC2 JUs automatically set a bailout indicator in their PPLI message when an ejection occurs; i.e., when the ejection seat actually leaves the aircraft, if JTIDS/MIDS is still operational. Bailout may be reported by voice by other aircraft. The controlling IU, if any, of an aircraft reporting bailout should establish a bailout point directly below the point at which the aircraft was located when bailout occurred. Some C2 JUs automatically report such a Bailout Point upon receipt of the PPLI from an aircraft under their control. However, any C2 IU operator receiving a Bailout report should report a Bailout Point if the controlling IU has not done so within a short period of time, subject to the procedure above.

5.6.8.2 Emergency Point Association. An Emergency Point often results from an emergency condition in a track previously reported on the interface. The Bailout Point situation described above is a good example. The Emergency Point must be reported separately from the associated track. When a previously reported track with which an Emergency Point is associated is known, an operator must cause the association to be reported on the interface.

5.6.9 Terminating Points

5.6.9.1 Dropping

a. When the C2 IU, which originated a point on the interface, or the R^2 IU for a point IAW paragraph 5.6.2, determines that the point has served its purpose and is no longer needed, it should drop the point by operator action. The FTC/TDC must also be alert to direct dropping points that he deems are no longer needed. See paragraph 5.6.3.f for procedures for dropping multi-point lines and areas.

b. IUs should not drop a point upon receipt of a Drop Track Report on the point when any of the following conditions exist:

(1) The point is paired or engaged to a track that the IU is controlling.

(2) The point is one of the TNs in a pairing or engagement originated by the IU.

(3) If the operator deems the point to be tactically significant.

c. In paragraphs 5.6.9.1.b.(1) and 5.6.9.1.b.(2) above, the operator may be alerted and should consider assuming R^2 for the point IAW paragraph 5.6.2.

5.6.9.2 Purging. Points are only purged from an individual C2 IU's display and database by operator action, unless the point is dropped from the interface as described above.

5.7 USW Operations

a. This section specifies the procedures for interface support of active and passive USW operations, and summarizes the USW information reported via the interface. The basic USW reporting procedures differ significantly from Air, Surface, and Land Surveillance. However, some procedures are the same. In these cases, they are not repeated here, but reference is made to the applicable section of the document.

b. The term “Subsurface Track” means an USW contact for which a position has been determined. This generally means an active sonar contact, but a passive contact can also be reported as a passive subsurface track if fixed sufficiently accurately.

c. The term “Passive Contact” means a line-of-bearing (LOB), or two ambiguous LOBs, gained by passive acoustic means. A Passive Contact may also include a range developed by Target Motion Analysis (TMA). A Passive Contact may also consist of only a range developed by a Range Only (RO) sonobuoy.

d. The term Under Sea Warfare Commander (USWC) is used in the generic sense to mean the IU designated as the on-scene commander responsible for coordinating USW operations. The USWC may be the force, area, or Local USWC, a Surface Action Unit (SAU) Commander, Screen Commander, or other appropriate IU.

e. The organization of this section is:

(1) General USW Reporting Concept.

(2) Subsurface Track Information Exchanged.

(3) Subsurface Information Difference Resolution.

(4) Lost Contact Procedures.

(5) Passive USW Operations.

(6) USW Points, Pines, and Areas.

(7) Sonobuoys and Sonobuoy Patterns.

(8) Subsurface Track/Point Termination.

(9) USW Weapons Coordination.

(10) USW Platform and System Status.

(11) Special Considerations for Operations with Subsurface IUs.

5.7.1 General USW Reporting Concept. The general concept of USW reporting via the interface differs considerably from that for Air, Surface, and Land Surveillance. It closely parallels the standard USW voice procedures, allowing tactical USW to be conducted via the interface with little or no voice coordination. The basic concept follows:

a. Each IU that gains contact, reports its contact with a different TN, even though it is known or believed to be the same as a contact already being reported by another IU. There is no sharing of R^2 for Subsurface Tracks as there is for Air, Surface, and Land. Thus all IUs in contact contribute their evaluation to assist in mutual classification and prosecution.

b. All Subsurface Tracks must be manually initiated. A track may be initiated without Confidence Level, but the operator shall assign a Confidence Level, or validate the Confidence Level assigned by the USW system as soon as possible.

c. Subsurface Tracks are not correlated either automatically or manually. However, any IU may associate two or more Subsurface Track TNs (see paragraph 5.10.10).

d. Subsurface Tracks do not have Track Quality. However, active sonar contacts held on own IU's sensors are reported as real-time tracks unless the last sensor data is more than 1 minute old. The active sonar of an USW helicopter that is linked to a control ship is considered the controlling IU's own unit sensor, but active sonobuoys are not. If more than 1 minute has elapsed since the last sensor contact, the track is automatically reported with the time of last contact, indicating a NRT.

e. To reduce display clutter or otherwise clarify the USW tactical picture, when multiple IUs report the perceived same contact, the USWC should consider the following actions:

(1) Associate two or more of the tracks.

(2) Direct one or more of the reporting IUs via voice to Drop Track.

(3) Depending on the number of IUs involved in an USW action, clarity of the tactical picture and overall tempo of operations, direct some IUs not to initiate Subsurface Tracks when they evaluate the contact to be the same as one already being reported.

f. Subsurface NRTs, based on information from other than own sensors, are reported in the same manner as Air, Surface, and Land NRTs, as specified in paragraph 5.5.2.5. This includes tracks based on active sonobuoy detections, intelligence reports, and other special onboard or off-board sources.

5.7.2 Subsurface Track Information Exchanged. The information reportable for Subsurface Tracks, in addition to position, course, and speed, is described below. Link 16 capabilities are generally the same as Link 11/11B, although a few capabilities have been added and a few terms have been changed. The CTN procedures in paragraph 5.5.5.1 are equally applicable to Subsurface Tracks and Points in a multi-link interface.

5.7.2.1 Data Type. All Subsurface Tracks are reported as either a General Subsurface Track, Surfaced Submarine, Snorkeling Submarine, or a Datum. Snorkeling Submarine is only specifically reportable by C2 JUs and is processed by PU/RUs as a General Subsurface Track with a depth of "Snorkeling." Paragraph 5.7.4.2 specifies procedures for reporting Datums. E-2C reports only Surfaced and Snorkeling Submarines. Snorkeling

Submarine is only specifically reportable by Model 5 IUs, and is processed by Model 4 IUs as a General Subsurface Track with a depth of "Snorkeling."

5.7.2.2 Confidence Level. The Link 16 term "Confidence Level" replaces the Link 11/11B term "Classification." All Subsurface Tracks must be classified with a Confidence Level of Possible Submarine (POSSUB) 1 through 4, which equates to LOW 1, LOW 2, HIGH 3 and HIGH 4, Probable Submarine (PROBSUB), Certain Submarine (CERTSUB), or non-submarine (NONSUB), as defined and required by USW doctrine.

5.7.2.3 ID. The standard IDs in paragraph 5.5.6 are also reportable for Subsurface Tracks on Link 16, although Link 11/11B is limited to FRIEND, HOSTILE, and UNKNOWN. Link 16 IDs of SUSPECT and ASSUMED FRIEND are translated to Link 11/11B as UNKNOWN and NEUTRAL is translated to FRIEND.

5.7.2.4 Platform. The Link 16 term "Platform" replaces the Link 11/11B term "Classification Amplification." It is particularly important that Subsurface Tracks be reported as Type 1, 2, or 3 Diesel, or Type I through VII Nuclear platforms when that information is available.

5.7.2.5 Non-Submarine Platforms. Except for the Platforms listed below, a Subsurface Track classified with a Confidence Level of non-submarine shall be reported on the interface with the Platform also set to non-submarine, then the track shall be manually dropped from the interface by the reporting IU. The following non-submarine platforms should continue to be reported as indicated:

a. Surface vessel: Change the Environment to Surface and continue reporting with the same TN. This change is not allowed on Link 11 and voice coordination is required.

b. Torpedo: Continue reporting as long as contact held, regardless of ID. Some sonar systems are capable of tracking torpedoes with a course and speed. Torpedo reports cause operator alerts in most receiving IUs.

c. Decoy: Continue reporting as long as detected, regardless of ID.

d. Mine: Continue reporting as a Subsurface Track if the evaluation has been made by an underwater mine detection system; e.g., KINGFISHER. Otherwise, drop the Subsurface Track and report a new "Mine" Hazard Point with a new TN.

5.7.2.6 Specific Type (Link 16 Only). The specific submarine class (e.g., LOS ANGELES SSN, CHARLIE II SSGN) can also be reported when known, whether ascertained through USW or Intelligence means. Operators must be alert to ensure that conflicting combinations of Platform and Specific Type are not reported.

5.7.2.7 Activity. The Link 16 term "Activity" replaces the Link 11/11B term "Current Mission". The activity in which a Subsurface Track is engaged is rarely known. If a friendly support submarine is tracked and reported on the interface, it should normally be reported with an Activity of "Direct Support."

5.7.2.8 NAT/ALL. See paragraph 5.5.6.4.

5.7.2.9 Contact Depth. Quantitative depths to 6000 feet are reportable, in 50 feet increments. Normally, depth will not be known with reasonable accuracy. Unless the quantitative depth is known accurately, it is important that a contact's qualitative depth (i.e., depth relative to the sonic layer) be reported as either Above Layer or Below Layer, or that depth be reported as Periscope Depth, Estimated Deep, or Bottomed, as applicable.

5.7.2.10 Sensor Holding Contact. The sensor currently holding the contact on which the reported position is based is reported only in general terms; i.e., Active or Passive Sonar, Active or Passive sonobuoy, Magnetic Anomaly Detection (MAD), or Towed Array. Visual, ESM, Radar, and Infrared are also reportable, but will normally only be applicable to Surfaced and Snorkeling Submarines.

5.7.2.11 IFF/SIF. Modes I through IV are reportable for Subsurface Tracks.

5.7.3 Subsurface Information Difference Resolution

a. When a PU/RU is reporting the track in question, voice coordination may be required to resolve differences or direct data changes.

b. The Environment, ID, and IFF/SIF difference resolution procedures in paragraphs 5.10.3 through 5.10.5 apply to Subsurface Tracks. However, they are only used when an IU holds the same contact or otherwise obtains information about a contact reported by another IU, but the IU with the different information is not reporting the contact itself. If the IU with the different information is also reporting its contact with a different TN, it reports the different information in its track reports.

c. (Link 16 only) The USWC should use the Change Data Order to direct that his evaluation of the contact's ID, Platform, Activity, Specific Type, and NAT/ALL be accepted by each IU reporting the same contact. This requires a Change Data order for each separate TN reported for the same contact.

5.7.4 Lost Contact Procedures

5.7.4.1 Track Continuity. As an IU reports a Subsurface Track through periods of contact and lost contact, it is important that interface tracking continuity be maintained for the same TN. When the operator or USW system indicates contact has been lost, this is automatically reported to the interface, with the time of Lost Contact. The track continues to be reported as a Lost Contact, with the last known information, unless dropped by manual action. It continues to move on the last known course and speed unless converted to a Datum. When contact is regained, it is automatically reported to the interface by deleting the Lost Contact time.

5.7.4.2 Datum Establishment. As long as one or more IUs report contact on what is evaluated to be the same submarine, it is normally not necessary to establish a Datum when contact is lost by some, but not all, of the IUs tracking the same submarine. However, when all IUs report lost contact for a significant period of time, the USWC normally directs the establishment of a Datum. If only one IU was tracking, that IU may establish a Datum, or just continue to report the track as a Lost Contact. The following are the procedures for establishing a Datum on the interface.

a. The IU directed, or deciding, to report the Datum manually converts its Subsurface Track to a Datum. The Datum automatically retains the same TN as previously reported. The lost contact time and other last known information reported by the IU continue to be reported automatically for the Datum.

b. The USWC should direct other IUs that have lost contact to drop their track, unless operational considerations dictate otherwise.

c. Although the last known course and speed of the track is reported for the Datum, the Datum remains fixed in the position where contact was lost. The last known course and speed, as well as the track's reported platform, can be used to compute a Farthest-on-Circle (FOC) and assist in determining search tactics. The FOC is not reportable on the interface, nor can search tactics be directed via the interface. However, the IU establishing the Datum can report a circular Datum Error of up to 15 miles radius.

d. When a Datum has been established and contact is subsequently gained, the contact should be reported as a new Subsurface Track with a different TN than the Datum. This is because it can normally not be ascertained immediately that the contact is the same as the one previously held and lost. However, if the IU gaining contact is the IU reporting the Datum and the operator is confident that the contact is the same submarine as represented by the Datum, based on acoustic signature or other evaluation parameters, the Datum may be manually converted to a Subsurface Track with the same TN.

e. The following actions should be considered when contact is gained and reported with a new TN after a Datum has been established:

(1) The IU gaining contact should associate it to the Datum, if the operator believes it to be the same contact.

(2) If not associated by the IU gaining contact, the USWC or any other IU believing the new contact and the Datum to be the same should associate them.

(3) When the USWC is confident the new contact is the same as the Datum, he should direct the IU that reported the Datum to drop it. If he considers that TN continuity will aid in further prosecution, he may also direct the IU reporting the contact to manually reassign the contact the same TN as was assigned to the Datum (see paragraph 5.7.4.2 a to d).

(4) If only one IU was previously tracking, lost contact, established the Datum, and regained contact, that IU may elect to drop the Datum and manually reassign the same TN without USWC direction.

f. Datums may also be established independent of previously reported tracks and in positions other than the position of a lost contact. A Datum Error up to 15 miles radius can be established.

5.7.5 Passive USW Operations. The interface fully supports coordinated passive USW operations. This section describes the specific capabilities and procedures for reporting and utilizing passive contacts.

5.7.5.1 Ambiguous/Resolved Bearings.

a. A sensor gaining passive contact may derive two ambiguous bearings due to the “mirror image” property of passive sonar and sonobuoys. Both bearings should be reported on the interface until resolved. Coordinated

exchange of ambiguous bearings between two or more IUs holding passive contact, or monitoring sonobuoys holding passive contact, is an excellent method of rapidly resolving the actual bearing. When resolved, only the single resolved bearing shall be reported on the interface.

b. Confidence Level, ID, Platform, qualitative Contact Depth, Sensor holding contact, and Lost Contact time are reported for passive acoustic contacts in the same manner as specified for Subsurface Tracks. The following information can also be reported for passive contacts:

(1) Bearing Accuracy.

(2) A source frequency and two associated frequencies, or broadband.

(3) Bearing Drift - Left, Right, or Steady.

(4) Doppler - Up, Down, or No.

(5) Sensor Layer Depth - indicates whether the passive sensor; e.g., towed array, dipping sonar, or sonobuoy transducer, is above or below the sonic layer.

(6) Sound Propagation Path - Direct Path, Bottom Bounce, Convergence Zone (CZ) 1, 2, or 3 or beyond, or Multi-path.

(7) Range and range accuracy.

c. The actual point of origin is always reported for a passive bearing line. Thus, a passive bearing line is seen as originating from a point astern of the ship holding contact if held on a towed array, or from the TN of USW helicopter or sonobuoy. If a sonobuoy holding passive contact had not been previously reported (e.g., because it was part of a reported pattern), the acoustic bearing line appears independent of any obvious source. This can be avoided by reporting the sonobuoy prior to reporting its contact.

5.7.5.2 Triangulation and Localization

a. Coordinated exchange of passive bearings among multiple IUs supports triangulation and localization of subsurface contacts. The result of these processes should be reported on the interface as an USW AOP, USW Fix, or a passive Subsurface Track. Bearing accuracy's, consistency of contact and operator judgment determine which is more appropriate, and the size of the

AOP, if reported. Passive Subsurface Tracks are specifically distinguished from active tracks by a Passive Indicator in C2 JUs, and in all IUs by setting the Sensor holding contact to Passive Sonar, Passive Sonobuoy, or Towed Array.

b. The USWC should designate appropriate IUs to report USW AOPs, USW Fixes, and Passive Subsurface Tracks resulting from triangulation and localization. Some IUs have automated capabilities to develop these products.

c. A passive Subsurface Track may also be developed by EW techniques, as described in paragraph 5.8. A passive EW Subsurface Track is distinguished from a Passive Acoustic Subsurface Track by the reported Sensor holding contact; i.e., ESM versus Passive Sonar, Passive Sonobuoy, or Towed Array.

5.7.5.3 Passive Target Motion Analysis

a. A single IU can develop a range to a passive contact using TMA, or similar, techniques. It is normally preferable that the solution is reported on the interface as a Passive Range and Bearing, rather than one of the localization products described above. This allows reporting of the Range Accuracy of the solution, which is often important in assessing the validity of the TMA solution and determining subsequent tactics.

b. Course and speed cannot be reported for a passive contact. Therefore, if it is considered more important to report target motion than Range Accuracy of a passive TMA contact, the Passive Contact should be converted to a Passive Subsurface Track.

5.7.5.4 Range-Only Contacts. Certain sonobuoys are capable of determining only an omni-directional range to an active or passive contact. These should be reported on the interface as “Range Only” contact if an IU monitoring such sonobuoys deems the information to be of value to other IUs.

5.7.6 USW Points, Lines, and Areas. USW Points are a form of Reference Point, and the procedures in paragraph 5.6 are equally applicable to USW Points, Lines, and Areas. The interface supports reporting of the USW Points, Lines, and Areas listed below. These are defined in the glossary, as well as USW doctrine. Amplifying information pertinent to interface reporting is provided below in some cases.

a. USW Points:

(1) Sinker.

(2) Brief contact.

(3) Estimated Position (EP).

(4) USW Fix.

(5) USW Search Center.

(6) Sonobuoy Positions and Pattern Reference Positions (see paragraph 5.7.7).

(7) SIM (see paragraph 5.6.6.1).

b. A Sinker, Brief Contact, EP, or USW Fix must be established with a different TN than to the related Subsurface Track or Passive Contact, if any exist. The operator should associate the point to the track or contact if applicable. However, if one of these four types of USW points is changed to another of these four types, it automatically retains the same TN.

c. Limiting Lines of Approach (LLA) (Link 16 only): C2 JUs can exchange LLAs. The LLA consists of a fixed or moving point, with two bearing lines emanating from it.

d. USW AOP: An USW AOP may be an area within which there is a high probability that a particular subsurface contact is located, or it may be a general area of probable submarine activity. USW AOPs are reported as follows:

(1) The area may be circular, elliptical, square, or rectangular, with a radius up to 254 miles.

(2) An USW AOP established for a particular subsurface contact must have a different TN than the Subsurface Track or Datum representing the contact. The operator should associate the AOP to the Subsurface Track or Datum.

(3) If the AOP is for a moving Subsurface Track, it cannot be “slaved” to the track via the interface, although some systems permit internal slaving to cause the AOP to move with the same course and speed as the associated track.

(4) When an USW AOP is converted to an USW Fix, or vice versa, it is reported with a new TN.

e. NOTACK Area: A NOTACK Area should be reported on the interface by any IU receiving it by other than data link from a friendly submarine, normally the Submarine Operations Coordinating Authority (SOCA) or an USW aircraft working with the submarine. Submarines equipped with Link 11 or Link 16 are also capable of reporting their own NOTACK areas, subject to the special considerations in paragraph 5.7.11.

(1) The NOTACK Area is normally fixed, as required by tactical doctrine. However, the link capability allows it to move on an assigned Course and Speed, or be slaved to another moving point, if appropriate.

(2) The NOTACK Area is automatically purged at the expiration of its reported duration. A NOTACK Area may be terminated prior to expiration by a manual Drop Track action on the TN. Such action should normally only be taken if requested by the submarine.

f. Submarine Patrol Area (SPA) (Link 16 only): The area assigned to a submarine for patrol may be reported as any shape or size. It may be appropriate to slave a SPA to a SIM or PIM. However, if multiple points define the SPA, it is subject to the limitation on slaving described in paragraph 5.6.6.2.b.

g. Other USW (Link 16 only): There are no other USW areas specifically reportable on the interface. However, a General Area, amplified by voice, can be used to report other USW areas of tactical significance and interest to JUs, such as:

(1) USW AOR.

(2) Joint Tactical Action Area (JTAA).

(3) Submarine Action Area (SAA).

(4) Submarine Generated Support Area (SGSA).

(5) Screen Stations.

5.7.7 Sonobuoys and Sonobuoy Patterns

5.7.7.1 Sonobuoys. All sonobuoys laid in the vicinity of the friendly force should be reported on the interface. This aids in preventing mutual interference and achieving localization. The following information can be reported for each sonobuoy:

a. Sonobuoy Type: Low Frequency Analysis and Recording (LOFAR), Command Activated Sonar System (CASS), etc. If the applicable type is not reportable, the sonobuoy should still be reported with no type indicated.

b. Radio Frequency (RF) Channel Number: 1-99 (Mandatory-the channel number is essential to locating and using a sonobuoy).

c. Transducer Depth in feet.

d. Activation and Deactivation time (Link 16 only).

e. Holding Contact: Yes or No.

f. Kingpin: Indicates the sonobuoy is the reference sonobuoy of a pattern.

5.7.7.2 Sonobuoy Patterns (Link 16 Only)

a. C2 JUs can report the details of sonobuoy patterns as an alternative to reporting each specific sonobuoy in the pattern. However, when this is done, the above information cannot be reported for individual sonobuoys, because the sonobuoys in the pattern will normally have different channel numbers, activation and deactivation times, etc., and may be of different types. Thus the pattern is only useful as general information to aid in preventing mutual interference by C2 JUs. This capability should be used only when the number of sonobuoys in the pattern makes individual reporting unfeasible, and lack of knowledge of the presence of sonobuoys by other than C2 JUs will not degrade utility of the pattern.

b. The following parameters are reported for patterns, as applicable. The parameters applicable to a given pattern and the manner in which they are applied, are dependent upon the pattern type. Therefore, pattern types not listed below should not be reported, because receiving C2 JUs will not know how to plot the pattern.

(1) Pattern Type: Barrier, wedge or Chevron, Circle (no Kingpin), Circle (with Kingpin), Brushtac, or Distributive.

(2) Number of Sonobuoys: 1 through 31.

(3) Sonobuoy Spacing: Increments of 125 yards.

(4) Row Spacing: Increments of 125 yards.

(5) Pattern Radius: Increments of 125 yards.

(6) Pattern Reference: The TN of the pattern reference is the TN of the pattern to be used in voice coordination. If the pattern reference is actually a previously reported track or point, such as a Datum, then the pattern must be assigned a different TN and associated with the TN of the previously reported track or point. The pattern reference must be one of the following:

(a) Reference Sonobuoy (Kingpin).

(b) Pattern Center, for a circular or symmetrical pattern, that does not have a Kingpin.

(c) Pattern Reference Position for a non-symmetrical pattern or a geographic offset position.

(7) Set and Drift: Reported as a course and speed for the pattern, if applicable.

NOTE: Although sonobuoy patterns cannot be forwarded to Link 11/11B, the Pattern Reference (paragraph 5.7.7.2b(6)) may be forwarded to Link 11/11B. All other information regarding a sonobuoy pattern is to be reported by voice, if applicable.

5.7.8 Subsurface Track/Point Termination

5.7.8.1 Drop Track Report. The Drop Track Report is used by an R^2 IU to report that it has dropped or ceased to report a Subsurface Track, Passive Contact, or USW Point. Points that are dropped by a Drop Track Report can still be reported by other C2 IUs that hold locally derived data and are eligible to assume R^2. However, no other IU can assume R^2 for a Subsurface Track or Passive Contact that is dropped. The USWC should direct the dropping of points that he deems are no longer needed.

5.7.8.2 Subsurface Track and Point Purging

a. Some C2 IUs automatically purge remote Subsurface Tracks after a specified time interval has elapsed without receipt of an update. However, this automatic purge may be overridden by operator action to prevent purging a specific TN. Some C2 IUs also override the automatic purge if a track meets predefined criteria; e.g., under engagement.

b. Passive contacts and USW points can only be purged by operator action.

5.7.9 USW Weapons Coordination. The interface should be used to coordinate USW engagements as described in paragraph 5.11. However, because the interface weapons coordination capabilities were designed primarily to support the Anti-Air Warfare Commander (AAWC) and Anti-Surface Warfare Commander (ASUWC), certain procedural clarifications and interpretation are necessary for USW operations. These are specified below.

5.7.9.1 USW Commands. All commands listed in paragraph 5.11.1 may be used in USW operations, by specifying a subsurface track as the target. Only the USWC or designated command authority shall issue USW Commands. Interpretation of the USW Weapon Type ordered is as follows:

a. “Any/All”: USW weapon to be used is at the discretion of the addressed IU.

b. “Aircraft”: Any fixed-wing USW aircraft or USW helicopter under control of the addressed IU is to be used to conduct the attack, unless a specific Friendly Weapon TN is ordered. The weapon type to be used by the aircraft is at the discretion of the controlling IU and aircraft. The weapon type “Aircraft” shall not be used in an USW Command addressed to an USW aircraft; one of the other three weapon types listed must be specified in that case. However, if an USW aircraft receives an USW Command specifying weapon type “Aircraft,” it may use any USW weapon at its discretion. To order an engagement of a surfaced submarine by a non-USW aircraft, that aircraft must be specified as Friendly Weapon TN.

c. “Missile”: Missile Delivered USW Weapon is to be used. Specific USW missile type to be used is at the discretion of the Addressed IU.

d. “Conventional”: Torpedoes or depth bombs (non-nuclear), including Anti-submarine Rocket-launched weapons, are to be used. Guns may be used if the target is surfaced.

5.7.9.2 USW Engagement Status. All Engagement Statuses, except Tracking, and procedures in paragraph 5.11.3 are applicable and shall be reported for USW engagements. The USW weapon system used; i.e., fixed-wing USW aircraft, USW helicopter, USW missile, or torpedo should also be reported for clarity.

5.7.9.3 USW Aircraft Control and Handover. The control of USW aircraft, including USW helicopters, shall be reported on the interface as specified in paragraph 5.11.5. Digital handover of USW aircraft control is accomplished as specified in paragraph 5.11.6

5.7.10 USW Platform and System Status. Paragraph 5.4 specifies all platform and system information that IUs report about themselves. Controlling units of USW aircraft report a very limited amount of status information on those aircraft, using the procedures in paragraph 5.11.5.1. The following distinctions between USW and other platform and system status should be noted:

a. Although ships report control of USW helicopters, they do not report any status information for them. They do, however, report whether embarked USW helicopters are Operational, Degraded, or Non-operational, and whether the helicopter deck is Ready, Foul, or Closed.

b. USW aircraft IUs can report their detailed weapon inventory and sensor capabilities via the interface.

c. The only USW aircraft status reported by controlling IUs is the aircraft Specific Type and time remaining on station. The time remaining on station indicates the time the USW aircraft is scheduled to depart its assigned patrol or screen station. It does not indicate the aircraft's fuel status. This information is only received by other USW aircraft and aircraft carriers. Model 4 aircraft carriers report such information that is available in the CV USW Module (USWM) for S-3 aircraft under their operational control. However, this CV reporting capability is discontinued in Model 5.

5.7.11 Special Considerations for Operations with Subsurface IUs

a. The Combat Control System (CCS) MK-1 provides USN submarines with a Link 11 capability. The onboard Data Link Communications System (DLCS) allows two-way link operations on UHF and HF frequencies. The submarine Link 11 system is called the Submarine Tactical Data Link (STDL) and it provides a significant improvement to the submarine's Over-the-Horizon

Detection Classification and Targeting (OTH-DCT) capability. Submarine Link 11 is installed in all SSN-688 class and later submarines. Submarines will also be equipped with Link 16.

b. Two basic scenarios exist for employment of the submarine Link 11 system. These are:

(1) An independent link established between a targeting aircraft and a submarine. The aircraft acts as the DNCS and FTC. The submarine monitors the link in radio silence. Gridlock is performed by having the aircraft locate the submarine and send its track symbol on the net for 5 to 10 minutes. The submarine can use slot buoys to report when link reception is satisfactory and gridlock has been performed.

(2) Submarine linking with multiple units, such as a Battle Group. The submarine receives targeting data over the Battle Group Link 11. The submarine monitors the Battle Group Link 11 in radio silence. The submarine can remain covert and has the flexibility to enter and leave the net as the tactical situation dictates.

c. When a submarine Link 11 submarine is present, one surface or air PU must be designated as the DLRP Transmit Unit. When the PU enables DLRP transmission, it automatically transmits DLRP periodically and whenever it is changed. This enables the submarine to maintain DLRP for proper track plotting.

d. Submarine Command and Control must be accomplished by message traffic or voice communications. Tasking for cruise missile attacks is conducted using voice and/or message formats. Submarine operations dictate that the submarine not be required to transmit or spend excessive time at communications depth. Use established submarine communications procedures to deliver critical C2 related information. It is the only effective way to ensure message delivery to the submarine. The submarine can be prompted to enter the submarine Link 11 link or establish communications using acoustic call-up systems or the submarine broadcast.

e. The primary use for submarine Link 11 is ASUW, but the system also lends itself to application in USW operations. For USW, submarine Link 11 can be used to obtain locating data on HOSTILE submarines to assist the submarine in gaining contact. Because the submarine can copy HF link off the floating wire antenna, it may be able to conduct USW searches concurrently with copying the link.

f. Basic submarine operations mandate that the submarine operates submarine Link 11 in radio silence. However, the submarine may be required to enter the link briefly to transmit its own position, the position or AOP of a contact held by the submarine, a NOTACK area, its missile inventory, or the status of a missile or torpedo engagement.

g. The principal limitation with submarine Link 11 operations is navigational accuracy. The submarine maintains an accurate geographic plot of its own location. The submarine must plot all tracks relative to DLRP as do all PUs. If gridlock results in accurate relative but not accurate geodetic reporting, submarine OTH-DCT operations are degraded.

h. A second limitation of submarine Link 11 operations is the number of radio transceivers. The submarine is usually unable to copy more than one HF and one UHF circuit at a time. The Link 11/11B Manager should make every effort possible not to perturb link operations with a submarine while the link is established. In the future, submarines should be equipped with two UHF transceivers to alleviate this problem.

i. Despite the above limitations, submarine Link 11 provides a cruise missile capability to strike under a broad range of scenarios. This OTH-DCT capability combined with the covertness and survivability of the submarine, and its inherent USW capabilities, represents a significant upgrade to the ability of the USN to conduct ASUW and USW.

5.8 Electronic Warfare Operations

a. Link 11/11B and Link 16 support EW operations. The functions of EW, EA, ES, and EP depend on the capability of each link to exchange information between IUs. The capabilities of Link 11/11B are limited by data throughput, susceptibility to jamming, and the information available in the message standard. Link 16 has a distinct advantage in supporting EW with its ability to partition information exchange into functional NPGs.

b. Because the interface EW design utilizing Link 16 is revolutionary, the interface EW operational procedures in this document must be considered tentative and incomplete. It is expected that other procedures and refinements will evolve as experience is gained in Link 16 and inter-link EW operations. These will be incorporated into the JMTOP, as well as EW operational doctrine publications as they evolve. Therefore, this section only introduces the general concept of EW reporting and coordination that is anticipated in the interface EW design.

c. The term, "EWC," means the IU responsible for tactical coordination of EW operations.

d. Operators involved in combined operations are to note that there is a difference between US EW terminology and that used within NATO.

5.8.1 EW Reporting and Coordination Concept. The interface is designed to fully support the concepts of "cooperative EW" and "data fusion." The EWC must always be located in an EW Node. The general concept is as follows:

a. All C2 IUs with an ES capability report all ES intercepts onto the interface either on Link 11/11B or the Link 16 EW NPG. These reports are normally automatic reports of all parametric data held and require no operator intervention. Parametric data is the raw, unevaluated EW intercept parameters received from ES systems. Thus, all C2 IUs with an ES capability are considered EW Assets, and the interface can be viewed as a "shared EW database" of all electronic activity detected in the area.

b. Although all IUs on Link 11/11B and the Link 16 EW NPG will receive these reports, they are intended primarily for the further use of only certain designated EW Nodes. Therefore, EW Assets that are not designated EW Nodes should tailor their displays or insert reception filters to limit retention and display of unevaluated parametric EW data.

c. EW Nodes have special capabilities to automatically collect and analyze all similar ES data and develop EW products. EW products are normally AOP, Fixes, or Passive Tracks that are deemed to be of tactical significance to the force. A LOB may be an EW product if it is all that is available on a tactically significant intercept. EW products normally result from analysis by an automated system and must be confirmed through evaluation by qualified EW operators prior to release to the interface. When released by an operator, the product is reported on Link 11/11B and Link 16 Surveillance NPG.

d. EW data are segregated into parametric and product information and the Link 16 EW NPG is segregated from the Surveillance NPG to allow IUs not participating in EW operations to be aware of tactically significant results of EW operations without having to deal with large quantities of parametric data.

e. The EWC controls the above information exchange by the use of EW Orders on Link 11/11B and the Link 16 EW NPG. These enable selective designation of C2 IUs to report particular intercepts while directing others to withhold their reports. EWC controls provide a means for requesting

evaluation by selected C2 IUs, directing ES searches, mandating force evaluations, associating multiple reported intercepts, etc.

f. EW Nodes must be designated as such, this information may be disseminated to network participants in the OPTASK LINK GENTEXT/REPORTING INSTRUCTIONS set. It is highly desirable, but not essential, that EW Nodes operate as C2 JUs or CIUs to the maximum extent possible. All C2 IUs with an ES capability are automatically considered as EW Assets, and need not be so designated. Aircraft that report ES or EA information to their controlling IU, either via link or voice, are considered EW Assets of the controlling IU.

g. The term EW IU as used herein refers to any EW Asset participating on the interface, including those designated as EW Nodes.

5.8.1.1 Special Processing of EW Data. The SPI is used to indicate the security processing status of LOBs, AOPs, Fixes, and EW tracks reported on the interface. The decision to require special handling is made at the discretion of the reporting unit, IAW national requirements and independent of the setting of the SPI in contributing LOBs, AOPs, or Fixes. However, if all contributions contain SPI, the AOP, Fix or EW track shall be reported with SPI and handled IAW paragraph 5.5.2.6.

5.8.2 EW Information Exchanged. Table 5-5 lists all EW information that can be exchanged via the interface. Most of the individual data elements are defined in EW operational doctrine.

5.8.2.1 EW Source and Data Type. All EW data reported on the interface is categorized by source and type, as follows:

a. EW Source:

(1) ES: Intercepts obtained by passive ES equipment.

(2) EA: Detection of active jamming of radars, communications, or other electronic equipment. Detection of a jammer on ES equipment is categorized as ES, not EA. IUs do not report on the interface that they are conducting jamming.

(3) Radio Direction Finding (RDF): Detection of communications signals by special direction finding equipment, such as Outboard and Combat DF.

(4) Other (Link 16 only): Other passive intercepts not considered ES or RDF, such as Infrared and Low Light Level TV (LLLTV).

b. EW Data Type:

(1) LOB: Each LOB, including Jam Strobes, determined by the above means is reported on the interface with its own TN.

Table 5-5. Interface EW Information Exchange

EW Product Data	Additional EW Parametric (Only) Data[2]
Track Number	Threat Evaluation
Time of Intercept	Nationality/Alliance[1]
Data Source (ES, EA, RDF, Other[1])	Specific Type[1]
Data Type (LOB, Fix, AOP, Track[1])	EW Local Discrete Identifier (ELDI)[1]
Bearing, Position, or Area	Agile Emitter[1]
Bearing Accuracy	Lock-on
Course and Speed ([1]for fixes)	Parameter Source (Measured or Library)[1]
Category	Modulation Code[1]
ID[1]	Broad Classification
Emitter Number	Amplifying Characteristics
Emitter Evaluation Confidence	Pulse Repetition Frequency (PRF)
Platform	Pulse Width
Platform Evaluation Confidence	Jitter
Platform Number	Scan Type
Frequency	Antenna Scan Rate/Period
Wartime Reserve Mode Indication[1]	Polarization
	Jammer Received Signal Level (JRSL)
[1] Link 16 only	
[2] Parametric reports also include any of the above product data that has been determined.	

(2) Fix: A fix results from the crossing of two or more LOBs that the operator or system deem to originate from the same emitter or different emitters in the same platform. Sequential fixes may result in an estimate of course and speed (Link 16 only) of the platform. However, fixes have no TQ and the time the fix was determined is always reported. A fix is automatically

assigned a different TN than any of the LOBs used to develop the fix. However, a fix resulting from an AOP, or vice versa, retains the same TN. Moving fixes are reported on and forwarded to Link 11/11B as sequential stationary fixes.

(3) AOP: An AOP is an area in which there is a 95 percent probability that a particular emitter or platform of interest is located. An AOP can be developed from two or more LOBs, analysis of fix data, or other organic or non-organic data. An AOP can only be reported on the interface as a circle, ellipse, square, or rectangle that is often just an approximation of the actual AOP determined based on the accuracy of crossed bearings. The course and speed, TQ, time, and TN properties of a fix apply equally to an AOP, except that AOP course and speed can also be reported on Link 11/11B.

(4) EW Track: (Link 16 only) Link 16 also allows the reporting of an EW Track, i.e., a fix or AOP for which position, course, and speed have been determined accurately enough that it is considered equivalent to a vehicular NRT. However, the information reported for an EW Track is the same as a moving EW fix or AOP. Also, when course and speed of a fix or AOP are determined accurately, and it is not important to continue reporting the EW information about the fix or AOP, a passive vehicular Air, Surface, Subsurface or Land Track should be reported. The AOP area is used by the TDS to automatically determine a TQ for the passive vehicular track. Furthermore, EW Tracks cannot be reported on or forwarded to Link 11/11B, but a fix, AOP, or vehicular track can be reported on and forwarded to Link 11/11B.

5.8.2.2 Emitter Numbers

a. An “evaluated” EW product has an assigned emitter number (EN). An EN is a five-digit octal number 00001 through 17777_8 that conveys the general environment, ID, threat level, and function of the reported emitter. The NEDB is currently the master list used to report ENs via the interface. Although various other lists of emitters exist and are used operationally; e.g., the ELINT Parameter Limits (EPL) List, it is imperative that only ENs from the NEDB be reported on the interface. The NEDB includes a cross-reference between ENs and EPL ELINT Notation. Most EW IUs incorporate the NEDB into their TDS or other EW database, to enable automated comparison of parameters and evaluation of local detections and remote reports.

b. Any form of number other than the NEDB ENs will be misinterpreted if reported on the interface. It is possible to define other lists to be used on Link 16, by defining new Emitter Number Indicators (ENI). However, new ENIs must be approved well in advance and implemented by all EW JUs in an interface before operational use and cannot be used on Link 11/11B.

c. When the NEDB does not suffice for proper emitter identification, and no other ENI has been approved and implemented, the ELDI capability described in paragraph 5.8.2.4 provides an alternative method of identifying emitters.

5.8.2.3 Platform Number. An EW Platform Number (PN) is a five-digit octal number 20000_8 through 37777_8 that specifically identifies the platform in which a reported emitter is located or represented by a fix or AOP. A LOB, fix, or AOP may have both an EN and a PN. However, there is currently no standard list of PNs. The ELDI capability described below provides an alternative method of identifying emitter platforms on Link 16.

5.8.2.4 ELDI (Link 16 Only)

a. ELDIs are decimal numbers 1 through 4094 that may be defined for any desired EW purpose(s). Their meanings should be determined by the EWC prior to any operation and promulgated in the OPTASK EW or EW section of the OPORD (may be included in the OPTASK LINK GENTEXT/REPORTING REQUIREMENTS). ELDIs can significantly extend the flexibility of EW reporting, but only among Link 16 EW NPG participants. Some examples of potential uses for ELDIs include, but are by no means limited to:

(1) Additional ENs not included in the NEDB that are expected based on the Electronic Order of Battle (EOB) or alternative EN lists other than the NEDB.

(2) Emitter platform identifiers, in lieu of a standard PN list.

(3) Hull-to-Emitter Correlation (HULTEC) lists.

(4) Other emitter amplifying information not otherwise reportable via the interface.

b. The 4094 ELDI numbers can be allocated for multiple uses; e.g., the block 1 through 999 might be allocated to additional ENs and the block 1000 through 1999 used for HULTEC. However, each reported intercept can have only one ELDI. The last ELDI reported for an intercept automatically replaces any previously reported ELDI.

c. The following must also be considered in developing ELDI lists:

(1) The ELDI is reported only in the parametric report of an intercept and is, therefore, known only to EW IUs. Thus, it cannot be used to provide an EN for an EW Product.

(2) ELDIs are not forwarded to Link 11/11B.

(3) ELDIs are displayed only as a number requiring operator lookup of the meaning. Thus, ELDI lists should be kept as short as feasible and ordered alphabetically or in a logical sequence.

5.8.2.5 Platform and Platform Evaluation Confidence (PEC). The broad platform type of an intercept can be reported as Space, Air, Surface, Subsurface, Land, Missile, or Missile Control Unit. For RDF intercepts only, the operator's confidence that the platform type is as evaluated and reported can also be reported as PEC.

5.8.2.6 Emitter Evaluation Confidence (EEC). For other than RDF intercepts, EEC is automatically derived by the EW system evaluation of a set of emitter parameters. EEC reports the confidence that the reported EN is correct, based on the number of parameter matches. It may also be set by operator action when the EN is determined or validated by the operator.

5.8.3 EW Reporting Responsibility. Except for EW tracks, there is no R^2 scheme for EW reporting. Each EW IU reports all information held on an emitter even though it is known or believed to be the same emitter reported by another IU. This is necessary to develop EW AOPs and fixes, or passive tracks, from LOB triangulation. The EWC can limit EW reporting using certain EW orders described in paragraph 5.8.7. EW reporting can also be moderated by use of the following capabilities as appropriate.

5.8.3.1 EW Reporting Mode

a. Most EW IUs are capable of operating in either the Parametric or Product mode of EW LOB reporting, as well as in an automatic or manual sub-mode of the Parametric mode. These capabilities are described below:

(1) Parametric Mode.

(a) Automatic: All EW intercepts are reported automatically as LOBs.

(b) Manual: EW LOBs are reported only when released by an operator. This does not imply the intercept has been evaluated or is a Product.

(c) In either of the above modes, an operator can also designate an LOB as a Product; i.e., evaluated as tactically significant. When this is done, the intercept is reported on both the Surveillance and EW NPGs of Link 16.

(2) Product Mode. EW LOBs are reported only when designated by operator as a product. This mode is normally limited to essentially autonomous, not cooperative, EW operations. However, it may also be appropriate for an EW Node to operate in the Product Mode.

b. The above modes apply only to EW LOBs. EW fixes, AOPs and Passive Tracks must always be manually initiated. Manual initiation of an EW Fix or AOP does not automatically designate it as a product; a separate operator action is required to designate any LOB, Fix, or AOP as a Product. However, initiation of a passive track automatically initiates the vehicular track on the Link 16 Surveillance NPG, as well as Link 11/11B, regardless of the EW reporting or forwarding mode in effect.

c. It is not necessary or intended that all EW IUs operate in the same EW reporting mode. Normally, most EW Assets should operate in the Automatic Parametric mode, while EW Nodes operate in either the Manual Parametric or Product mode. However, when many EW Assets are participating in an interface, it may be advisable that most of them operate in the Manual Parametric mode. The EWC should designate the EW reporting mode for each EW IU participating on the interface. This information may be disseminated to network participants in the OPTASK LINK GENTEXT/REPORTING INSTRUCTIONS set initially and changed via voice or OPTASK LINK changes, as appropriate. The Automatic Parametric mode is the default mode of each EW IU unless otherwise designated.

5.8.3.2 <u>EW Data Forwarding (EWDF) Mode</u>

a. There is a significant potential for overloading Link 11/11B with forwarded EW data in a dense EW environment. Furthermore, it may be desirable that EW data originated on Link 11/11B only be forwarded onto the EW NPG to ensure that only evaluated EW product data are transmitted on the Surveillance NPG. Therefore, FJUs have two different modes for forwarding EW data for each direction of forwarding. These are the Limited and Full EWDF modes, as follows:

(1) Link 16 to Link 11/11B (EWDFA):

(a) Limited Mode: Only Product data are forwarded.

(b) "Full EW" Mode: All EW data are forwarded. However, the FJU combines Parametric and Product data for the same TN into a single report for forwarding.

(2) Link 11/11B to Link 16 (EWDFJ):

(a) Limited Mode: All EW data from Link 11/11B are forwarded, but only onto the EW NPG, and are therefore treated as parametric data. In this mode, all PU/RUs are considered EW Assets whose data are fused with other EW data and evaluated by C2 JUs designated as EW Nodes.

(b) "Full EW" Mode: EW data are forwarded redundantly onto both the Surveillance and EW NPGs, although some of the parametric EW data elements cannot be translated to EW Product messages.

b. It is not necessary that the FJU operate in the same EWDF mode in both directions of forwarding; e.g., the FJU may operate in the full EWDFA mode and the Parametric EWDFJ mode. The Full EW mode is the standard EWDF mode in both directions unless otherwise specified. If it is desired that either Limited EWDF mode be used, this must be specified in the OPTASK EW GENTEXT/REPORTING REQUIREMENTS set (This information may be disseminated to network participants in the OPTASK LINK GENTEXT/REPORTING INSTRUCTIONS set.). Changes to the EWDF mode after interface operations have begun may be specified by the EWC by voice coordination and/or a change to the OPTASK EW. Because the Limited (Product) EWDFA mode denies detailed EW Parametric information to PU/RUs, it should not be selected unless the platform in which the EWC is embarked, and any other platform designated as an EW Node, are expected to operate to the maximum extent possible as a C2 JU or CIU.

5.8.4 EW Information Management

5.8.4.1 EW Information Difference Resolution

a. The Environment and Identity difference resolution procedures in paragraphs 5.10.3 and 5.10.4 apply to EW Products reported on the interface. Any EW IU may report an Environment difference and/or ID difference for an

EW Product LOB, AOP, or Fix reported by another IU. On Link 11 EW Product Environment and Identity Differences can only be resolved by voice.

b. The Environment and ID difference resolution procedures in paragraphs 5.10.3 and 5.10.4 do not apply to EW Parametric information. EW IUs holding the same emitter as reported by another IU but holding different parametric information should do one of the following:

(1) Report their intercept using a different TN if it is an LOB not already being reported by own IU, or

(2) Originate an Emitter Evaluation report on the other IU's TN. This provides a recommended evaluation of all parameters held for consideration by the other IU and the EWC. (see paragraph 5.8.7.2)

c. EW IU operators do not always know whether an intercept is being reported as a Product or a Parametric report. When this is the case, the procedure in 5.8.4.1b above should be used to report a difference.

d. The Change Data Order (CDO) is not applicable to EW information. When the EWC desires to mandate an evaluation of a specific EW TN, he should use the Emitter Evaluation Report. This will cause all evaluated information about the TN in both Product and Parametric reports to be changed to that directed by the EWC.

5.8.5 EW Associations. There are several different methods of associating reported EW information with other reported EW information, and associating EW information with tracks. These are described below.

5.8.5.1 EW-to-EW Association. Associations between various reported EW information assist in organizing displays and databases and developing EW Products, Fixes and AOPs. Interface EW-to-EW associations are equivalent to voice EW “Correlation” reports. Most EW IUs have two operator selectable modes for EW-to-EW association. In the automatic (or system) mode, associations are determined by the TDS or EW system and transmitted on the interface automatically and not displayed to operators. In this mode, the associations are intended only to assist in internal system “bookkeeping,” particularly by EW Nodes. In the manual (or operator) mode, associations are determined by and displayed to EW operators, although the associations may be based on recommendations made automatically by the TDS or EW system. The EW association mode to be used is an individual IU decision not requiring coordination with the EWC or other EW IUs. All EW IUs must be accept associations originated by the EWC; all other EW associations only constitute

recommendations. The meanings of EW-to-EW associations reported on the interface are described below.

5.8.5.1.1 Parameter Association. The associated TNs have similar parameters, and the detected emissions are deemed to originate from the same emitter. Normally, used to indicate that two or more LOBs should have been used for triangulation to fix the position of an emitter. May also be used to indicate that two or more fixes or AOPs represent the same emitter. In the latter case, the EWC should direct that all but one of the reporting IUs cease reporting and/or drop the fix or AOP.

5.8.5.1.2 Emitter Association. The associated TNs have dissimilar parameters but are deemed to be collocated; i.e., they are emanating from two different emitters in the same platform. Normally used to indicate that two or more LOBs should be or have been used for triangulation to fix the position of a platform. They may also be used to report that two or more fixes or AOPs representing different emitters represent the same platform.

5.8.5.1.3 Intercept-to-Emitter Association (Link 16 Only). Associates an intercept (LOB) with a separately reported fix, AOP, or passive vehicular track representing an emitter. These associates and the "Emitter-to-Platform Associations" described below are used in automated association and schemes employed by some ESM systems. They are normally exchanged automatically without operator involvement. They are reported on or forwarded to Link 11/11B only as general data associations (see paragraph 5.10.10).

5.8.5.1.4 Emitter-to-Platform Association (Link 16 Only). Associates an emitter (LOB, fix, or AOP) with a separate reported platform (fix, AOP, or passive vehicular track) in which the emitter is deemed to be located. They are normally exchanged automatically without operator involvement. They are reported on or forwarded to Link 11/11B only as general data associations (see paragraph 5.10.10).

5.8.5.1.5 Disassociation. Disassociates a TN from all associations in which it was involved.

5.8.5.2 EW-to-Surveillance Associations. The general data association capability described in paragraph 5.10.10 may also be used to associate EW information with an active surveillance track. Such associations are only originated by operator action. Unless the EW information is deemed to provide tactically significant additional information about the track, it should normally be dropped from the interface shortly after the association is made, because an active radar track is always preferable to passive information.

5.8.6 EW System Status Reporting (Link 16 Only). C2 JUs can report the status of their EW equipment on Link 16, as described in paragraph 5.4.3.b. A C2 JU that does not hold current EW system status data on a C2 JU and desires such information can request it by initiating a Data Update Request by Request Indicator (DURRI) addressed to the C2 JU with the weapon status RI set. To obtain an EW system status update for all or a large number of C2 JUs, the DURRI should be addressed to the collective address.

5.8.7 EW Coordination and Control

a. The interface EW Orders are designed to allow full coordination and control of all EW actions without requiring voice coordination. Table 5-6 provides the equivalence of interface EW Orders and Voice brevity codes. The meanings of, and procedures for originating and responding to, each of the EW Orders used to coordinate interface EW operations are provided in this section.

b. Several of the EW Orders are not necessarily limited to EW operations and EW IUs. These are Evaluate Jamming, Frequency Protection Orders (Protect/Guard/Taboo), and Set EMCON. However, it must be recognized that these orders transmitted on the interface are only received by EW IUs and; therefore, may require voice coordination with other units. Furthermore, the Frequency Protection and EMCON orders can only be originated and received by C2 JUs.

5.8.7.1 Responses to EW Orders

a. C2 JU operators receiving EW Orders are required to respond with a WILCO or CANTCO to any EW Order specifically addressed to their IU. However, PU/RU operators only respond if they cannot comply (CANTCO).

b. EW reports made specifically in response to an EW Order are automatically identified as such. The operator originating the EW Order is automatically alerted when it has been complied with, or if it has not been complied with after a reasonable length of time.

c. If an operator WILCOs an EW Order requiring subsequent EW reports and contact is subsequently lost or a search yields negative results, the operator shall initiate a No Find response to the order. Orders for which a No Find response is appropriate are Periodic Report Request, Evaluation Request, Directed Search and Evaluate Jamming, and Direction Finder Requests. The interface No Find report is equivalent to a voice “Ceased,” “Negative Report,” or “Negative Trout” report.

d. (Link 16 only) A C2 JU originating an EW Order can assign a Task Priority. This indicates the relative importance of the order to other EW Orders and EW tasks currently being acted upon by the receiving C2 JU(s). Operator action should be taken on EW Orders in the order indicated by the Task Priority, not necessarily the order in which received. The task priorities are:

(1) First Priority/Critical.

(2) Second Priority/Urgent.

(3) Third Priority.

(4) Not-to-Interfere Basis.

Table 5-6. Relationship of Interface EW Orders and Voice Brevity Words

Links 11/11B, and Link 16	Voice
PERIODIC REPORT REQUEST	RENT, REVERT, OR WATCH
EVALUATION REQUEST	EVALUATE RACKET
DIRECTED SEARCH REQUEST	ESM GUARD, INTERCEPT GUARD, SWITCH, OR FORD
CEASE REPORTING	CEASE REPORTING OR DUAL RACKET REPORT
EVALUATE JAMMING	INTERROGATIVE CLIFF
Link 16 Only	Voice
PARAMETRIC DATA UPDATE REQUEST	ACTIVE RACKET SITREP REQUEST
DIRECTION FINDER REQUEST	TROUT
PROTECT	PROTECT
GUARD	GUARD
TABOO	TABOO
JAMMING REQUEST	CANYON
DEPLOY DECOYS	CURVE
SET EMCON	SET EMCON

e. Most EW IU systems automatically keep track of their own EW Orders issued and responses thereto. The issuing operator is alerted when no response is received within a certain length of time.

5.8.7.2 Emitter Evaluations. Paragraph 5.8.7.3.2c provides the procedures for reporting an Emitter Evaluation in response to an Evaluation Request. An Emitter Evaluation may also be originated without a request at any time by any EW IU to provide an evaluation of an existing TN reported by another IU. When the Emitter Evaluation is originated by the EWC, it constitutes an order for all EW IUs to accept the evaluation for the TN. When originated by other than the EWC, it constitutes a recommendation to the EWC and the reporting IU.

5.8.7.3 EW Orders. All of the interface EW Orders are defined and procedures for their use are specified in this section. The EW Orders that are equally applicable to Link 11/11B and Link 16 are listed first, followed by EW Orders unique to Link 16.

5.8.7.3.1 Periodic Report Request. This EW Order directs the addressee to report the specified TN at specified intervals and/or upon tactically significant changes. It shall only be originated by the EWC and must be addressed to the EW IU currently reporting the TN. Procedures for originating and responding to a Periodic Report Request are as follows:

a. The reporting interval shall be specified as one of the following.

(1) 1, 5, 15, or 60 minutes - reports are made only at the specified interval, unless changes occur that are deemed by the operator to be tactically significant.

(2) Update and watch - a single report is made, then reports are to be made only when changes occur that are deemed by the operator to be tactically significant.

(3) Once - a single report is made, then the IU shall cease reporting the TN.

(4) IAW normal transmit rules - reports are made automatically when predetermined tactically significant data changes occur, when changes occur that are deemed by the operator to be tactically significant, or approximately every 48 seconds, whichever is less.

b. Except for tactically significant change reports initiated by an operator, the addressee's TDS automatically complies with the specified interval after the order is WILCOed.

c. The Periodic Report Request must be addressed to the EW IU that is currently reporting the specified TN, therefore, this order is only necessary

when the EWC desires to increase the normal reporting interval or set a watch. However, it is also useful anytime as a confirmation that the EWC desires continued reporting of the TN by the addressee. For a Fix or AOP, this order is normally used only to increase the reporting interval. For LOBs, it is normally used in conjunction with the Cease Report order to other EW IUs, typically in the following situations:

(1) It is desired to limit the number of IUs reporting LOBs on the same intercept. For example, if several IUs are reporting what is evaluated to be the same emitter, the EWC might direct the three IUs with the most accurate or reliable ESM capability to continue reporting to enable accurate triangulation of the emitter and direct the other IUs to cease reporting.

(2) It is desired that only one IU maintain a watch on a stationary emitter that is held by several IUs and whose location is commonly known to the force; i.e., triangulation is unnecessary. This is accomplished by specifying one of the above periodic intervals, or "Update and Watch," and directing all other IUs currently reporting the emitter to cease reporting.

5.8.7.3.2 Evaluation Request

a. This EW Order requests the addressed EW IU to independently evaluate a TN being reported by the originator or another EW IU or of a set of parameters included in the order. Any EW IU may originate it. It is typically used to increase the confidence in an evaluation, or to reduce or eliminate ambiguities prior to releasing an EW Product to the interface. When an evaluation request is sent to the EWC, it requests that the EWC direct a single force evaluation of the TN.

b. The receiving operator determines whether to make a manual operator evaluation or to request that his EW system perform an automatic evaluation. In the latter case, the operator shall validate the evaluation before it is transmitted.

c. The response to an Evaluation Request is a one-time Emitter Evaluation report initiated by the evaluating operator. Such a report must contain, as a minimum, the evaluated Emitter Number or Platform Number. It also automatically includes all other evaluation results. The Emitter Evaluation is automatically addressed to all EW IUs collectively. The interface Emitter Evaluation report is equivalent to a voice "Racket" report.

5.8.7.3.3 Directed Search Request

a. This EW Order establishes or modifies ES search assignments, or directs ES searches for a particular tactically significant emitter, platform, or track. It shall be originated by only the EWC and may be addressed to a specific EW IU or collectively to all EW IUs.

b. A Directed Search Request directs the addressee(s) to conduct a designated sector, area, or omni-directional ESM search for applicable combinations of the following:

(1) Frequency or frequency range.

(2) PRF (Link 16 only).

(3) Specific emitter by Emitter Number.

(4) Specific platform by Platform Number.

(5) Specific track by TN, including a previously reported EW LOB, Fix, or AOP, or a Surveillance Track.

(6) Known threats by Environment, Nationality, or ELDI (Link 16 only).

c. If only a sector or area is specified without any of the above, a general ES search in the designated sector or area is directed.

d. If a specific time is designated in the Directed Search Request, a coordinated search with one-time simultaneous reports from all detecting IUs at the specified time is requested for the purpose of obtaining cross bearings to develop or refine a fix or AOP.

e. If a time duration is specified, the search is only requested during that time period, commencing at the time specified, or immediately if no commencement time is specified.

f. The method of complying with a Directed Search Request is a function of ES system and TDS design. IUs with tunable or trainable ES equipment are expected to tune or train the equipment as necessary to concentrate their search as requested. In other IUs, the operator is expected to use the appropriate means to either cause the ES system to concentrate its search or to focus his attention as requested. An operator must not CANTCO a Directed

Search Request, because his system is unable to strictly comply with the request.

g. Any addressed EW IU gaining an intercept that meets the criteria of an existing Directed Search Request reports and updates the intercept IAW the existing EW reporting mode; i.e., either automatically or manually.

5.8.7.3.4 Cease Reporting. This EW Order directs the addressed EW IU to cease reporting an EW TN that it has been reporting. It shall be originated by the EWC only. It is used to eliminate interface reports of intercepts that the EWC deems invalid, redundant, no longer of interest, or unnecessary. The EWC should use this order aggressively to maintain a clear EW picture and reduce link loading, system processing and operator burden.

5.8.7.3.5 Evaluate Jamming

a. This EW Order requests the addressee to report if it is experiencing jamming. It may be originated by any EW IU and addressed to a specific IU or to all IUs collectively. The order requests evaluation of one of the following:

(1) An omni-directional general evaluation for any jamming.

(2) An evaluation for jamming from a specific track. A sector of the addressee's radar scope, centered on the track in which to look for jamming may also be included.

(3) A general evaluation for jamming within a specified sector of the addressee's radar scope.

b. Each of the above may also include:

(1) A time period during which to look for and report jamming.

(2) A specific jammer to search for, identified by Emitter Number.

(3) A frequency or frequency range and/or PRF to evaluate for jamming. If a communications frequency or frequency range is specified, an evaluation of jamming, deception, or intrusion on the applicable nets is requested, and sector shall not be specified.

c. The evaluate jamming requests, which include a sector, should normally not be sent to all IUs collectively, because the same sector will normally not apply equally to each IU's radar scope. However, such a request

may be sent if a representative sector is appropriate for all IUs; e.g., the sector 000-180 might be used to ask all IUs if they are being jammed from the east.

d. If jamming is detected that meets the criteria of the request and is not already being reported, the addressed IU(s) shall initiate jam strobe reporting on the interface. If deception or intrusion that is not reportable via the interface is detected, a voice report shall be made. If no jamming, deception, or intrusion is detected that meets the criteria of the request, the operator shall initiate a No Find report.

e. Detection of jamming, deception, and intrusion is not strictly an EW function. EW operators receiving an Evaluate Jamming request must coordinate with surveillance or radio operators to conduct the requested evaluation. IUs originating these reports must recognize that IUs not participating in interface EW operations will not receive the request.

5.8.7.3.6 Cancel Request. This EW Order is used to cancel a previous EW Order. It may be used to cancel any of the interface EW Orders described in the foregoing paragraphs or the Link 16 EW Orders described in the following paragraphs. An EW Order may be canceled only by the IU that originated the order and may be addressed to any or all of the addresses of the original order.

5.8.7.3.7 Parametric Data Update Request (Link 16 Only)

a. This EW Order allows any C2 JU to obtain an update of EW parametric data reported on the Link 16 EW NPG. Its use is generally limited to ensuring that a JU, normally an EW Node, that has just become active in the EW NPG, has a complete EW picture. For all other purposes, transmission of a DURRI by any C2 IU would be more appropriate. Furthermore, it must be recognized that a parametric DUR will only obtain EW data being reported by C2 JUs, but a DURRI will obtain all reported EW data.

b. Most EW parametric data is transmitted on the Link 16 EW NPG approximately every minute and need not be requested. The only data that is transmitted in response to a Parametric DUR is reported at a reduced frequency due to a Periodic Report Request and EW associations and Emitter Evaluations that are currently in effect.

c. A Parametric DUR should normally be addressed collectively to all C2 JUs, but it may be addressed to a specific C2 JU if appropriate. In either case, addressed JUs automatically respond with only the above indicated data that they have originated. Response to a Parametric DUR requires no operator

action, except that if the request is to a specific JU, that JU's operator is alerted and must WILCO the request before the data is transmitted.

5.8.7.3.8 Direction Finder Request (Link 16 Only)

a. This EW Order is used to obtain simultaneous cross-bearings to develop or refine a fix or AOP. It is normally originated by the EWC, but may be originated by any EW Node. It may be addressed to a specific set of appropriately equipped C2 JUs individually, or to all C2 JUs collectively. When addressed collectively, only appropriately equipped C2 JUs ("Duffers") are expected to respond.

b. The target of the Direction Finder Request is specified as one or both of the following:

(1) An existing TN, normally an emitter being reported in LOB, AOP, or Fix reports.

(2) A specific frequency or frequency range.

c. The Direction Finder Request is used only to request Direction Finder action on communications emitters, i.e., coordinated RDF, UHF Direction Finder (UHFDF), or HF Direction Finder (HFDF). The Directed Search Request is used to coordinate searches for other emitters.

d. The specific time to take the DF action must be specified. It should be sufficiently in the future to allow all addressed C2 JUs to make necessary preparations.

e. Appropriate operators in addressed C2 JUs must ensure that Direction Finding equipment is set up as necessary to detect the target TN or frequency, and make reports at the required time. In some C2 JUs, these reports are made automatically, but operator initiation may be required in others. Responses to Direction Finder Requests may require coordination with communications or intelligence personnel.

5.8.7.3.9 Frequency Protection Requests (Link 16 Only)

a. The three EW Orders, Protect, Guard, and Taboo direct the setting of varying degrees of protection against friendly interference to a specified frequency or frequency range as follows:

(1) Protect: Friendly frequencies used for a particular operation, that are identified and protected to prevent inadvertent jamming by friendly forces while active EW operations are directed against hostile forces. Jamming should be restricted on these critical frequencies unless absolutely necessary or until coordination with the using unit is made. They are generally time-oriented, may change with the tactical situation, and must be updated periodically.

(2) Guard: Enemy frequencies that are currently being exploited for combat information and intelligence. A guarded frequency is time-oriented because the list changes as the enemy assumes different combat postures. These frequencies may be jammed after the commander has weighed the potential operational gain against the loss of technical information.

(3) Taboo: Any friendly frequency of such importance that it must never be deliberately jammed or interfered with by friendly forces. Normally these include international distress, safety, and controller frequencies. However, they may be time-oriented because the restrictions may be removed as the combat or exercise situation changes.

b. Frequency Protection orders may be originated by any appropriate operational commander and addressed to a specific C2 JU or all C2 JUs collectively.

c. A time of commencement and/or duration of frequency protection also may be ordered. If no commencement time is ordered, protection is to commence as soon as possible. If a duration is ordered, the protection is to be lifted at the end of the specified duration. There is no Link 16 automated means to order lifting of frequency protection after it has been set but prior to its scheduled termination. However, a frequency protection order may be canceled prior to the scheduled commencement time by using the cancel request order.

d. The authority for use and the specific actions to be taken upon receipt of these orders are functions of EW doctrine and local procedures. An EW operator receiving a frequency protection order must notify the appropriate watch officer immediately. If the order is addressed specifically to own unit, the required operator response should not be sent until appropriate own unit authority has been notified and concurred unless the ordered commencement time or local procedures dictate an immediate response.

5.8.7.3.10 Jamming Request (Link 16 Only)

a. This EW Order directs a specific C2 JU to conduct jamming. This order is intended only to coordinate jamming for force protection, not individual unit self-protection. It may be originated by any appropriate operational commander and must be addressed to a specific C2 JU.

b. The jamming to be conducted may be specified in various ways as follows:

(1) TN: Jam the track or emitter currently being reported as TN.

(2) Bearing: Jam the specified bearing from the addressed unit (or in the sector if specified, or in the specific direction if an elevation angle is specified.).

(3) Position: Direct jamming at the specified position.

(4) Area: Jam the specified area.

(5) Emitter/Platform Number: Jam the specified emitter or platform.

(6) Frequency: Jam the specified frequency range.

(7) Known threats: Jam all threats of the specified Nationality, Environment, Platform, Activity, and/or Specific Type.

(8) ELDI: Jam the threat identified or otherwise indicated by the specified ELDI.

c. Combinations of the above may also be ordered in a single jamming request. They are to be interpreted together; e.g., if both a bearing and frequency are specified, jamming is to be conducted along the bearing against the specified frequency only.

d. A time of commencement and/or duration of jamming may also be ordered. If no commencement time is ordered, jamming is to commence as soon as possible.

e. Specific equipment or types of jamming to be used are not ordered via the interface. Voice must be used if that degree of ECM control is required.

Otherwise, the equipment and jamming type are at the discretion of the addressed C2 JU, as necessary to satisfy the order.

f. The Jamming Request can also direct the cessation of jamming currently being conducted at a specific time or immediately using the Automatic EA Negation capability set to "Break Engage." If the addressed C2 JU is conducting jamming in response to a previous request, that jamming is to cease. Otherwise, any jamming currently being conducted by the addressed C2 JU is to cease.

g. The Cancel Request Order should be used to cancel a Jamming Request prior to the ordered commencement time, or if it is known that requested jamming has not yet commenced.

5.8.7.3.11 Deploy Decoys (Link 16 Only)

a. This EW Order directs a C2 JU to deploy decoys of a specified type for a specified mission. This order is intended to coordinate decoy deployment for force protection, not individual unit self-protection. It may be originated by any appropriate operational commander and must be addressed to a specific C2 JU.

b. Decoy type must be specified as one of the following, as defined in EW doctrine:

(1) Active Electronic.

(2) Chaff.

(3) Infrared (IR).

(4) Electro-optic (EO).

(5) Corner Reflector.

c. Decoy mission may be specified as one of the following as defined in EW doctrine:

(1) Seduction.

(2) Confusion.

(3) Distraction.

d. The decoy deployment may be ordered as follows:

(1) A position or area in which decoys are to be deployed.

(2) A corridor or sector along or within which decoys are to be deployed, specified as a bearing line, with a sector width if a sector is specified.

(3) A frequency or frequency range to be decoyed.

e. A time of commencement and/or duration of decoy deployment may also be ordered. If no commencement time is ordered, deployment is to commence as soon as possible. If a duration is ordered, decoys are to be deactivated at the end of the specified duration, if applicable.

f. The Deploy Decoys order can be used to direct the cessation of decoys currently being conducted, at a specific time or immediately, using the automatic EA Negation capability set to "Break Engage." If the addressed C2 JU has deployed decoys in response to a previous request, those decoys are to be deactivated, if applicable.

g. The Cancel Request Order should be used to Cancel a Deploy Decoys Order prior to the ordered commencement time, or if it is known that deployment has not yet commenced.

5.8.7.3.12 Set EMCON (Link 16 Only)

a. EMCON conditions may be set or modified via Link 16 by any appropriate operational commander and be received by C2 JUs only. Thus, force EMCON orders normally require transmission by other means to reach other friendly units. The EMCON order may be addressed to specific or all C2 JUs.

b. The Link 16 EMCON order allows specifying the EMCON condition by EMCON plan source and designator, as follows:

(1) Local/Promulgated by Force Commander, Plan Number 1-15: Identifies an EMCON plan specified in the OPORD or other directive promulgated for this operation. Example: "Set local EMCON Plan 5."

(2) Preplanned/Standing OPORD Plan A-O. Identifies an EMCON plan promulgated in the standing OPLAN or other EW doctrine. Example: "Set EMCON A."

c. If EMCON plan designations specified in appropriate directives do not conform to the above Link 16 designation system, then equating the EMCON plan and Link 16 EMCON plan designations must be specified in the OPTASK LINK GENTEXT/SPECIAL INSTRUCTIONS set.

d. An EMCON time of commencement and/or duration can be ordered. If no commencement time is ordered, EMCON is to be set immediately. If a duration is ordered, EMCON is to be lifted at the end of the specified duration. There is no Link 16 means to order lifting of EMCON after it has been set but prior to its scheduled termination. However, an EMCON order may be canceled prior to the scheduled commencement time by using the Cancel Request Order.

e. New EMCON plans or modifications can also be specified via Link 16 using the set EMCON order. The following EMCON plan parameters can be set or modified via Link 16:

(1) Plan source and designation.

(2) Plan modification.

(3) Time-sharing implementation.

(4) Radiation status indicator.

(5) Radiation restriction.

(6) Change radiation factor.

(7) Platform type.

(8) Circuit.

(9) Long-range navigation (LORAN) filter setting.

f. Setting EMCON requires actions by various personnel other than EW operators. An EW operator receiving an EMCON order must notify the appropriate watch officer immediately. If the order is addressed specifically to own unit, the required operator WILCO or CANTCO response should not be sent until appropriate own unit authority has been notified and concurred, unless the ordered commencement time or local procedures dictate an immediate response.

5.9 Intelligence Reporting. The interface provides the capability to exchange intelligence information concerning tracks that are being reported on the interface. Intelligence information can be initiated by sources with special intelligence collection capabilities; i.e., the information is derived by other than the normal data link means of radar, sonar, and ESM, and may not necessarily be available on the interface. The nature and capabilities of intelligence sources that contribute information to the interface vary greatly. Sources that transmit intelligence information on the interface include, in particular, Rivet Joint, E-3, Senior Scout, Senior Troupe, CARS (MSCS), and USN ships. This section describes the intelligence information exchanged and procedures for its use.

NOTE: Many systems use intelligence messages as a vehicle to report amplifying data and many non-intelligence platforms also send intelligence messages.

5.9.1 Intelligence Information Exchanged

a. Intelligence reports provide amplifying information about a track, known as the subject track, that is already being reported on the interface. Intelligence reporting is independent of R^2 for the subject track. The subject track may be a real-time, active track being reported by any C2 IU originating the intelligence information or another special source. Due to the nature of intelligence collection, the subject track is normally non-friendly and the intelligence information may contribute significantly to evaluating the subject track's ID.

b. Some of the reportable intelligence data elements are the same as contained in normal Surveillance Track reports described in paragraph 5.5.6. The intelligence information is not automatically accepted as force-evaluated information to replace the surveillance information. It must be viewed as one of various sources of information that is considered for inclusion in Surveillance Track reports for the subject track. It is only the intelligence source's estimation. Surveillance personnel must consider the reliability of the intelligence source and other factors in deciding whether to accept the intelligence information as the force evaluation.

c. Each reportable intelligence data element is described in the following paragraphs. Those indicated with an asterisk (*) are also reportable in Surveillance Track reports, as described in paragraph 5.5.6.

5.9.1.1 Environment:* The Intelligence and subject track Environment must be the same. If an intelligence source believes that an environment is different

from one currently reported on the interface, the appropriate operator must take action to resolve the Environment difference before any intelligence information can be reported by the IU for the subject track. This action may consist of changing the Environment if own IU has R^2, reporting an Environment difference if own IU does not have R^2, or advising the intelligence source that the operator does not concur with the intelligence estimation of Environment.

5.9.1.2 Platform:* The general type of platform of the subject track; e.g., Fighter, Cruiser, SAM Site, Attack Submarine.

5.9.1.3 Activity* and Activity Amplification:

a. The Activity is the subject track's overall current activity or primary mission.

b. Some sources are also capable of deriving and reporting more detailed information about a track's current specific activity. This includes each of the phases in a typical engagement sequence; e.g., Assigned to Destroy, Weapons Armed, or Weapons Released. This Activity Amplification is reportable only in Intelligence reports, but must be considered in evaluating the subject track's ID and Activity, as well as planning engagement actions.

c. Paragraph 4.4.6.5 defines additional adaptable Activity and Activity Amplification values to ensure that enemy activities likely to be encountered in a particular operation are reportable on the interface.

5.9.1.4 Specific Type:* The specific type of the subject track, (e.g., MIG-27, Kara Class CG, Hawk, SSN 1) is only reportable in intelligence reports on Link 11/11B, but is reportable in both surveillance and intelligence reports on Link 16.

5.9.1.5 NAT/ALL: The nationality (e.g., Iraq, North Korea) or Political Alliance (e.g., NATO, United Nations Force).

5.9.1.6 Operational Status: The subject track's operational status provides information about operational limitations, (e.g., Battle Damage, Ordnance Depleted, Low Fuel State) that should be considered in engagement decisions.

5.9.1.7 Target: The sources report of the TN, most likely a friendly track that is the target of the subject track, must be brought to command attention immediately, as it clearly affects engagement decision.

5.9.1.8 Controlling Unit: The sources report of the TN, most likely a non-friendly track, that is controlling the subject track, may affect engagement decisions as destruction of the controlling unit may reduce or eliminate the threat of the subject track.

5.9.1.9 Intelligence Local Discrete Identifiers (ILDIs)

a. ILDIs are decimal numbers, 1 through 4094 that may be defined for any desired intelligence reporting purpose(s), subject to the limitation that the intelligence information must be applicable to a specific track. Their meanings should be determined by intelligence planners prior to any operation and promulgated in the OPTASK LINK GENTEXT/INTELLIGENCE LOCAL DISCRETE IDENTIFIER (set 16) set and/or Intelligence section of the OPORD. ILDIs can significantly extend the flexibility of intelligence reporting. They allow tailoring intelligence reporting to unique or particularly important characteristics of the operation, area, enemy, etc.

b. The 4094 ILDI numbers can be allocated for multiple uses; e.g., block 1 through 50 might be allocated for additional targeting information, 51 through 100 for information about the subject track's point of origin. However, each subject track can have only one current ILDI, because each intelligence report can contain only one ILDI. The last ILDI reported for a track automatically replaces any ILDI previously reported for that track by any source.

5.9.2 Intelligence Information Security. Intelligence information does not automatically require special handling. The decision to require special handling is made by the source originating the information. Setting the SPI in intelligence reports indicates special handling. SPI intelligence reports are subject to the security filtering requirements specified in paragraph 4.4.3.2.6 and other SPI handling requirements in paragraph 5.5.2.6. The relationship between SPI intelligence information and the subject track is as follows:

a. Setting Force Tell or Emergency on the subject track will force SPI intelligence information for the track through a security filter.

b. Setting of SPI on intelligence information does not automatically impose the SPI requirements on the subject track.

c. When the TDS operator changes surveillance information on the subject track based on SPI intelligence information, the operator must determine whether the track becomes a SPI track.

5.9.3 Terminating Intelligence Information. There is no specific method of removing intelligence information from the interface. As long as the subject track is being reported, the last reported intelligence information remains effective, unless the originator of the information has reset each data element to No Statement (see paragraph 5.10.11). Intelligence information is automatically dropped when the subject track is dropped. Some C2 IUs have an operator capability to selectively purge intelligence information.

5.10 Information Management. The foregoing sections have specified the operational procedures for reporting IUs, tracks, acoustic and EW information, and intelligence. This section provides the management procedures for information reported via the interface. Procedures are specified for the following:

a. Resolution of Dual Designations.

b. Resolution of Duplicate TNs.

c. Resolution of Environment Conflicts.

d. Resolution of ID Differences.

e. Resolution of IFF/SIF Differences.

f. Resolution of Strength Differences.

g. Establishing Track Alerts.

h. Use of Pointers.

i. Data Update Requests.

j. Data Associations.

k. Resetting Erroneous Data.

5.10.1 Dual Designations

a. A dual designation exists when the same track or point is being reported using multiple TNs. Dual designation is normally the result of failure to properly correlate tracks as specified in paragraph 5.5.2.2.

NOTE: C2 IUs entering or reentering an interface shall ensure that all correlations have been accomplished prior to commencing track reporting. Other situations likely to lead to failure to correlate, and hence dual designations, are:

(1) C2 IUs participating with poor reception capability.

(2) Registration errors in unit position or radar alignment or an inability to remain in gridlock that causes an IU to not correlate own unit radar video with received tracks.

(3) Areas of high-track density or with tracks that are maneuvering.

(4) Tracks merging causing two or more TNs to follow one track.

(5) Use of automatic tracking radars or beacons.

(6) Data filters that block the receipt of another IU's track.

b. Dual designation is recognized automatically by some systems or by operator observation of two or more tracks having similar track data. Dual designations are the most common cause of track coordination problems. Although it is necessary to understand the resolution process of removing dual designations from the interface, it must be stressed that correcting the conditions that caused the dual designation is the first priority. The FTC/TDC will resolve the dual designation and determine its root cause. If implementation of the corrective measures is beyond his authority, he will recommend such corrective measures to the ICO.

5.10.1.1 Resolution of Dual Designations. There are two methods of resolving dual designations when detected. These are Voice Resolution and Link 16 Resolution. They are described below, and the criteria for their use explained. When there are any PUs or RUs in the interface, or any C2 JU that has not implemented the Link 16 Correlation message, only Voice Resolution shall be used.

a. Voice Resolution (also referred to as Manual Resolution): Voice Resolution of dual designations is necessary whenever the Link 16 Resolution capability cannot be used. Also, Voice Resolution must be used for remote-to-remote dual designations; i.e., when the IU recognizing the dual designation does not hold locally derived data on either track. The Voice Resolution procedures are specified below and summarized in Table 5-7.

(1) If the C2 IU recognizing a dual designation has R^2 for one of the tracks and does not hold an OCC for that track or a correlation restriction (see paragraphs 5.5.2.2.2 and 5.5.2.2.1, respectively), it may drop that track and make the remote track local. That action should resolve the dual designation without voice coordination. However, other IUs do not know that the track was dropped due to a dual designation and, thus, do not know to combine its data with the retained TN. Therefore, the IU should consider Voice Resolution of the dual designation in the same manner as specified in the following steps.

Table 5-7. Voice Resolution of Dual Designation

Step	Action
1	Any C2 IU: Upon recognizing a dual designation, advise the FTC/TDC.
2	FTC/TDC: Request that a specific TN be dropped.
3	All C2 IUs: (1) If the specified TN has an OCC or correlation restriction, inform FTC/TDC immediately. (2) If no OCC or correlation restriction is held for the TN, take actions to drop reported TN. Additional voice reports are not required.
4	FTC/TDC: If any C2 IU reports that it is unable to drop the requested TN, request all other IUs drop the other TN.
5	All C2 IUs (still holding the first TN): Repeat step 3.
6	FTC/TDC: If any C2 IU reports unable to drop TN as a result of step 3, inform all IUs that the dual designation condition exists and will be resolved upon termination of OCC or Correlation Restriction that would not allow for immediate resolution.

(2) C2 IU recognizes dual designations.

(a) If the C2 IU recognizing a dual designation does not have R^2 for either track, he shall advise the FTC/TDC by voice.

(b) If the C2 IU recognizing a dual designation holds an OCC or correlation restriction for the track for which it has R^2, he shall advise the FTC/TDC by voice and should recommend that the other TN be dropped.

(3) The FTC/TDC shall request all IUs to drop one of the TNs based on any OCCs held by the FTC/TDC. If the FTC/TDC holds a correlation restriction, he will advise the C2 IU reporting the dual designation that it cannot be resolved.

(4) All C2 IUs shall determine if the specified TN has an OCC, or if the two tracks have a correlation restriction. If so, the FTC/TDC shall be informed immediately. If not, take action to drop the TN.

(5) If any C2 IU reports an OCC, the FTC/TDC shall request all IUs to drop the other TN, unless the FTC/TDC holds an OCC for it, and step 4 shall be repeated.

(6) If the correlation cannot be completed due to a correlation restriction or OCCs on both TNs, the FTC/TDC shall inform all IUs that the dual designation cannot be resolved until the restriction or OCC no longer applies.

b. Link 16 or Automatic Resolution:

(1) Link 16 Resolution is accomplished using a Correlation message that is transmitted and received only on Link 16. The first C2 JU to detect a dual designation automatically transmits the message to all other C2 JUs participating on the Surveillance NPG. The Correlation message is always a recommendation, not an order, regardless of the source. It recommends the TN to be retained (TN-1) and the TN to be dropped (TN-2) and indicates whether a reverse correlation (reversal of TN-1 and TN-2) is acceptable. The determination of TN-1 and TN-2, and whether a reverse correlation is acceptable, are automatic system functions that are performed without operator intervention.

(2) Depending on system design and mode of operation, the system either automatically transmits the correlation message or presents a recommendation to the operator. In the latter case, the system either awaits

operator action or transmits the message if the operator does not override the recommendation in a reasonable length of time. Systems utilize the correlation restrictions and OCCs in paragraphs 5.5.2.2.1 and 5.5.2.2.2 to make these recommendations. They should also be used by operators in assessing system recommendations when in the manual or manual override mode.

(3) The FTC/TDC must ascertain if any C2 JUs have not implemented the Correlation message, or if track data are being forwarded between Link 16 and Link 11/11B. If either condition exists, the FTC/TDC shall direct all C2 JUs to inhibit Link 16 resolution and use only Voice Resolution.

5.10.1.2 Action Upon Reception of a Correlation Request

a. Systems that receive the Link 16 Correlation message automatically, process the request to determine if it should be accepted, rejected, or reversed. The correlation is accepted and executed automatically unless the conditions for rejection or reversal specified in paragraph 5.10.1.2.d below exist. The system acts without prompting, only alerting the operator when operator action is required.

b. Systems that do not implement the Link 16 Correlation message, may provide some degree of assistance to the operator when the operator indicates a voice request for correlation has been received, depending on system design. However, the operator must respond by voice to reject or reverse a correlation request. Therefore, the following procedures prescribe IU actions that may be performed automatically in some IUs, but manually in others.

c. Upon receipt of a Link 16 or voice correlation request, the receiving IU has three options:

(1) Accept the correlation.

(2) Reject the correlation.

(3) Propose a reverse correlation.

d. The correlation is rejected if any of the restrictions in paragraph 5.5.2.2.1 applies, or own IU does not agree that the two tracks correlate, or own IU correlates one of the TNs to a different TN. In the latter case the IU shall report the new correlation. In the event there is an OCC on TN-2 as specified in paragraph 5.5.2.2.2, but a reverse correlation is acceptable, the IU should propose a reverse correlation as opposed to rejecting the correlation

request. A reverse correlation is a response to the correlation request that proposes that the dropped and retained TNs be reversed. In the absence of any restrictions, the IU shall accept the normal correlation, and, if own IU has R^2 for TN-2, drop TN-2 from the interface.

5.10.1.3 Dual Designation of Reference Points. A dual designation exists when two or more points with different TNs represent the same point type at the same geographic location. Dual designations of points shall be resolved by voice coordination between the reporting IUs and the FTC/TDC. Resolution shall consist of establishing a common point, as specified in paragraph 4.4.5.

5.10.1.4 Dual Designation of IUs

a. A dual designation exists when an IU is reported as both a track/point and an IU with different TNs.

b. When a dual designation exists, it shall be resolved by voice coordination between affected units. To resolve the situation, the unit that is reporting the track/point shall drop its local track and inhibit reacquisition and reporting of the IU. The IU, when active, will report itself.

5.10.2 Duplicate Track Number. A duplicate TN exists when the same TN is used by two or more IUs for two or more different tracks. The duplicate TN is the direct opposite of dual designation. This situation can be caused by;

a. Failure of two or more IUs to track two targets identically through a merge and a subsequent separation.

b. Link degradation that inhibits the IU from receiving data and the knowledge that a specific TN is in use.

c. Erroneous correlation (either automatic or manual), i.e., failure to decorrelate.

d. Assignment of a TN outside own IU's allocated TN block without proper TN accountability.

e. Filter employment that inhibits receipt of data.

f. Multiple IUs inadvertently authorized to use the same TN block.

5.10.2.1 Automatic Resolution of Duplicate TNs. The automatic decorrelation capability described in paragraph 5.5.2.3 can detect, resolve, and eliminate some duplicate TNs.

5.10.2.2 Manual Resolution of Duplicate TNs. Duplicate TN situations appear to the operator as a jump in track position. One unit reports the TN in one location, unaware that another unit is using the same TN to report a different track in a different location. The following manual procedures are used to resolve duplicate TN situations:

a. Any C2 IU that has reason to believe that one of its common tracks is involved in a duplicate TN situation shall immediately initiate action to assign a new TN to its local data. If OCCs require the retention of the local TN, request the other IU to initiate a new TN.

b. If a SPI track is involved in a duplicate TN, the C2 IU reporting a non-SPI track with the same TN should drop the track and create a new track.

5.10.3 Environment Conflicts

a. Track Environment defines the environment in which a track operates. Track Environments are Space, Air, Surface, Subsurface, and Land. Tracks of Unknown Environment are also reportable on Link 16. The R^2 IU can change the Environments, but only for the track. Track Environment conflicts occur between platforms holding common tracks. When two or more IUs are using different Environments for the same TN, an Environment conflict exists. Such conflicts can occur as a result of erroneous sensor data system limitations or operator error. Procedures for resolution of Environment conflicts are specified below.

b. A C2 IU that disagrees with the currently reported Track Environment informs all other C2 IUs of the difference, either by changing the Environment if it has R^2 for the track or by reporting an Environment difference on the interface if it does not have R^2. Appropriate operators in all C2 IUs locally holding the track are alerted to the existence of a reported Environment conflict. Operators receiving an Environment difference alert must take a manual action to either accept or reject the change. R^2 IUs that accept an Environment change simply re-designate the track; for example, from Air to Surface. The new Environment is transmitted in the next report of that TN. An IU not holding R^2 that disagrees with an Environment received has the opportunity to reject the Environment change. The manual action rejecting the Environment will result in an Environment difference report being transmitted

on the track. IUs not holding a contested track as common might not be aware that there is a disagreement over Environment.

c. Environment differences between Air or Land and Subsurface; or between Space and Land, Surface, or Subsurface cannot be reported via data link. Such changes can only be done by transmitting a new track report with a new TN. If the IU has R^2 for the track in question, a Drop Track report on the original TN must also be transmitted. If the IU does not have R^2 for the track in question, it must contact the R^2 IU by voice and request the original TN be dropped.

d. PU/RUs do not allow Environment changes between Surface and Subsurface. When a PU/RU has R^2 for the track in question, the same procedure specified in paragraph 5.11.3c applies.

e. Environment changes may also be accomplished by transmission of a Change Data Order by the FTC/TDC or another C2 IU specifically designated as having CDO authority. IUs automatically change to the Environment ordered. Controlling IUs do not automatically accept CDOs for tracks under their control. An operator is always alerted when the environment changes. If the R^2 IU does not implement the ordered environment, then a Drop Track report is automatically transmitted, and the operator is alerted. In this case, if the local data are considered valid after re-evaluation, a new track report can be transmitted with a new TN. Link 11/11B only allows Environment changes of Air to Surface and Surface to Air.

f. An operator initiating an Environment difference shall also re-evaluate the ID and other identifying information for the track; i.e., Platform, Activity, Specific Type, and the Exercise and Special Interest status. Acceptance of an environment change constitutes acceptance of all of the other identifying information about the track.

g. The resolution of an Environment difference takes precedence over an ID conflict. However, Identity conflicts may be resolved concurrently with an Environment difference if a CDO is used implementing both resolutions simultaneously.

5.10.4 <u>ID Difference Resolution</u>

5.10.4.1 <u>General</u>

a. Track ID is the most important element of information on the interface. All tactical actions depend upon correct track identification. It is

essential that incorrect IDs be eliminated and that all differences in the ID evaluations by IUs be resolved as expeditiously as possible.

b. Excessive ID conflicts requiring operator resolution action have been a major concern in joint operations. To correct this problem, the ID difference resolution process has been simplified by automation. These simplifications are pending in some PU/RUs. Therefore, system reactions that differ from those described below may be encountered in an interface with Link 11/11B units.

c. The ID difference resolution procedures are applicable to all track categories. However, PU/RUs cannot resolve Subsurface Track ID differences via data link. Therefore, when a PU/RU has R^2 for a Subsurface Track, voice coordination will be required to resolve an ID difference.

5.10.4.2 ID Difference Resolution Procedures. The following are the simplified ID difference resolution procedures. To specify these procedures, the basic IDs are: UNKNOWN, ASSUMED FRIEND, FRIEND, NEUTRAL, SUSPECT, and HOSTILE.

a. Any C2 IU that evaluates a track's basic ID to be different than, or an upgrade to, what is currently being reported may report the difference on the interface. Changes from ASSUMED FRIEND, FRIEND or SUSPECT, to UNKNOWN or FRIEND to ASSUMED FRIEND should not be reported as differences on the interface because they are automatically discarded on reception. However, these may be ordered using the CDO.

b. When an ID difference is reported by an IU that does not have R^2 for the track, only that IU and the R^2 IU are involved in the resolution process. Third party IUs may not even be aware a difference has been reported.

c. When a different ID is reported, C2 IUs take actions as specified in Table 5-8. However, if any C2 IU rejects the new ID, only the first such IU reports a difference, and paragraph b above applies. A “conflict” requires an operator action to accept or reject the reported ID. All other actions are automatic requiring no operator action (see Table 5-8).

5.10.4.3 ID Differences on Controlled Tracks. Tracks currently being reported on the interface as controlled by an IU are exempt from reporting the ID difference. All IUs automatically accept the ID reported by the controlling IU and automatically reject any ID difference, except a CDO, reported by any other IU. Thus, reports from the controlling IU have the same effect as a CDO. (see paragraph 5.10.4.5c)

5.10.4.4 Difference Resolution Below the ID Level. Differences in the Platform, Activity, Specific Type, or Special Interest status of a track can be resolved via the interface by some systems. Some systems do not use the interface for these types of difference resolution and are resolved only by the FTC/TDC or any other designated authority in a CDO, by the controlling units of a track or by voice.

5.10.4.5 Change Data Orders

a. The CDO causes all IUs to accept the same Environment and identification data as transmitted from and as held by a C2 IU with specific interface authority to issue such an order. Only the FTC/TDC and C2 IUs specifically designated as CDO authorities may originate a CDO. This authority is designated in the OPTASK LINK.

b. Upon receipt of a CDO, all IUs automatically accept the ordered Environment, ID, PRI AMP, ID AMP, Platform (Link 16 only), Activity (Link 16 only), Specific Type (Link 16 only), and Special Interest status (Link 16 only) for the track. This order automatically replaces the locally held data with the ordered data at each IU; therefore, initiation should be undertaken only upon clear justification and requires operator action. The CDO should only be used as a last resort or emergency measure when the Environment and ID difference resolution processes fail to produce timely resolution. An example of the use of the CDO is when a track other than HOSTILE is clearly threatening the force and lack of timely action to upgrade the ID to HOSTILE is causing inadequate threat reaction.

c. As an exception to the above, some controlling IUs automatically reject a CDO for a track under their control. However, other IUs automatically accept the CDO, but then automatically accept the ID reported from the controlling IU. Thus, operators may see a brief (few seconds) ID change, then a change back to the controlling IU's ID. Therefore, the CDO should not be used for controlled tracks. Any IU that considers it essential to change the ID of a controlled track, must request the controlling IU by voice to change the track's ID.

d. The CDO shall not be used to revert the ID of a track to PENDING. A CDO is automatically rejected if an ID of other than PENDING is held and the CDO attempts to revert the ID to PENDING

Table 5-8. ID Difference Resolution

Local Data	Remote Data Received						
	PENDING	UNKNOWN	ASSUMED FRIEND	FRIEND	NEUTRAL	SUSPECT	HOSTILE
PENDING	NA	A	A	A	A	A	C*
UNKNOWN	R	NA	A	A	A	A	C*
ASSUMED FRIEND	R	R[1]	NA	A	A	C	C
FRIEND	R	R[1]	R	NA	C	C	C
NEUTRAL	R	C	C	C	NA	C	C
SUSPECT	R	R[1]	C	C	C	NA	C*
HOSTILE	R	C	C	C	C	C	NA

Legend

A = Automatically accept the remote data.

R = Automatically reject the remote data.

R[1] = U.S. systems will automatically reject and other NATO systems will interpret as a C.

C = Conflict. Operator acceptance or rejection required.

C* = In these three cases, systems may have a feature to automatically accept received ID as own unit ID.

NA = No action required.

5.10.5 IFF/SIF Difference Resolution

a. For each contact reported as a track, there can only be one set of IFF/SIF codes that correctly represents the current response to IFF/SIF interrogations. Therefore, when an operator determines that an IFF/SIF data difference exists between C2 IUs or that the reported data are not as anticipated, the operator shall take action as indicated in this procedure. Responses to IFF/SIF interrogations must be verified to resolve data differences and to ensure correct data are reported on the interface.

b. IFF/SIF data differences and data errors may be caused by the following:

(1) Malfunction of IFF/SIF equipment.

(2) Duplicate TN resulting in different IFF/SIF data for the same TN.

(3) Operator error when entering IFF/SIF manually.

(4) Operator or system correlation error.

(5) Two or more contacts/tracks in formation or close proximity simultaneously responding to the same interrogation, causing erroneous codes (sums or differences) to be received or causing only one of the replies to be received.

(6) Beacon video processor malfunction.

5.10.5.1 IFF/SIF Difference Resolution Procedures

a. Recognition of an IFF/SIF data error only occurs if an operator compares specific local IFF/SIF data obtained with data obtained from another source; e.g., pilot report or another IU. This data comparison may be prompted by a TDS-generated alert or by voice communications, indicating a data difference. Responses to IFF/SIF interrogations must then be verified to correct data errors.

b. Any C2 IU recognizing an IFF/SIF data difference or suspecting an IFF/SIF data error shall verify or correct the data involved using the following procedures in the sequence listed:

(1) Re-interrogate and update any local data involved ensuring that such data are consistent and current.

(2) If the track is controlled by own IU, verify the data by voice contact with the pilot.

(3) Clear remote data using the IFF Clear function. This causes all C2 IUs to revert the indicated mode(s) to zero in their database until the next valid code response is received from the track or reported by another IU. (Except for Mode IV, see paragraph 5.10.5.3)

(4) Manually initiate an IFF Difference Report. This cannot apply to Mode II data if a nonzero value has already been reported on the interface. For specific procedures to resolve Mode II differences, see paragraph 5.10.5.2.

(5) Coordinate by voice with other involved C2 IUs to resolve the difference.

c. If an IFF data difference persists after the above actions, the IU holding local data that differ from remote data shall decorrelate by establishing a new track and associating the local IFF data with the new track. This procedure must apply even though the position of two tracks appears identical.

d. When exchanging IFF information by voice, the following terms and meanings must be used to avoid misunderstanding:

(1) IFF Data Held. IFF code(s) held in the TDS database and displayable to the operator.

(2) IFF Response. IFF code(s) being received (or squawk) as result of own interrogation.

5.10.5.2 Mode II Differences. The Mode II code requires special consideration because it is normally a unique vehicle identifier. Its advantage is in avoiding erroneous track correlations and alerting operators to erroneous entries. Therefore, the maintenance of a clear tactical picture is dependent to a certain extent upon the protection and utilization of Mode II uniqueness. However, operators must be aware that a Mode II code is not always unique to specific aircraft in certain theaters and operations.

a. A nonzero Mode II code cannot be changed for a specific local track. However, the Mode II code can be cleared using the IFF/SIF Clear function. This results in Mode II being zeroed until the next Mode II interrogation.

b. When local sensors detect an apparent Mode II change, it should be treated by the TDS and operators as a potential new track.

c. Operators may be alerted when two or more tracks have the same Mode II code. This provides a strong indication that a dual designation exists. Some systems allow the operator to suppress this alert. However, the capability to suppress the alert should be used judiciously, and only when it is known that there is a high incidence of multiple aircraft present assigned the same Mode II code.

5.10.5.3 Mode IV Differences

a. Mode IV is the primary means for FRIEND identification. Differences in the Mode IV reported on the interface must be resolved immediately. Mode IV data provided on the interface consists of values of:

(1) 0 = Not Interrogated.

(2) 1 = Interrogated - No Response.

(3) 2 = Interrogated - Invalid Response.

(4) 3 = Interrogated - Valid Response.

b. Mode IV upgrades (to a higher number in this list) are automatically accepted by all IUs. However, downgrades are automatically rejected. Therefore, if an operator believes a Mode IV downgrade is appropriate, he must use the Mode IV IFF Clear function. Re-interrogation and voice coordination with other IUs should normally be conducted in these cases. However, some systems might not accept a Mode IV IFF clear request.

5.10.5.4 IFF/SIF Update Requests. Some C2 IUs are capable of requesting an update of any or all modes associated with a specific track when they hold no data for those modes. However, operators should be aware that the R^2 IU automatically reports all IFF/SIF data held approximately every 2 minutes. Therefore, use of the IFF/SIF Update Request should be limited to tracks of immediate concern when an IU has just entered the interface, is experiencing poor link connectivity, or has reason to believe that other C2 IUs have IFF/SIF data not held by own IU.

5.10.5.5 PU IFF Limitations. The above procedures apply to all C2 JUs and RUs, and most PUs. However, some PUs are unable to fully comply with these procedures. These limitations vary and primarily involve inability to fully exchange IFF/SIF Clear and Update Requests. When IFF-limited PUs are in an interface and IFF/SIF problems are encountered, voice coordination may be required to perform functions normally accomplished via the interface.

5.10.6 Strength Changes (Link 16 Only). Paragraph 5.5.6.6 describes the Link 16 capability to report the specific number of vehicular objects comprising a TN. Link 16 also provides a capability for a C2 JU that does not have R^2 to report that it believes the strength of a track is different than that reported by the R^2 IU. If a C2 JU receives such a report, the change may be automatically accepted or the operator may take a manual action to accept or reject the change.

5.10.7 Track Alerts. A track alert is used to indicate that a track is of particular significance and ensure that all C2 IUs are aware of the track. A track alert forces the track through all filters, including security filters. A track alert is not for the same purpose as Special Interest status, which does not force the track through filters. However, it is permissible and often appropriate for a track alert to be sent on a Special Interest track. The two types of track alert are:

a. Emergency. The Emergency alert indicates a life-threatening condition that requires immediate action or assistance.

b. Force Tell. The Force Tell alert indicates that a condition exists that, although not meeting the criteria for the Emergency alert, is sufficiently important to ensure that all C2 IUs are aware of the presence of the track.

5.10.7.1 Track Alert Initiation

a. Any C2 IU may initiate a track alert on any track, point, fix, AOP, or LOB. Due to the normally urgent nature of a track alert, its use need not be directed by or coordinated with the FTC/TDC.

b. When a C2 IU that does not have R^2 for the track initiates a track alert, the R^2 IU automatically commences reporting the alert status for that track.

c. Emergency alerts are not applicable to Reference Points on Link 16. However, Emergency Points may be initiated, and are forced through filters.

d. Extreme caution should be taken in the use of the Force Tell or Emergency alerts on SPI data due to the sensitive nature of the information involved.

5.10.7.2 Track Alerts for JUs (Link 16 Only)

a. JUs are capable of setting a track alert on themselves. This capability may be used to indicate an emergency condition in any JU or to set Force Tell on a nonC2 JU. The latter is necessary because nonC2 JUs are eligible to be filtered in the same manner as Air FRIEND tracks. When a nonC2 JU sets a track alert on itself, the Air FRIEND track forwarded to Link 11/11B will also have the track alert status.

b. When a JU that had set an alert on itself becomes inactive on Link 16, a C2 IU, which assumes R^2 for the JU as a track and had received the previous alert status automatically, sets the alert on the track.

c. C2 JUs are also capable of directing that a nonC2 JU set force tell on itself. This capability should be used by the FTC/TDC or individual air controllers when it is known that a filter affecting Air FRIEND tracks is in effect but it is particularly important for all IUs to be aware of the movements and actions of nonC2 JUs. Upon receipt of such direction, the nonC2 JU automatically sets Force Tell with no operator action required.

d. For technical reasons, track alerts cannot be set on active PU/RUs, nor can Emergency alerts on C2 JUs be forwarded to Link 11/11B.

5.10.7.3 Termination of Track Alerts

a. Any C2 IU may terminate a track alert. However, a track alert should normally be terminated by only the IU that initiated the alert or by the FTC/TDC.

b. When an IU that does not have R^2 for the track terminates an alert, the R^2 IU automatically ceases reporting the alert status.

c. An emergency alert on a JU shall be terminated by only the JU itself.

5.10.8 Pointers

a. The Pointer provides a capability for a C2 IU operator to call the attention of operators in other C2 IUs to a specific geographic location without assigning a TN. The Pointer is always used in conjunction with voice coordination. This capability is useful for ascertaining if other C2 IUs hold contacts in a particular area, pointing out areas of impending threat activity, resolving anomalies, calling attention to weather formations, and the like.

b. Pointers on Link 11/11B may only be addressed to a single IU. Certain Link 11/11B systems have an automated capability to send the same Pointer to multiple units with a single switch action. Pointers on Link 16 may be addressed to a single, selected group, or all C2 JUs. It may be directed to all concerned operators in general or to one of the following specific functional areas within the addressed C2 IU(s):

(1) Weapons.

(2) Tracking/Surveillance.

(3) EW.

(4) Special Processing.

c. There is no means to terminate a Pointer via the interface. Operators should purge the Pointer from their display when no longer needed.

d. The above procedures are not applicable to Pointers transmitted to or by nonC2 JUs or Link 4A aircraft. These are specified in Chapter 6.

5.10.9 Data Update Requests. The DUR is used to request certain data from one or more C2 IUs. This request is transmitted automatically by most TDSs when entering the interface. However, it may be initiated by operator action at any time. The DUR may be used to update information:

a. Purged or dropped locally.

b. Missed during periods of inactivity.

c. Missed due to poor data reception.

d. That is not updated frequently.

e. On a specific TN (Link 11B or Link 16 only).

5.10.9.1 Initiating a DUR

a. On Link 11, a DUR is an operator option when a general update from a specific C2 IU is desired. The addressee will respond with all own unit data for the items listed in paragraph 5.10.9.2. A Link 11 DUR can not be used to request specific TN data.

b. On Link 11B only, a DUR is used between directly tied units to automatically initialize or re-initialize data transmission. When a Link 11B unit has completed all preliminary signal transmissions, it will send a DUR to signal that it is ready to receive data. The receiving unit responds with a general update of all data for which it holds R^2.

c. On Link 16, a DUR may be addressed to a specific unit or collective address. If the addressed unit(s) is on Link 16, then a DUR can request updated data on a specific TN or by specific request indicator values.

d. A DUR may be used to request an update on a specific track on Link 16 and between directly tied units on Link 11B. The receiving unit responds with a complete set of data for the track, including data source position, identification, and other amplifying data.

5.10.9.2 Response to DUR. The responses to a DUR from any IU differ depending upon whether the addressed unit(s) is on Link 11, Link 11B, or Link 16.

5.10.9.2.1 Link 11/11B Response. If the addressed unit(s) is on Link 11 or Link 11B, the responding unit replies with own unit data pertaining to the following items:

a. EW bearings and fixes.

b. All special points originated by addressed units.

c. Areas of probabilities.

d. Weapons and engagement status information.

e. EW/Intelligence information.

f. (Link 11B only) If the responding unit is a forwarding unit, it will also provide unit position reports on units for which data are being forwarded.

5.10.9.2.2 Link 16 Response. If the data are requested on a specific TN, then the responding JU(s) shall reply with all data described below depending on its relationship to the referenced TN. If the responding JU is a:

a. C2 JU with R^2 on the referenced track, then it shall respond with surveillance information on the track.

b. JU that has originated surveillance amplification data on the track, then it shall respond with intelligence information or EW amplification information.

c. JU controlling the referenced track, then it shall respond with weapons coordination and management information and platform and system status information. This will include the controlling unit report and the engagement status.

d. C2 JU with R^2 on the reference track, then it shall respond with the requested data. Ballistic missile track data can be requested either with or without error estimate data included.

5.10.9.2.3 Indicator Values. If the data are requested by indicator values, then the C2 JU(s) that originated the data shall respond. An operator selects the data desired by setting the appropriate request indicator value. The possible values are:

a. Reference point.

b. Land (ground) point.

c. EA data.

d. ES data.

e. EW fixes.

f. Weapon status.

g. Weather data.

h. Intelligence.

i. Filter.

j. Ballistic missile error estimate data.

k. Ballistic missile update rate.

5.10.10 Data Association

a. The interface Data Association capability allows a C2 IU to report that there is an unspecified relationship between any two TNs currently being reported. The relationship should be obvious to receiving operators by the nature of the TNs. For example, when an EW LOB and an Air Track are associated, it is obvious that the associating IU believes that the LOB emanates from an emitter in the Air Track. If the relationship is not obvious, voice coordination should be used.

b. The following limitations exist on the use of Data Association:

(1) Data Associations shall not be used to indicate an assignment of a friendly track to a station, point, tanker, etc. That is the purpose of the Pairing capability described in paragraph 5.11.4.

(2) Data Association shall not be used to indicate an engagement of a target by a friend. That is the purpose of Engagement Status reports described in paragraph 5.11.3.

(3) Data Association should not be used to indicate that an enemy is engaging a friend. That is the purpose of the Intelligence reporting Target TN capability described in paragraph 5.9.1.7. However, Data Association may be used by a C2 IU that does not originate Intelligence messages to indicate such a relationship.

(4) Data Association shall not be used to indicate two correlated TNs. That is the purpose of the correlation capability described in paragraph 5.10.1.

(5) A Data Association shall only be terminated by the IU reporting the association.

(6) If either data involved in the association is dropped, the association is assumed to be terminated.

c. Data Associations are displayed in a manner clearly distinguishable from the above relationships.

5.10.11 Resetting Erroneous Data. Some interface data elements have a "Reset to No Statement" value in addition to the "No Statement" value. The reset capability allows an operator to positively eliminate previously reported data from the interface when it is determined that the information is in error or no longer correct, but no other correct information is available. This is necessary because most IUs automatically reject a No Statement value if other data are held, but the Reset value requires all IUs to automatically reset the data to No Statement.

5.11 Weapons Coordination and Management. Interface support of weapons coordination and management consists of the exchange of information and orders to effect weapons employment and to prevent mutual interference during their employment. This section specifies the interface procedures for coordinating the employment of weapons and managing friendly assets to ensure a high state of readiness to counter threats. This section is limited to the coordination and management between C2 IUs. All Link 4A and Link 16

Air Control procedures, including those between a controlling IU and its controlled aircraft, and fighter-to-fighter procedures, are contained in Chapter 6. Also, paragraph 5.4 specifies the procedures for IU self-reporting of weapons status. Thus, this section is limited to procedures for the following functions:

a. Commands.

b. Engagement Coordination.

c. Engagement Status Reporting.

d. Pairings.

e. Aircraft Control Status.

f. Digital and Voice Handovers (C2 IU to C2 IU).

g. Coordination of Interceptors and SAMs.

h. Manual Voice Procedures.

5.11.1 Commands

a. Commands provide the means for directing weapons system engagements. This section defines the Commands for the entire interface and the procedures for their use.

b. The commands, Weapons Free and Weapons Tight, impose a status or condition applicable to weapons systems within a defined volume of air space. Transmission of “Weapons Free” or “Weapons Tight” control orders against specific targets by US forces is prohibited. These Weapons Release conditions must be passed by voice communications between U.S. Forces. If these Weapons Release conditions are received via tactical data link then voice confirmation is mandatory.

5.11.1.1 Command Definitions. The following definitions shall be used to define the intent of orders and commands exchanged over link or voice communications between interfaced TDSs.

a. Weapons Free. A weapon control order imposing a status whereby weapons systems may be fired at any target not positively recognized as friendly.

b. Weapons Hold (Voice Only). A weapon control order imposing a status whereby weapons systems may only be fired in self-defense or in response to a formal order. Weapons hold is transmitted by voice only.

c. Weapons Tight. A weapon control order imposing a status whereby weapons systems may be fired only at targets recognized as Hostile.

d. Assign. Perform all functions of engagement of target but do not fire until ordered or target becomes eligible for destruction under existing doctrine and/or ROE. Specific Weapon Type (Any/All, Missile, Conventional, or Aircraft) may also be ordered.

e. Engage. A fire control order used to direct or authorize units and/or weapon systems to fire on a designated target. Specific Weapon Type to use may also be ordered.

f. Engage with ASM/SSM. Engage the target specified for destruction with the number of ASMs or SSMs ordered, to impact the target at the time ordered. Times may be reported over Link 16 of up to 23 hours, 59 minutes and 59 seconds. Times over 59 minutes will not be transmitted to Link 11. When impact time exceeds 59 minutes, the FJU will send a CANTPRO to the originating C2 JU.

g. Hold Fire. Emergency order to stop firing. Missiles already in flight are to be prevented from intercepting, if technically possible. The weapon or aircraft remains assigned to the target.

h. Cease Fire. A weapon control order used to direct units to stop the firing sequence against a designated target. Guided missiles in flight will continue to intercept. The weapon or aircraft remains assigned to the target.

i. Cease Engage. A fire control order used to direct units to stop the firing sequence against a designated target. Guided missiles in flight will continue to intercept.

j. Cover. Perform all functions of engagement on a specified track up to the point of firing. Specific Weapon Type (Any/All, Missile, Conventional, or Aircraft) may also be ordered.

k. Salvo/Clear Aircraft. Emergency order. Target Engagement Message. About to engage target with Birds. Fighter to be hauled off in ample time to clear the missile shot and the controller is to pass disengagement direction. If

Command is collectively addressed, all controlling IUs clear all friendly aircraft from vicinity of target. (Brevity word for this Command is SCRAM).

l. Proceed to Point. Proceed or direct the specified unit to proceed to the designated point.

m. Cease Proceeding to Point. Cease or direct the specified unit to cease proceeding to the designated point.

n. Conduct Procedures Indicated. Conduct or direct the specified unit to conduct the indicated procedures.

o. Cease Conducting Procedures Indicated. Cease or direct the specified unit to cease conducting the indicated procedure.

p. Assume Duties Indicated. Assume or direct the designated unit to assume the indicated duty.

q. Cease Duties Indicated. Cease or direct the designated unit to cease performance of the indicated duty.

r. Transfer Control. Transfer control of the specified aircraft to the specified unit (see paragraph 5.11.6).

s. Assume Control. Assume control of specified track, or direct the specified unit to assume control (see paragraph 5.11.6).

t. Return to Base. Return or direct the specified unit to return to the specified base or to home base or other prearranged base if no base is specified.

u. Launch Alert Aircraft. Launch or direct the specified unit to launch, alert aircraft of the type specified, to proceed to the target, point, or aircraft controller indicated. If no aircraft type is specified, launch alert fighters or other prearranged type of aircraft. On Link 11/11B, either Fighter or USW Helo must be specified. If sent by a C2 JU to a PU/RU with any other type of aircraft specified, this Command is forwarded as Launch Alert Fighter.

v. Investigate/Interrogate (Link 16 only). Engage the specified target with the specified aircraft, but do not fire until ordered, or the target becomes eligible for destruction under existing doctrine and/or ROE. This Command is forwarded to Link 11/11B as Assign.

w. Intervene (Link 16 only). Order the specified aircraft to take action to divert the designated target from its intended flight path. This Command is not forwarded to Link 11/11B (see paragraph 6.7.1.3.j).

x. Shadow (Link 16 only). Order the specified platform to maintain surveillance on the designated target. This command is not forwarded to Link 11/11B.

NOTE: The national use of weapon control orders and weapon control status messages may vary; therefore, care must be taken when using these messages.

5.11.1.2 Command Procedures

a. Only C2 IUs transmit Commands on the interface. Commands are sent only to other C2 IUs, or the collective address. Commands are not sent to nonC2 JUs, nor are nonC2 JUs included in the collective address for commands. When Commands requiring action by controlled aircraft are received, Mission Assignments containing appropriate direction shall be sent by the controlling IU to the controlled aircraft, as specified in Chapter 6.

b. The Weapons Free/Weapons Tight, Hold Fire, Cease Fire, Salvo/Clear aircraft, and Conduct/Cease Procedures Indicated Commands may be sent to a specific addressee, or to all C2 IUs by means of a collective address. All other Commands must be addressed to a specific addressee.

c. Commands that are addressed to IUs require an operator response. The options are WILCO, CANTCO, or HAVCO.

d. To expedite C2 when a command is sent to a specific C2 IU, the receiving IU automatically acknowledges receipt immediately with a Machine Receipt (MR) or CANTPRO to the IU originating the command. If a MR is sent, a later response is expected (WILCO, HAVCO, or CANTCO). The originating operator is alerted if either the expected acknowledgment or response is not received for the original command. Upon receipt of such an alert, the originating operator can re-send the Command to the same IU or another IU, or use an alternate method of transmission, such as voice.

e. MRs or other responses are not transmitted in response to Commands sent to the collective address. Therefore, the originating IU does not know if a collectively addressed Command is received by all intended IUs.

f. If the receiving IU cannot process the Command for technical reasons, the receiving IU automatically sends a CANTPRO reply. A C2 JU also automatically includes the reason for the CANTPRO, if it is one of the following:

(1) The Command is not implemented by the addressee.

(2) One or more of the specified TNs is not held.

g. For Commands from a C2 JU to a PU/RU, the FJU CANTPROs the Command if no MR is received from the PU/RU, or if the FJU holds the PU/RU as inactive (see paragraph 5.11.1.5).

h. A WILCO, HAVCO, CANTCO, or CANTPRO response terminates the Command sequence. Some systems automatically report the appropriate Engagement Status when a Command is WILCOed, whereas others require operator action to initiate or change the Engagement Status. If a WILCO response has been sent for a Command, and events subsequently dictate that the Command cannot be complied with, a Heads-Up alert should be initiated on the track to alert the interface of an inability to engage the track. Voice communications shall be initiated with the command that originated the Engage Order to clarify the engagement status.

i. The Weapon Type, conventional, shall only be used to order gun engagements, torpedo, or conventional depth bomb USW engagements. Self-defense engagements shall not be ordered via the interface.

5.11.1.3 Command Authority

a. Only C2 IUs with specific Command authority shall issue interface Commands. The CJTF and AADC always have Command authority. The CJTF or AADC may designate in the OPTASK LINK message other C2 IUs as having the authority to originate Commands within the interface as necessary. The TDS does not automatically validate Command authority, and a CANTPRO is not automatically transmitted on the basis of the lack of command authority. The TN of the originator of a Command is displayed to the operator at the receiving IU. Before responding to a Command, the operator must validate the authority of the originating IU. The operator may decide to respond with a CANTCO if the order is deemed to be from improper authority or otherwise seems to be erroneous.

b. The Hold Fire, Cease Fire, and Salvo/Clear Aircraft emergency Commands may be originated by any C2 IU.

5.11.1.4 Command Execution. For most Commands, the type of weapon or specific unit to be used is not specified.

NOTE: However, if the originator deems it essential to specify a type of weapon or specific unit to be used to execute a command, caution should be exercised. An operator may respond with a WILCO but might not know that a weapon or unit was specified due to system implementation. Therefore if a specific weapon or system is required for a given command, the originator should validate the WILCO with voice contact.

5.11.1.5 Command Initiation During EMCON or Radio Silent Operation

a. An IU may operate in a net (Link 11 or Link 16) in the Radio Silent Mode. This allows an IU to monitor information exchanged on the net without disclosing its location through the transmission of data. Though commands may still be addressed to IUs in the Radio Silent Mode, the IUs are unable to MR or acknowledge (WILCO, CANTCO, or CANPRO) these orders and commands.

b. An operator in an IU who transmits a command to a Radio Silent IU will be alerted when no MR is received from the Radio Silent IU. This only indicates that the tactical data system has no means of confirming that the command was received. Confirmation that the command sent has been received, and is being acted on, can only be observed on the tactical display. For example, a CAP under the control of the Radio Silent IU departs CAP station and conducts the engagement ordered. Commands sent to Radio Silent IUs are, in effect, sent in the blind.

c. Commands sent to an IU operating in the Radio Silent Mode that are forwarded through a USN FJU will be displayed to the originating operator as “CANTPRO - No Machine Receipt” or as “CANTPRO” from an FPU. Commands are sent to Radio Silent IUs without acknowledgment or receipt.

d. Silent IUs are considered to be inactive for interface purposes. Some FJUs do not forward an addressed Command to an inactive IU, although USN FJUs do. Therefore, when a silent IU is on a different link than the originator and FJU is not USN, the originator receives either a CANTPRO - Addressee Inactive response if the originator is a JU, or just a CANTPRO response if the originator is a PU/RU. These responses must be interpreted to mean the silent IU did not receive the Command, and voice or other means must be used to send the Command to the silent IU.

5.11.2 Theater Ballistic Missile Defense (TBMD) Engagement Coordination (Link 16 Only)

a. TBMD Engagement Coordination provides the means for two or more C2 JUs capable of engaging TBMs to conduct more efficient engagements through coordination and to reduce the probability of wasted resources. TBM engagement coordination includes those activities between two or more weapon systems with common or shared TBMD responsibilities within an area of operations or theater. Weapon systems must have a means of exchanging options, strategies, and expectations of support to ensure adequate defense of defined assets and effective use of limited resources.

b. TBMD Engagement Coordination is used by an upper tier TBM-capable system such as the US Army THAAD system to advise a lower tier and adjacent system, such as USN AEGIS ships and US Army PATRIOT systems, that support on a particular engagement is desired; and to advise the requesting system that support to that engagement can or cannot be provided.

5.11.2.1 Procedures. When operating in a theater with shared TBMD responsibilities, systems may find it operationally effective and efficient to coordinate engagements against common threats. TBMD engagement coordination is a cooperative relationship that does not, in and of itself, empower any participant with command authority. When two or more TBMD capable C2 JUs operate in a cooperative defense posture, they may share engagement intent, Method of Fire (MOF), Probability of Kill (PK) tracking status, and support expectations. Participating C2 JUs are responsible for developing specific coordination procedures, but shall adhere to the following general guidelines.

a. The normal message exchange sequence begins with a C2 JUs detection, or receipt of a potentially threatening TBM track. The C2 JU shall evaluate the nature of the threat to determine if;

(1) The threat will be engaged,

(2) The threat is eligible for coordinated engagement.

(3) Support is needed.

b. The participating C2 JUs shall determine criteria for coordinated TBM engagements. The C2 JU will initiate the engagement coordination process by announcing engagement intent and support expectations. Each threat shall be

treated as a separate engagement coordination process. The engagement coordination and support expectations include all of the following:

(1) Intend to Engage, Do Not Intend to Engage. No evaluation of support expected is implied, and the receiving C2 JU need not reply.

(2) Support Expected, Support Not Expected. Used only when a C2 JU intends to engage the threat. The receiving C2 JUs assume that the transmitting C2 JU intends to engage the threat and that the MOF is based on the expectation of support as indicated.

(3) Available For Support, Not Available For Support. Transmitted as a response to a request for support. A C2 JU may announce at any time that it is available or not available to support another C2 JU.

c. An announcement of intent to engage does not supplant the requirement for a C2 JU to report its engagement status.

d. In coordinating an engagement, a C2 JU may announce its calculated MOF as follows:

(1) Single Shot (Shoot)	One missile is launched to engage the threat.
(2) Dual Shot (Shoot-Shoot)	Two missiles are launched in rapid succession to engage the threat.
(3) Multiple Shot (Ripple)	Two (or more) missiles are launched within a system-specific time interval, but not in rapid succession.
(4) Shoot-Look-Shoot	One or more missiles are launched to engage the threat. The engagement is evaluated and, if necessary, additional shot(s) are launched.

e. As amplifying information in the engagement coordination process, a JU may report its PK against a target based on the selected MOF.

5.11.3 Engagement Status Reporting

5.11.3.1 General. All C2 IUs will report all engagements, including self-defense and engagements by non-IUs. Engagement reports provide the type of weapon system conducting the attack, the current status of the attack,

and the target under attack to the operator. This information is used to prevent mutual interference, reduce fratricide, ensure all threat targets are engaged, and report the status of each engagement. Engagement status can be reported by voice or data link. Data communications provides a real-time display of each engagement to all IUs automatically so the target can be re-attacked if the engagement is not successful, or the weapons can be reassigned when the target is destroyed.

5.11.3.2 Engagement Status Definitions. The following are the definitions of all Engagement Status reportable on the interface.

a. Weapon Assigned: The specified friendly IU or track has been assigned to the specified target.

b. Tracking/Locked-ON/Ready-to-Fire/Bird Affirm: The tracking radar of the specified friendly IU or track is locked on the specified target and is ready to fire as soon as the target is within weapon range and eligible for destruction. In Link 11/11B, this status is not used for aircraft.

c. Firing/Missile In Flight/Engaging to Destroy: For a surface missile or USW engagement, weapon has been launched by the specified friendly IU or track and is en route to the specified target. For an aircraft engagement, the specified aircraft is engaging the target with intention to destroy.

d. Effective/Target Destroyed/Grand Slam: The designated target has been completely destroyed or rendered no longer a threat. The engagement is broken.

e. Partially Effective: All targets associated with the target TN have not been destroyed. The engagement is continuing.

f. Not Effective: Miss or abort. The target is not destroyed. The engagement is continuing.

g. Engagement Broken: The previously reported engagement is terminated.

h. Heads Up: The designated target constitutes a threat to friendly forces. Originator is unable to assure complete destruction of the target.

i. Engagement Interrupted: The previously reported engagement has been temporarily interrupted and will be continued as soon as possible.

NOTE: This Command is used only by NATO. If received by a US IU, it is interpreted as Engagement Broken.

j. LASHE/Perimeter Engagement: Transmitted by Hawk units only. An engagement mode where a single unit conducts multiple, simultaneous engagements without the capability of performing independent kill assessments. However, Engagement Status values of Firing and Engagement Broken will be automatically transmitted for each missile and target pair.

k. Investigating/Interrogating (Link 16 only): The specified unit is not yet tracking the target. The target is being investigated by the unit, but will not fire until ordered or the target becomes eligible for destruction under existing doctrine and/or Rules of Engagement (ROE). This status is forwarded to Link 11/11B as Weapon Assigned.

l. Shadowing (Link 16 only): The specified unit is maintaining surveillance on the designated target. This status is forwarded to Link 11/11B as Weapon Assigned.

m. Intervening (Link 16 only): The specified unit is taking action to divert the designated target from its intended flight path. This status is forwarded to Link 11/11B as Weapon Assigned.

n. Covering (Link 16 only): The specified unit is maintaining a position relative to the designated target from which a successful intercept can take place if needed. This status is forwarded to Link 11/11B as Weapon Assigned.

5.11.3.3 Engagement Status Reporting Procedures

a. Engagement Status information reports the engagement of a friendly track to a target. The friendly track can be an IU or a non-IU that has a weapon capability, or a controlled aircraft. Engagement status reporting is initiated by any C2 IU for its and supporting unit weapon systems and currently controlled aircraft when the engagement is initiated or changed. Engagement status reporting may also be manually initiated and updated by some C2 IU for any non-IU known to be engaging. Once an engagement is reported, it is automatically updated as the engagement progresses, at least every minute.

b. NonC2 JUs report engagement status to their controlling IU on their control channel. The controlling IU then reports the engagement status on the interface. This function is performed automatically in most C2 IUs. Only the controlling IU is allowed to report the Engagement Status of a controlled track.

c. A C2 IU can obtain an update of all engagements reported on the interface by initiating a DURRI for weapon status on Link 16. A C2 JU can request updated Engagement Status on any TN engaged by a C2 JU, by initiating a track-specific DUR addressed to the engaging C2 JU. This capability appears to have limited utility, since all engagements are updated at least every minute.

d. Some IUs have the capability for simultaneous engagements, either of multiple tracks or single track with multiple weapons systems; e.g., missiles and aircraft. Simultaneous, multiple engagements by a friendly track (e.g., F-14D), may be reported if different targets are involved. However, if multiple weapon systems are employed against the same target, only one weapon system can be reported. In most IUs, this is automatically the first weapon system employed, although the operator can override and report the other by manual actions.

e. The C2 IU reporting an engagement must report either Effective or Engagement Broken to terminate the engagement. All engagements must be terminated on the interface.

f. The Heads-Up alert warns that the warning originator cannot assure complete destruction of a given target. This warning is not restricted to being reported in conjunction with an engagement, nor does it report the termination of an engagement.

5.11.4 Track Pairings

a. Pairings are used to show that a tactical relationship other than engagement exists between a friendly track and any other reported track or point. Some common examples of the use of pairings are:

(1) Fighter paired to its assigned CAP station.

(2) Aircraft paired to the tanker for rendezvous or refueling.

(3) Strike aircraft paired to the Waypoint or Strike Initial Point (IP) to which it is proceeding.

(4) Any friendly track paired to the return base.

(5) Ship paired to the assigned Picket Station, Plane Guard Station, etc.

(6) Any friendly track paired to an Emergency point for SAR operations.

b. C2 IUs may report the pairing of any friendly track with a previously reported point or track, except only the controlling IU shall report a pairing for a controlled aircraft. A friendly track may be paired to multiple points or tracks. As an example, a fighter may be paired to a tanker and a CAP station.

c. A Pairing does not constitute an assignment or order to assume the indicated tactical relationship. For example, reporting of a Pairing between a fighter and a CAP station does not direct the fighter's controlling IU to move the fighter to the CAP station. It only informs the interface that the fighter is assigned the CAP station.

d. A Pairing continues in effect until specifically terminated by the reporting IU. Only the C^2 IU responsible for reporting a Pairing may terminate that pairing. When a handover of aircraft control occurs, the new controlling IU automatically assumes responsibility for reporting Pairings involving the controlled aircraft that had been reported by the previous controlling IU. The new controller must manually terminate such Pairings.

e. If either track is dropped, the Pairing is automatically terminated.

5.11.5 Aircraft Control Status

a. To ensure timely, effective allocation of all friendly air assets and to prevent fratricide, the air defense C2 IUs must know the controlling unit of all controlled friendly air tracks. Also the USWC and other USW C2 IUs must know the controlling unit of USW aircraft. Therefore, any C2 IU that is currently performing an air control function for any Air Track is required to report to the interface that it is the controlling unit of the track. Control shall only be reported when both digital or voice communications have been established between the controller and the aircraft, and the controller is confident the aircraft knows it is under control. Control of aircraft under approach or tower control need not be reported to the interface.

b. Controlling unit status is independent of track R^2. R^2 for controlled tracks is determined and shared in the same manner as other Air Tracks unless otherwise specified.

c. When control of an air track shifts from one C2 IU to another C2 IU, using digital or voice handover procedures, the new controlling IU assumes

responsibility for controlling unit reporting to the interface. However, when control shifts from an IU to a non-IU, the IU reports termination of control, and the new controlling unit is not reported on the interface. There are no means for control by non-IUs to be specifically reported on the interface.

5.11.5.1 Controlled Aircraft Status

a. The controlling IU also assumes responsibility for reporting certain status information about a controlled aircraft, unless the aircraft is a nonC2 JU or an USW Air PU that is reporting its own status. When a controlled nonC2 JU or USW Air PU is inactive or silent on the interface, the controlling IU automatically reports their status. If the controlling IU is a C2 JU, the status information reported can include any or all of the information described in paragraph 5.4 applicable to the aircraft. Other controlling IUs are limited to reporting the aircraft's specific type, fuel status, availability for mission assignment, and the simple presence or absence of missile Specific Types.

b. The aircraft status information is automatically reported as available, whether received in previous Link 16 or Link 4A reports from the aircraft or manually entered by the controller. Controllers must be alert to update or delete stale aircraft status information.

5.11.5.2 Control Conflicts. If a controlling IU for an aircraft receives a controlling unit report from another IU for the same aircraft, and a digital handover with that IU is not in progress, a “Control Conflict” exists and the controller is alerted. The alerted controller should then validate that he is still controlling subject aircraft. If validated, then voice coordination with the other IU reporting control is required to resolve the conflict. If the alerted controller determines that he no longer has control, he must manually terminate control to clear the conflict. Intended control shifts using the digital handover process between C2 IUs are an exception to this procedure.

5.11.5.3 Termination of Control

a. When control of an aircraft is handed over to a non-IU, or terminated without being assumed by another controlling unit, the controller shall manually terminate control of the aircraft.

b. When control of an aircraft is handed over to an IU using the interface digital handover process, the old controller does not manually terminate control. In this case, receipt of a Controlling Unit report from the new controlling IU automatically terminates the previous IU's control.

c. Termination of control does not automatically terminate engagements being conducted by the aircraft. These must be manually terminated if appropriate. When control is handed over digitally, the new controlling IU automatically accepts responsibility for reporting engagements in progress.

5.11.6 Digital Handover Procedures

a. Handover is defined as the coordinated transfer of controlling unit responsibilities for an aircraft from one controlling unit to another controlling unit. When the link interface is used for the transfer, the handover is a digital handover. The digital handover process permits the rapid transfer of control without any voice coordination between the IUs involved, including the aircraft if it is a nonC2 JU. However, use of voice coordination in conjunction with the digital handover process may be necessary, particularly when handing over an engaged aircraft.

b. There are four different methods of initiating the digital handover process depending on who decides a handover is necessary. These are summarized briefly below, and detailed procedures for each are provided in subsequent paragraphs.

(1) Assume Control Request: The current controlling C2 IU requests another C2 IU to assume control.

(2) Transfer Control Request: A C2 IU requests the current controlling C2 IU to transfer control to him.

(3) Assume Control Command (Link 16 only): The appropriate commander directs a C2 IU to assume control of an aircraft that is currently controlled by another C2 IU or is not under control.

(4) Transfer Control Command: The appropriate commander directs the current controlling C2 IU to transfer control to another C2 IU.

c. Throughout these procedures, the following abbreviations are used for brevity:

(1) Current Controlling IU (CCU): The C2 IU controlling the aircraft when the digital handover process is initiated.

(2) New Controlling IU (NCU): The C2 IU receiving the transfer and control when the digital handover process is completed successfully.

d. Aircraft includes a single aircraft or all aircraft in a flight. However, when a flight is handed over, only the TN of the flight leader is used in the handover process.

5.11.6.1 Assume Control Request Procedures. This is the most common handover method. It is used when an aircraft flies to another C2 IU's AOR, when the CCU can no longer control an aircraft effectively, when a CCU recognizes an NCU can better utilize the aircraft, or when directed to counter an imminent threat or otherwise reallocate air assets. The step-by-step procedures are as follows:

a. CCU initiates Assume Control Request to NCU specifying the aircraft TN. The request automatically includes any engagement or pairing TN. An aircraft is engaged if its current status is “Weapon Assigned” or “Engaging.” Only one target can be included in the request. If the aircraft is engaged to multiple targets, the NCU should already hold all engagements that have been reported to the interface. However, voice coordination should be conducted to ensure the NCU is aware of all engagements. The following information about the aircraft is also automatically included in the request, if available:

(1) Voice Call Sign.

(2) Link 4A Address.

(3) Mission Correlator (Link 16 only) or Mission Number (Link 11/11B only). (For an Inter-link handover, these cannot be forwarded. They should be provided by voice, if available.)

(4) Aircraft type, fuel status, and weapon inventory. (This information will normally already be held by the NCU, due to IU or controlling unit aircraft status reporting.)

b. CCU awaits response from NCU; if none is received within a certain delay (system option), one of the following occurs:

(1) Non-receipt alert - indicates the NCU did not receive the request. The controller should check if the NCU is active. If so, reinitiate the request or use voice handover. (This alert is displayed if no acknowledgment or response is received.)

(2) No alert or reply - indicates the NCU received the handover request and is waiting for its operator action. After a reasonable delay, voice should be used to request that a reply be transmitted.

c. If the NCU's TDS cannot process the request, it automatically transmits a CANTPRO response without alerting the operator. Automatically one of the following reasons or no reason is included in the response:

(1) System Limitation. The number of handovers in progress, aircraft under control, or alerts/orders pending prohibits processing the digital handover request by the NCU.

(2) TN Not Held. The engaged aircraft or target TN is not held by the NCU.

(3) Aircraft Under Own Control. The subject aircraft is already under the NCU control.

(4) Unit not exercising Air Control Capability. The NCU does not have an air control capability or its air control capability is not available.

(5) Unacceptable ID. ID of the subject track is unacceptable for handover; e.g., HOSTILE, SUSPECT, or UNKNOWN track.

(6) Action Not Implemented (Link 16 only). The NCU does not implement the Assume Control Request capability.

d. For an inter-link handover, the FJU transmits a CANTPRO response under the following conditions, including the reason in the response:

(1) No MR. FJU did not receive a machine receipt from the NCU.

(2) Addressee Inactive. FJU holds the NCU as inactive.

e. If the NCU received and processed the request, the NCU controller shall respond with either a WILCO to indicate assuming control of subject aircraft, or a CANTCO to indicate control cannot be assumed. Before responding to an engaged handover request, the NCU controller should ascertain if the aircraft is conducting multiple engagements. A WILCO reply includes the control communications data to be used for control, as specified below. This information is either entered by the NCU controller or automatically by the TDS. If the NCU and CCU are JUs, the NCU may also request that the aircraft Squawk Flash or change to a specified Mode III IFF code to aid in positive identification. That information is automatically transmitted to the CCU in the WILCO reply, and the CCU then provides it to the aircraft. The communications information provided in the WILCO reply

indicates the type of control desired by the NCU, as follows:

(1) Link 16 Control: Link 16 control channel and either JTIDS/MIDS voice channel or UHF voice frequency.

(2) Link 4A Control: Link 4A frequency or channel and UHF voice frequency.

(3) Voice Control: UHF voice frequency only.

f. The CCU acts based on the NCU's reply, as follows:

(1) CANTPRO.

(a) Take corrective action based on the reason given for the CANTPRO, as feasible.

(b) If no reason was given, or if corrective action has been taken, the controller should ensure local procedures used were correct and reinitiate the handover.

(c) The controller at the NCU responding with the CANTPRO reply is not aware that the handover request was received and a CANTPRO was transmitted.

(d) If a second CANTPRO reply is received, make voice contact with the NCU to resolve the problem or abandon the handover attempt to this IU.

(2) CANTCO: The digital handover process is automatically terminated. Either abandon the attempt to handover the aircraft or handover to another C2 IU.

(3) WILCO: Instruct the aircraft to contact the NCU on the designated Link 16 control channel, Link 4A frequency or channel, or voice frequency designated by the NCU, using the procedures specified in Chapter 6.

g. After establishing control of the aircraft IAW Chapter 6, the NCU initiates controlling unit reporting for the aircraft. This consummates the handover. The NCU must continue an engagement if the aircraft was handed over in an engaged status, but continuance of a prior pairing is at the NCU's discretion.

h. A WILCO reply cannot be changed to a CANTCO or vice-versa. However, an assume control request may be cancelled by transmitting a handover cancellation request, as follows:

(1) The CCU may cancel an Assume Control Request prior to the receipt of the initial controlling unit report from the NCU. If the former CCU desires to regain control after receipt of the controlling unit report, it must initiate a Transfer Control Request to the NCU, as specified in paragraph 5.11.6.2.

(2) The NCU is not able to cancel an Assume Control Request. After sending the WILCO, the NCU controller must attempt to complete the handover and then may send an Assume Control Request to the former controlling IU or any other C2 IU. If the handover cannot be completed, the aircraft may be instructed to report to the CCU for control using procedures specified in Chapter 6. In this case, the CCU may cancel the Assume Control Request when the aircraft checks back in with him.

(3) The Handover Cancellation Request on Link 16 requires acknowledgment and response in the same manner as the handover request. However, a receiving controller should always WILCO the request. The CCU and NCU must use voice to resolve any response other than WILCO.

5.11.6.2 Transfer Control Request Procedures. The Transfer Control Request permits an IU to request control of an aircraft from the CCU. It is used when a C2 IU does not have sufficient air assets to counter imminent air threats within its AOR. The step-by-step procedures follow:

a. NCU initiates the Transfer Control Request to the CCU specifying the aircraft TN. The TDS does not transmit the request until the NCU controller takes console actions to enter or validate control communications information as specified below. If the NCU and CCU are JUs, the NCU may also request that the aircraft Squawk Flash or change to a specified Mode III IFF code to aid in positive ID. That information is automatically transmitted to the CCU in the Transfer Control Request, and the CCU provides it to the aircraft if the request is WILCOed. The communications information provided in the request indicates the type of control desired by the NCU, as follows:

(1) Link 16 Control: Link 16 control channel and either JTIDS/MIDS voice channel or UHF voice frequency.

(2) Link 4A Control: Link 4A frequency or channel and UHF voice frequency.

(3) Voice Control: UHF voice frequency only.

b. NCU awaits CCU response. If none is received within about 1 minute (System Option), one of the following occurs:

(1) Non receipt alert. Indicates the CCU did not receive the request. The controller should validate that the CCU is still active, and if so, reinitiate the request or use voice. (This alert is displayed if no acknowledgment or response is received.)

(2) No alert or reply. Indicates the CCU received the handover request and is waiting for its operator action. After a reasonable delay, voice communications should be used to request that a reply be transmitted.

c. TDS will automatically transmit a CANTPRO response without alerting the operator if the request cannot be processed. The most common in this type of handover is action not implemented. Otherwise, no reason is specified.

d. For an inter-link handover, the FJU transmits a CANTPRO response under the following conditions, including the reason in the response:

(1) No MR. FJU did not receive a machine receipt from the NCU.

(2) Addressee Inactive. FJU holds the NCU as inactive.

e. If the NCU receives a CANTPRO with no reason indicated, the controller should ensure local procedures used were correct and reinitiate the handover. The controller at the CCU responding with the CANTPRO reply is not aware that a handover request was received and a CANTPRO was transmitted. If a second CANTPRO reply is received the CCU should be contacted by voice to resolve the problem or abandon the attempt to receive a handover from this IU.

f. If the CCU received and processed the request, the CCU controller must respond with either a WILCO or a CANTCO. If the reply is WILCO, the CCU instructs the aircraft to contact the NCU on the Link 16 control channel, Link 4A frequency or channel, or voice frequency designated by the NCU, using the procedures specified in Chapter 6. If the reply is CANTCO, the digital handover is automatically terminated. The only NCU recourse is to request control of another aircraft.

g. After establishing communications and control of the aircraft IAW Chapter 6, the NCU initiates aircraft controlling unit reporting. This consummates the handover. The NCU must continue an engagement if the aircraft was handed over in an engaged status, but continuance of a prior pairing is at the NCU's discretion.

h. A WILCO reply cannot be changed to a CANTCO or vice-versa. However, a Transfer Control Request may be canceled by transmission of a Handover Cancellation Request, as follows:

(1) The NCU may attempt to cancel a transfer control request prior to transmitting the initial controlling unit report. However, if the CCU has already directed the aircraft to change control, the CCU controller should respond with a CANTCO to the cancellation request, and the handover process must continue. If the former NCU desires to relinquish control after initiating controlling unit reporting, it must initiate an Assume Control Request to any appropriate C2 IU.

(2) The CCU may cancel a transfer control request prior to receipt of the initial controlling unit report from the NCU, even if the CCU has already responded with a WILCO.

(3) The Handover Cancellation Request on Link 16 requires acknowledgment and response in the same manner as the handover request. However, a receiving controller should always WILCO the request except as indicated in (1) above. Voice must be used to resolve receipt of any response other than WILCO by the canceling IU.

5.11.6.3 Assume Control Command (Link 16 Only)

a. The Assume Control Command orders the addressed C2 JU to assume control of an aircraft that is either not currently under control, or is under the control of another IU. All command procedures in paragraph 5.11.1.2 apply.

b. If the response to the command is WILCO, control shall be assumed as follows:

(1) If the aircraft is not under control, the C2 JU shall initiate the assumption of control process as specified in Chapter 6.

(2) If the aircraft is currently under control, the C2 JU shall initiate the Transfer Control Request process.

c. CANTPRO command response may include the reason for the CANTPRO. Unless the reason dictates otherwise, the originating C2 JU should take appropriate action and reinitiate the command.

d. The commander ordering control to be assumed can monitor controlling unit reports for the aircraft to determine when the command has been carried out.

e. The Assume Control Command can only be transmitted between C2 JUs. Voice coordination must be used to direct a PU/RU to assume control of an aircraft.

5.11.6.4 Transfer Control Command

a. The Transfer Control Command orders the addressed controlling IU to transfer control of an aircraft to another IU.

b. If the response to the Command is WILCO, the addressed controlling IU shall initiate the Assume Control Request process.

c. If the response to the Command is CANTPRO, it may include the reason for the CANTPRO. Unless the reason dictates otherwise, the originating C2 IU should take appropriate action and reinitiate the Command.

d. The commander can determine when the transfer command has been carried out by monitoring controlling unit reports for the aircraft.

5.11.6.5 Voice Handover Procedures. A voice handover occurs when two IUs use voice communications to initiate and respond to a Handover Request. This type of handover requires no link data exchange; therefore, it can be completed between active and/or inactive units. The CCU or NCU may initiate the voice procedures. The procedural steps for the voice handover depend on the active and/or inactive status of the interface units. If either unit is digitally active in the interface, that unit will terminate or initiate appropriate data link messages. An IU is considered to be active in the interface if it is capable of transmitting and receiving digital information.

a. The CCU controller will provide the NCU controller with the following information by the voice net that has been designated for handovers:

(1) Voice call sign.

(2) Aircraft position (bearing and range from receiving unit or common reference point).

(3) Aircraft heading.

(4) Aircraft altitude (nearest 1000 feet).

(5) Aircraft TN (if both units are active).

b. The following amplifying information may be provided:

(1) Mission Number or Mission Correlator, type aircraft and flight.

(2) IFF/SIF Mode/Code.

(3) Speed.

(4) Paired/Engaged status.

(5) Weapon status.

(6) Fuel remaining and time to bingo.

(7) Link 4A address.

(8) Destination/target (to include intermediate points).

(9) Frequency designator, as appropriate.

c. The NCU controller will then pass the following information to the CCU controller:

(1) Frequency designator.

(2) IFF/SIF Mode III and code to be assigned after transfer.

(3) Time/position for handover.

d. The above coordination must be completed before the mission goes beyond CCU radar and communication range. In the absence of a voice coordination capability, the adjacent control unit's common frequency designator, aircraft altitude(s), and handover point as specified in the daily ATO will be passed to the pilot. During all handovers, the CCU will tell the pilot to

return to present frequency if no contact is made on the NCU's handover frequency designator.

e. The CCU controller, after the NCU controller has verified radar contact and accepted control (WILCO), will:

(1) Instruct the controlled aircraft to contact the NCU controller on the designated frequency.

(2) Transmit the Terminate Control Report and other status messages, as appropriate, if it is an active IU that has been transmitting controlling unit reports. If the aircraft is engaged, the Engagement Broken Report should be transmitted.

(3) Standby on the old frequency until the NCU controller reports by voice that it has control.

f. After accepting control (WILCO), the NCU controller will:

(1) Establish voice contact with the designated aircraft.

(2) Perform identification, as required.

(3) Report to CCU controller via voice when control has been established.

(4) Take action to transmit the Controlling Unit Report, Engagement Status, and other aircraft status reports as appropriate, if NCU is active in the interface and is assuming responsibility for controlling unit reporting.

5.11.7 Coordinating Engagements Within a MEZ

a. The integration of SAM and interceptor aircraft in air defense offer multiple, diverse weapons that provide mutual support and simultaneously compound the problems encountered by an attacking enemy. As a general procedure, interceptor aircraft should operate outside of a MEZ. This simplifies target identification within the MEZ, reduces the risk of fratricide and assures the SAM unit that all targets within the MEZ are potential threats.

b. During an intercept if the target appears to penetrate a MEZ prior to the interceptor completing the engagement, a Cover Command can be issued to

the SAM unit. This alerts the SAM unit to be prepared to engage the target if ordered.

c. Prior to a friendly aircraft penetrating a MEZ, a Weapons Hold should be issued to the SAM unit and voice coordination effected. An engaged interceptor whose target enters a MEZ may continue the intercept until the interceptor approaches the MEZ boundary. At this time two options exist, a Weapons Hold can be issued to the SAM unit and the intercept can continue, or a Break Engagement can be issued to the interceptor and the SAM issued an Engage order on the target. Close voice coordination is required when the interceptor penetrates the MEZ. In Weapons Hold, the SAM unit may fire in self-defense and the interceptor must be vectored away from the engagement.

NOTE: Weapons Hold can be transmitted by voice only.

d. Conflicts between SAMs and interceptors, not covered by operations orders, will be resolved through direction of the AADC depending on level of centralized control

5.11.7.1 Joint Coordination and Use of Airspace. Procedures for joint coordination and use of airspace are established by the ACA and published in the ACO.

5.11.8 Voice Cross-Tell Procedures. Whenever data link or computer failure results in IU data isolation, use voice procedures to exchange data with the designated unit. Between land-based units, other point-to-point communications may be used. During failure periods, when manual tell is required, normally only priority one data will be exchanged. However, when net loading permits, lower priority data will be exchanged. At the time of the failure, the FTC/TDC will instruct the failed unit to cross-tell his track picture to a designated interface unit, who will manually enter the data into the system as non-real-time tracks. For full procedures see APP1.

5.11.8.1 Priorities. The following four general priorities are established:

a. Priority One. Air tracks within 50 miles of the surveillance area perimeter that are a potential threat to another IU. Tracks will be reported in the following priority sequence:

(1) EMERGENCY.

(2) HOSTILE.

(3) SUSPECT.

(4) UNKNOWN.

(5) FRIENDLY Fighter/Interceptor.

b. Priority Two. All remaining tracks within 50 miles of the surveillance area perimeter.

c. Priority Three. All remaining air tracks within the surveillance area.

d. Priority Four. Other track categories upon request.

5.11.8.2 Priority Reporting. Priority one tracks will be passed as soon as possible after detection until the element receiving track reports accepts tracking responsibility or until otherwise directed.

5.11.8.3 Bearing and Range (BRG/RNG). This reporting system will report track position as follows - bearing in degrees from a reference point, followed by the reference point designator and nautical miles. All bearings will be reported as magnetic unless otherwise specified. For example, to report a position 180 degrees magnetic from point “AA” at 32 nautical miles, the correct voice report would be 180 AA 32 (stated “ONE EIGHT ZERO ALPHA ALPHA THIRTY-TWO” or “ONE EIGHT THREE TRUE ALPHA ALPHA THIRTY-TWO” with three degrees east magnetic variation).

5.11.8.3.1 Reference Points. Reference points will be specified by the AADC as double letters and may be standard reference points or significant geographic reference points.

5.11.8.3.2 Standard Reference Points. The standard reference points within the interface are:

a. TT: Originator's present position.

b. XX: The standard position established by the AADC on which a search, enemy reporting, and so forth are based.

c. YY: Addressee's present position.

d. ZZ: The center of the interface as designated by the AADC.

5.11.8.3.3 Track Reference. Units in a manual mode of operation will use their appropriate call signs to report air contacts. Air contacts will be reported sequentially until an IU assigns a TN. (Example: New Bogey, India Lima one, India Lima two, etc.).

5.11.9 Manual Tell Formats. Manual tell formats are as follows:

5.11.9.1 Initial Report Format.

5.11.9.1.1 Format

a. ID (hostile, friendly, etc.).

b. Position (BRG/RNG).

c. TN or Track Reference.

d. Time (minutes after the hour).

e. Course.

f. Raid Size (Strength).

g. Altitude (feet in 1000).

h. Speed (knots).

i. Remarks (squawk, weapons assigned, etc.).

5.11.9.1.2 Example. (Station called) this is (station calling) New Hostile 180 AA 32, Track 0247, Time 40, Course 150, Altitude 35, Speed 450, over.

5.11.9.2 Update/Amplifying Reports. Priority tracks will be updated every 2 minutes. All others will be updated every 5 minutes. Additionally, amplifying reports will be transmitted when one or more of the following occurs:

a. Change in classification.

b. Course alters more than 20 degrees.

c. Speed changes by more than 50 knots.

d. Altitude changes 2000 feet or more.

5.11.9.2.1 Format

a. ID.

b. TN or Track Reference.

c. Position.

d. Time.

e. Course.

f. Raid Size (Strength).

g. Altitude (feet in 1000).

h. Speed (knots).

i. Remarks.

5.11.9.2.2 Example. (Station called) this is (station calling) Hostile Track 0247, 180 AA 35, Time 49, Course 125, over.

5.11.9.3 Engagement Report. Engagement report is issued only if no weapons were assigned when the initial report was made.

5.11.9.3.1 Format

a. ID.

b. TN or Track Reference.

c. Position.

d. Time.

e. Weapon.

f. Remarks.

5.11.9.3.2 Example. (Station called) this is (station calling) Hostile Track 0247, 180 AA 32, Time 49, CAP Station 2, over.

5.11.9.4 Splash/Grand Slam/Heads-Up Report. Splash/Grand Slam/Heads-Up Report is sent by the reporting unit when a raid is splashed, is grand slammed, penetrates the picket line, enters an adjoining sector, or cannot be engaged. Grand slam reports are authority to remove subject raids from the priority one reporting criteria.

5.11.9.4.1 Format

a. Splash.

b. ID.

c. TN or Track Reference.

d. Position (Heads-up reports only).

e. Time.

f. Weapon.

g. Remarks.

5.11.9.4.2 Examples

a. (Station called) this is (station calling) Splash Hostile Track 0247, Time 52, CAP, over.

b. (Station called) this is (station calling) Grand Slam Hostile Track 0247, Time 55, Missile, over.

c. (Station called) this is (station calling) Heads-Up Hostile Track 0247, 180 AA 32, Time 55, Heads-Up (stations called), over.

5.11.9.5 Hold Report. Hold report is used by the element having contact on a track after the reporting unit has lost contact or by a unit in a better position to track the contact. The unit initiating a Hold report assumes tracking responsibility by no weapons release authority.

5.11.9.5.1 Format

a. “Hold”.

b. ID.

c. TN or Track Reference.

d. Position.

e. Time.

f. Remarks.

5.11.9.5.2 Example. (Station called) this is (Station calling) Hold Hostile Track 0247, 180 AA 32, Time 57, over.

5.11.9.6 CAP Position Report. CAP position reports are made after the CAP is under close control of the assigned control units. Controlling units will not report CAP positions unless the CAP is outside of its assigned sector. When the CAP is returning to base, the controlling unit will send position reports of the CAP every 3 minutes until the CAP is under terminal control.

5.11.9.6.1 Format

a. ID.

b. Call Sign.

c. Position.

d. Time.

e. Remarks.

5.11.9.6.2 Example. (Station called) this is (station calling) Friendly, Gunslinger 15, 180 AA 32, Time 16, CAP, out.

5.12 Threat Warning Information (Link 16 Only)

5.12.1 General. Threat warning information is exchanged on the interface to provide immediate notification of impending hostile threats. This information should include the threat location, its environment, the threat type, threat

posture, its course, speed, and altitude, and the target of the threat.

5.12.2 Immediate Threat Reporting. Any C2 JU with knowledge of an immediate threat against another friendly unit can originate a Threat Warning. This warning can be sent even though the Threat Warning track is not currently being reported on the interface. However, if the track is not currently on the interface, the Threat Warning track should immediately be followed by a normal surveillance track. In all cases the threat track and the surveillance track should have the same TN. NonC2 JUs are not able to originate a threat warning unless the Threat TN is already being reported on the interface.

5.12.3 Threat Warning Addressing. When possible, the threat warning should be addressed to the unit responsible for the protection of the targeted unit (this may be the unit itself). The message is sent to the collective address when:

a. The originator is in doubt as to the unit assigned to protect the targeted unit.

b. When the target unit is not a JU.

c. The threat is general in nature and applies to many JUs.

NOTE: Originators should be aware that some NonC2 JUs may only have a capability to receive and display Threat Warnings where own unit is specified as the target.

5.12.4 Threat Warning Termination. When the threat is no longer deemed to be immediate or is no longer a threat, it is canceled by sending a Threat Warning Cancellation. The Threat Warning Cancellation has no bearing on the surveillance track of the same TN.

CHAPTER 6

LINK 16/4 AIR CONTROL PROCEDURES

6.1 Introduction

a. Air control refers to the function of a unit controlling one or more aircraft. Control may be made through digital or voice means. Voice control of high performance aircraft has the advantages that controller intentions can be made as explicit as language allows; and information and orders can be broadcast and received by all units listening to the radio channel. Disadvantages of voice control are lack of EMCON facilities, vulnerability to ECM and the need to duplicate verbal instructions and orders onto data links for wider dissemination. Digital control allows for secure, ECM resistant transmissions while also allowing for the dissemination of this data onto other data links. Digital control is limited by the need to have pre-formatted messages that may introduce ambiguity into the data exchange. Digital control is heavily dependant on interoperability and the co-ordinated implementation by all units of the applicable message standards. The choice between voice and digital means to control aircraft is dependant on many factors including the equipment configuration in the relevant aircraft, the degree of security and ECM resistance required and the specific scenario. This chapter will deal with control of aircraft by digital means. The data links available are MIDS/Link 16 and Link 4A. Link 4C is a separate fighter-to-fighter link and is discussed in Appendix A. Some C2 platforms are limited to their current Link 4A capabilities. However, they can control aircraft on either Link 4A or Link 16 subject to Link 4A limitations. Platforms that have a full Link 16 air control implementation are described with the descriptor (Link 16 Only).

b. Link 4A provides a high-capacity network for automatic data processing; however, data is not encrypted and is considered susceptible to interception, deception, and jamming. Link 16, by comparison, is an encrypted, high capacity system that is jam resistant and utilizes an extremely high data rate, resulting in more air control capability when implemented fully. The Air Force fighter aircraft are not equipped with Link 4A. For detailed information on Link 4A, see Appendix G in the classified supplement.

c. Link 16 allows for control functions and digitized voice channels to be allocated to different NPG net numbers for each group of users. For operational brevity and clarity throughout this chapter, the term “control channel” means Link 16 control NPG, and the term “voice channel” refers to the two voice NPGs. The control channel is a number between 0 and 126. The voice channels are either A or B followed by a number between 0 and 126.

d. Digital control is tactical control and should not be confused with air traffic control that may be given by the same unit. Tactical control involves the exchange of tactical data, orders and status. Air Traffic control involves both civilian and military air traffic services providing airspace control. In this chapter, control is taken to mean tactical control. An aircraft may be under air traffic control of one unit and tactical control of another; similarly, tactical control does not imply explicit air traffic control.

e. In this chapter, controller means the operator on the C2 JU, which may be a surface, land or air vehicle. Aircrew means the operator in the nonC2 aircraft that is to be controlled by the C2 JU.

f. A formation of aircraft operates with a designated flight leader. Controlled aircraft can operate in two different modes. In the first mode, the flight leader will respond to any order for the whole formation. Each element of the formation will have access to the assignment or order from the C2 JU. In the second mode, each element of the formation does not have automatic access to assignments and orders and needs to be individually addressed.

6.2 Link 4A and Link 16 Air Control Capabilities Relationship

a. Link 16 provides many new as well as duplicate aircraft control capabilities as Link 4A, except for the Automatic Carrier Landing System (ACLS) capabilities. Link 16 will eventually replace Link 4A. Controlling units and aircraft equipped with Link 4A that also have Link 16 may retain the full Link 4A capability until the Link 4A only platforms are replaced. Technically, both data links can be used at the same time, however from an operational perspective control is offered on only one data link.

b. Capabilities and procedures in this chapter generally apply regardless of whether control is performed via Link 4A or Link 16. However, capabilities and procedures that are limited to one link are so annotated. The following notations are used for brevity:

(1) Link 16 Only. Applies only to Link 16 air control by a controlling unit using Link 16.

(2) Link 4A Only. Applies only to Link 4A air control by a controlling unit using Link 4A.

c. Controllers must be aware that unique capabilities and procedures annotated “Link 16 only” cannot be used when controlling via Link 4A. All

must be aware that unique capabilities and procedures annotated "Link 4A only" cannot be used when controlling via Link 16.

6.3 Air Control Concepts. Link 4A control can be conducted as one or two-way communications between controller and controlled aircraft. Link 16 communications and control between controller and aircraft are conducted on the Control NPG. Each controlling unit and its complement of aircraft communicate on a specified frequency in the case of Link 4A or a specified control channel independent of all other controllers and aircraft operating on other nets of the Control NPG in the case of Link 16. Controlling units must operate only on their assigned control channel. Any attempt to operate on another units assigned control channel will disrupt air control operations. Air control data link message capabilities are as follows:

a. Mission assignments.

b. Vectors.

c. Flight path information (Link 16 Only).

d. Controlling unit change orders.

e. Track and target correlation information.

f. Target reporting.

6.3.1 Uplink/Backlink Operation. Conceptually, air control can be divided into an uplink from the controller and a backlink from the controlled aircraft. On Link 4A, the uplink transmits messages from the controller to the aircraft. For two-way Link 4A, backlink transmits from the aircraft to the controller. On Link 16, each controller and its complement of aircraft operate independently of other controllers and in addition, the controlling unit reports to other controlling units the status and intentions of its controlled aircraft. Procedures for coordination between controllers are specified in Paragraph 5.11. This communication is done on the Mission Management NPGs and is dealt with in Chapter 5.

a. The Link 16 air control uplink supports one controller with dedicated access to the net for transmission of its information. This information consists of broadcast and addressed messages. Mission assignments to a particular aircraft or formation are addressed. Track information via the uplink is generally sent to the collective address. On Link 4A, all messages are addressed to specific aircraft; however, some control systems can enter

multiple aircraft addresses to send the same data link vector message information to more than one aircraft. Link 16 air control uplink accommodates requirements for controlling units and controlled aircraft capabilities that vary by Service equipment, desired update rates, and the quantity of participants. The uplink may be used for track reports, mission assignments, vectors, Handovers, engagement status, and correlation determinations. Networks are tailored to meet the requirements of the anticipated participants and tactical environments as determined by operational commanders.

b. The Link 16 air control backlink accommodates the transmission of aircraft sensor data and engagement status to the controlling unit. Aircraft sensor data can be used by the controlling unit to augment the surveillance picture. Engagement status is used for both situational awareness by the controlling unit and for transmission on the Weapons Coordination and Mission Management NPG.

6.3.2 Surveillance/Engagement Status Monitoring. All controlled aircraft are required to monitor the Surveillance NPG for track information and the Weapon Coordination and Management NPG for engagement status information. Uplinking tracks will still be required when controlling via Link 4A. Some aircraft may be able to suppress display of some or the entire surveillance picture. Some aircraft may also filter by ID.

6.3.3 Aircrew Response to Uplink Messages. Aircrew shall respond to addressed messages from a controlling unit. The response may be WILCO, HAVCO or CANTCO. CANTPRO will be transmitted automatically by the aircraft's terminal as determined by the implementation of the platform. Failure to respond to the controlling unit will cause alerts to be displayed to the operator and the need to rely on voice to confirm the aircrew response.

6.4 Air Control Initiation. Air control initiation is establishing digital communications and control between controller and aircraft on Link 4A or a Link 16 air control net.

6.4.1 Link 4A Control Initiation

a. Either the controlling unit or the controlled aircraft may request Link 4A operation using the voice transmission "Request Dolly." The response is "Roger Dolly" or "Unable Dolly," depending upon Link 4A equipment status. If equipment is operational in both units, the controller pairs the Link 4A aircraft to the initial destination. Upon receipt of Link 4A data, the aircraft reports "Dolly Sweet." If no data is received, the voice response should be "Negative

Dolly," and both units will conduct equipment diagnostics and voice reports to attain Link 4A communications.

b. Controller TDS console operations depend upon the type and number of aircraft being controlled. If equipment permits, a controller may enter flight leader and wingman data link (Link 4A) addresses on a single TDS symbol. Both aircraft will then receive the same Link 4A data. If equipment does not provide this capability, then separate symbols should be entered for each aircraft, with separate Link 4A addresses. When operating with two-way aircraft, in the case of two aircraft with a single symbol, the second aircraft must operate in one-way (cancel reply) mode.

c. Once Link 4A control is established, voice communications should be kept to a minimum. In the event Link 4A is disestablished, voice control may be conducted on a non-secure voice circuit. If equipment is available, Link 4A coordination to establish the data link should be conducted on a secure circuit.

6.4.2 Link 16 Air Control Initiation

a. Two options exist for the use of timeslots on the Control NPG - static and dynamic. Static air control net management uses time slot assignments given to each aircraft at initialization. Dynamic air control net management is detailed below in paragraph 6.4.2.1.b. Static or dynamic air control net management is specified in individual networks and the decision to use the options is made during Pre-mission Planning. Not all aircraft can conduct dynamic air control.

b. Either the controller or the aircrew can initiate the assume-control sequence. The controller initiates control by designating the aircraft for control on its display. The aircrew initiates control by selecting the Control Channel assigned to the desired controlling unit.

6.4.2.1 Aircraft-Initiated Control Request

a. To prepare for Air Control operations, the controller selects the assigned Control Channel that was designated during pre-mission planning. A Control Request is automatically or manually transmitted after the aircrew selects the appropriate Control Channel and nominates a specific C2 JU. The Control Request causes an alert for the controller who shall either designate a particular aircraft as a controlled aircraft, or reply CANTCO if unable to take control. Once the controller has designated a particular aircraft as a "controlled aircraft," in the case of static net management, a WILCO to the

Control Request from the aircraft is automatically transmitted, and the assumption of control is complete.

b. In the case of dynamic Air Control net management, time-slot block assignments that are used on the Control NPG are provided to the C2 JU in the Link 16 network initialization process. If the controller attempts to take control and no time-slot assignments are available, the controller is notified that the "file is full," whereupon he can either make a time-slot assignment available (delete controlled status of another aircraft) or send a CANTCO reply to the aircraft request. If time-slot assignments are available (or made available), the controller sends the assignment to the aircraft then sends a WILCO reply to the Control Request from the aircraft and the assumption of control is complete.

c. The aircrew uses aircraft controls and displays to select the Air Control function and the assigned controlling unit's Control Channel. In the case of dynamic Air Control net management, this places the aircraft in the uplink receive mode awaiting the reception of the time slot-block assignment message that clears previous transmit assignments and provides new transmit assignments on this net. After receiving a time-slot assignment and completing the control assumption process the aircraft may receive mission assignment messages from the controller. Selection of a new Control Channel or processing of a Change Control message from a C2 JU initiates the aircraft Control Request process. A CANTPRO, CANTCO or no response from the C2 JU to the aircraft Control Request generates an alert to the aircrew and requires voice coordination with the C2 JU. Voice coordination may be required to determine the TN of a prospective controlling unit or other data.

d. If the controller assigns time slots to an aircraft prior to receipt of a Control Request, the controller can initiate transmission of a mission assignment. However, some C2 systems will indicate to the operator that two-way control has not been established.

6.4.2.2 Controller-Initiated Control Request. The C2 JU designates an aircraft for control, which causes a Control Change Order to be transmitted to the aircraft. This order contains all the control communications information needed for the aircraft to contact the controller. Once the aircraft is on the assigned Control Channel, it transmits a Control Request. The subsequent procedure is identical to the Aircraft-initiated Control Request described in paragraph 6.4.2.1.

6.5 Aircraft Handover Procedures. Procedures for coordination of aircraft handover between controlling units are specified in paragraph 5.11.6. The

following procedures are used between controlling units and controlled aircraft to execute Handovers.

6.5.1 Link 4A Handover

a. The Link 4A handover discrete is sent to an aircraft when the new controlling IU has replied positively that it will take control of the aircraft.

b. Upon receipt of the handover discrete on Link 4A, and voice confirmation if required, the aircrew switches automatically or as briefed to the primary Link 4A frequency assigned to the new controlling IU. The aircrew shall check in by voice on the assigned voice frequency and ensure that Link 4A is established in accordance with procedures in paragraph 6.4.1a.

c. The aircraft display loses tracks, points, and orders transmitted to the controlled aircraft by the original controlling IU upon shifting to the new controlling IU's Link 4A frequency. The new controlling IU must transmit selected new tracks, points, and orders upon taking control.

6.5.2 Link 16 Handover

a. When the Current Controlling Unit (CCU) receives a WILCO from the New Controlling Unit (NCU) for an Assume Control Request, or WILCOs a Transfer Control Request, it transmits a Control Change Order to the controlled aircraft. The aircrew is alerted upon receipt of the order. This order provides the NCU's TN and the type of control desired, as follows:

(1) Link 16 Control. Consists of the Control Channel and either JTIDS/MIDS Voice Channel or UHF Voice Frequency.

(2) Link 4A Control. Consists of the Link 4A Frequency or Channel and UHF Voice Frequency.

(3) Voice Control. Consists of UHF Voice Frequency only.

b. The Control Change Order may also provide the NCU's Voice Call Sign, a Mode III IFF/SIF code for aircraft use, and a squawk flash request.

c. Upon concurrence, the aircrew transmits a WILCO to the CCU. Then the aircrew selects the NCU's Control Channel (if Link 16 control is ordered) and transmits a Control Request to the NCU. The NCU designates the aircraft for control. The NCU transmits a WILCO to the Control Request, which completes control initiation. This detailed process is shown in Figure 6-1.

Action	CCU	NCU	Aircraft
1. CCU Transmits Control Change Order to aircraft. This provides the aircraft with necessary data to formulate the Control Request.			
2. Aircraft WILCOs the Control Change Order.			
3. Aircraft initiates a Control request to the NCU.			
4. NCU WILCOs the Aircraft Control request.			

Figure 6-1. Link 16 Handover Process between Controllers and Aircraft

d. If, during the handover process, no reply, or either a CANTCO or CANTPRO is received from the aircraft, the handover is terminated. If no reply is received, the operator should establish voice communications and/or reinitiate the request. If a CANTCO is received, then establish voice communications with the aircrew to determine the reason.

6.6 Procedures for Terminating Control. When control is terminated on an aircraft, the controller ensures the aircrew is informed and transmits Terminate Control to the interface. This is required when a voice handover is performed or when control is no longer required.

6.6.1 Terminating Link 4A Control. When a controller desires to terminate control of an aircraft, the controller will notify the aircrew by voice. Aircraft with multiple radios can be notified directly, otherwise a “Revert To Voice” discrete is sent to the aircraft so the Link 4A link can be broken and the aircrew reverts to voice. When control is terminated the “Terminate Control” will be sent to the interface relinquishing control. If terminating control is the result of a Handover to another control agency, the new control agency will transmit the Controlling Unit Report upon assumption of control and the old control agency will cease reporting control automatically.

6.6.2 Terminating Link 16 Control. The controller must send a Terminate Control order to the aircraft if the aircraft is not handed over to another controlling unit. The controller is alerted if the aircraft does not respond or responds negatively. If this occurs, the controller coordinates by voice or attempts to re-establish control by procedures delineated in paragraph 6.4.2.2.

6.7 Control Procedures. This section specifies procedures for assigning missions, transmitting vector information, and exchanging track data to conduct air control operations, both air support and air defense, once control has been established. The procedures are the same for Link 4A and Link 16 control, unless otherwise specified. The successful use of data link for air control requires the controlling unit and the controlled aircraft to operate as a total system. The controlling unit and the aircraft shall use the following procedures:

a. Once two-way data link communications have been initiated, the controlled aircraft automatically transmits reports to the controlling unit.

b. The controlling unit may designate high-interest tracks to controlled aircraft via the uplink, even though the aircraft monitors the Surveillance NPG. This ensures that the aircraft does not filter tracks that the controlling unit has determined are of high interest to the controlled aircraft. The use of this facility is to be carefully controlled to prevent display overload in the controlled aircraft. It is possible for some fighters to suppress any track on the basis of ID.

c. All controlling C2 JUs must have the ability to correlate nonC2 target reports and surveillance tracks. The controlling unit automatically attempts to correlate/decorrelate targets received from the aircraft to local/remote tracks. Aircraft receive correlated and decorrelated information by uplink. Currently, Air Force C2 JUs are unable to accept radar targets transmitted on the backlink by controlled fighters for correlation. Further, Air Force nonC^2JUs are unable to receive correlation and decorrelation information by uplink.

d. Except when reporting exercise alert states (TBD), the setting of the Exercise Indicator in control messages applies to the exercise status of the track/target. When authorized, operators may report artificial values for Specific Type data only. Operators receiving control messages with exercise status set are to assume that the values reported for the above data are artificial and for exercise purposes only. All other data is to be considered real. On termination of exercise status, all artificial data will be cleared immediately and replaced with real data as it becomes available.

6.7.1 Mission Assignments. Mission assignments are transmitted to controlled aircraft. Aircraft under two-way control respond WILCO, HAVCO or CANTCO. CANTPRO is an automatic terminal response; HAVCO may also be automatically transmitted in certain response situations. The following

Mission Assignment orders to an aircraft are available to a controlling unit, regardless of the link being utilized.

a. Identify a specific target by any means available.

b. Engage.

c. Priority Kill.

d. Break engagement.

e. Contact a new controlling unit.

f. Orbit at a specified position.

g. Return to base.

h. Go to Voice.

6.7.1.1 Data Link Terminology Differences. Link 4A and Link 16 terms differ for some of the above orders. Table 6-1 defines discrete terms described in the previous paragraph, when passed over either link.

Table 6-1. Common Link 4A and Link 16 Mission Assignments

Link 4A	Link 16
Challenge [1]	Investigate/Interrogate
Engage [1]	Engage
Priority Kill	Priority Kill
Cancel Engage/Priority Kill	Break engagement
Handover	
Orbit	Orbit
RTB	Return to Base
Go to Voice	Go to Voice
[1] This Mission Assignment is accompanied by a vector and the intercept method.	

6.7.1.2 Link 16 Mission Assignments. In addition to the common mission assignments provided for data link air control, Link 16 provides a controlling

unit additional capabilities for detailed mission assignments. Table 6-2 lists those additional assignments.

6.7.1.3 Mission Assignment Procedures. Specific controlling unit and aircrew procedures for each of the missions are provided in the following paragraphs. Controlling units should be aware that some aircraft are not capable of performing all missions listed. Controlling units should also be aware that some aircraft are not capable of processing more than one assignment/engagement at a time. For these aircraft, a second assignment/engagement, if accepted, will override the display of the first assignment. The objective of a mission assignment is represented by a single track and TN. A mission assignment applies to one group only. The procedures for multiple targeting of a flight of fighters vary significantly between different platforms. USAF aircraft can accept only one mission assignment at a time.

a. Identify. A controlling unit will designate a target by its TN and transmit Challenge (Link 4A) or Investigate/Interrogate (Link 16) to a controlled aircraft. The aircrew shall respond WILCO or CANTCO via data link or voice. If WILCO is transmitted the controlled aircraft will attempt to identify the designated target and report the ID to the controlling unit. If CANTCO is transmitted the aircraft will coordinate with the controlling unit via voice. The ID of the designated target may be passed by the nonC2 JU aircraft by assigning an ID to an own sensor track, where this capability exists, by voice or by use of alphanumeric free text messages, where this capability exists.

b. Engage and Priority Kill. A controlling unit can order an aircraft to destroy a specific target. Target location is provided in the order. The controlling unit can manually enter detailed target information. TN designation will be automatically sent to the aircraft. The aircrew shall respond WILCO or CANTCO if the order was received via data link and the link is operating in two-way mode. Controlling units may transmit a vector to the target; however, tactical decisions regarding the implementation of the engagement including disposition of forces and attack paths should be left to the aircraft. Priority Kill is to be taken as an order to engage that target before all other assignments and to treat the engagement as the highest priority action for the aircraft.

Table 6-2. Additional Link 16 Mission Assignments

Mission Assignments	Actions
Refuel	Directs an aircraft to an airborne tanker or other refueling location, includes altitude, if known.
Recall	Cancels any previous mission assignment, (except Engage, Priority Kill, Clear to Drop or Attack) and recalls the aircraft to a specific location to await further assignment. If no altitude or elevation is specified, the current altitude is assumed. This order is not used to direct an aircraft to proceed to a specific location to land. Return to Base is used for that purpose.
Clear to Drop	Provides clearance for a Tactical Air (TACAIR) Transport to drop its stores at a specific location.
Cease/Do not Drop	Orders a TACAIR Transport to stop dropping or not to drop any stores at a specific location.
Intervene	Orders an aircraft to divert a designated target aircraft from its intended flight path.
Divert	Orders an aircraft to cease its current mission and trajectory, except Engage, Attack, Priority Kill, or Clear to Drop and proceed to a specified location.
Air-to-Ground	Orders an aircraft to change its mission to air-to-Ground.
Air-to-Air	Orders an aircraft to change its mission to air-to-air.
Search and Rescue	Orders an aircraft to a SAR mission.
Combat Air Patrol	Orders an aircraft to a CAP mission.
Precision Bombing	Orders an aircraft to a precision bombing mission.
Laser Designation	Orders an aircraft to a laser designation mission.
Beacon Bombing	Orders an aircraft to a beacon bombing mission.
Close Air Support	Orders an aircraft to a CAS mission.
Interdiction	Orders an aircraft to a strike mission.
Aerial Reconnaissance	Orders an aircraft to a reconnaissance mission.
Escort	Orders an aircraft to escort another aircraft or flight.
Shadow	Orders an aircraft to maintain surveillance on a designated airborne target.
Weapons Free	Orders an aircraft weapon control status of Weapons Free. (Currently prohibited from use via data link.)
Weapons Tight	Orders an aircraft weapon control status of Weapons Tight. (Currently prohibited from use via data link.)

Table 6-2. Additional Link 16 Mission Assignments (continued)

Mission Assignments	Actions
Salvo/Clear Aircraft	Orders an aircraft to avoid a specified location.
Alert Condition White	Broadcasts an alert condition of White.
Alert Condition Yellow	Broadcasts an alert condition of Yellow.
Alert Condition Red	Broadcasts an alert condition of Red.
Cover	Orders an aircraft to maintain a position relative to a designated target from which a successful intercept can take effect, if needed.
Visual Identification	Orders an aircraft to visually identify a target.
Formal Alert/Counter Surprise	Promulgates Formal Alert and Counter Surprise conditions (not used by United States).
Go to Voice	Orders an aircraft to establish voice communications with its control agency.
High Interest Track	Orders an aircraft to automatically establish and maintain track data on a selected Surveillance Track.
Cancel High Interest Track	Orders an aircraft to cancel the high interest track designation on a specific Surveillance Track.
Sensor Target Reports ON	Orders an aircraft to report on the Control NPG all or specific sensor air targets.
Sensor Target Reports OFF	Orders an aircraft to cease Control NPG reporting of all or specific sensor air targets.
Cease Mission	Orders an aircraft to clear all previous orders against a specific target, except Engage/Priority Kill, Clear to Drop or Attack. These orders are to be canceled by Break Engagement, Cease/Do Not Drop, or Cease Attack respectively.
Suppression of Enemy Air Defense	Orders an ASO aircraft to a SEAD mission and provides target data.
Armed Reconnaissance	Orders an ASO aircraft to an armed Reconnaissance mission and provides target data.
Attack	Clears an ASO aircraft to attack the target and provide target data.
Cease Attack	Orders an ASO aircraft to cease attacking the target.
Related Mission Data	Provides an ASO aircraft additional target data on assigned target.
Counter Air Attack	Orders an ASO aircraft to a counter air attack mission.
Fighter Sweep	Orders an aircraft to a fighter sweep mission.

c. Break Engagement. A controlling unit can rescind an order to destroy a target with an order to break the engagement against that specific target. Because each break engage order is specific for a target, aircraft that previously received orders against more than one target may continue to engage the remaining targets in priority, if that information was passed as described in the previous paragraph. The aircrew shall respond WILCO or CANTCO. When the aircraft is within or close to weapon employment parameters, voice should be used in addition to the mission assignment.

d. Orbit. A controlling unit can order an aircraft to orbit either at its present position, at a position that includes an altitude, or a vector to the orbit position. The aircrew shall respond WILCO or CANTCO.

e. Return to Base (RTB). The controlling unit can order an aircraft or all aircraft on the control channel to return to a specific base with location information provided or as a general order without location. When a general RTB order is issued, the aircraft is to proceed to the pre-briefed recovery base. The aircrew shall respond WILCO or CANTCO.

f. Go to Voice. A controlling unit can direct an aircrew to contact him by voice. This is properly acknowledged by a voice transmission from the aircrew or directly on the data link with WILCO or CANTCO.

g. Refuel (Link 16 Only). A controlling unit can order an aircraft to refuel and designate a location and a TN to provide the refueling facility or tanker. Additional information on the track representing the facility or tanker is automatically provided, if available. The aircrew shall respond WILCO or CANTCO. The controlling unit may transmit a vector to the refueling point or tanker by a follow-on action.

h. Recall (Link 16 Only). A controlling unit can cancel a mission (except Engage/Priority Kill, Clear to Drop or Attack) and recall an aircraft or all aircraft on the control channel to a specific location by designating the location, as a minimum. If the designated recall point has been assigned a TN, then altitude, course, and speed, as available, are automatically transmitted. The aircrew shall respond WILCO or CANTCO.

i. Clear to Drop/Cease/Do Not Drop (Link 16 Only). A controlling unit can provide clearance for an aircraft on TACAIR Transport missions to drop stores, to stop dropping stores or not to drop stores at a specified location. The aircrew shall respond WILCO or CANTCO.

j. Intervene (Link 16 Only). A controlling unit can order an aircraft to intervene a target; i.e., cause the target to alter its intended flight path. To do so, the controlling unit must designate the air target that must have a TN. All available data associated with that track is provided automatically. The aircrew shall respond WILCO or CANTCO. If it is intended that the target be routed away from a specific area, that intention and the nominated area shall be passed to the aircraft by other means.

k. Divert (Link 16 Only). A controlling unit can order an aircraft to cease its current mission (except Engage/Priority Kill, Clear to Drop or Attack) and proceed to the designated location specified by a TN. The divert point altitude, course, and speed, as available, are also automatically provided. The aircrew shall respond WILCO or CANTCO.

l. Air-to-Ground and Air-to-Air (Link 16 Only). A controlling unit can send general mission assignments of Air-to-Ground or Air-to-Air to controlled aircraft. When sent to a multi-mission aircraft, these mission assignments direct the aircrew to change to the appropriate configuration. The aircrew shall respond WILCO or CANTCO.

m. Search and Rescue (Link 16 Only). A controlling unit can order an aircraft to a SAR mission. The SAR location, as a minimum, must be designated as the mission objective. If the objective has an assigned TN, it is automatically provided. The aircrew shall respond WILCO or CANTCO.

n. Combat Air Patrol (Link 16 Only). A controlling unit can order an aircraft to a CAP station, which must be designated with a TN. The location, course and speed, if applicable, of the station are provided automatically. The aircrew shall respond WILCO or CANTCO.

o. Precision Bombing (Link 16 Only). Some controlling units can order an ASO aircraft to a precision bombing mission. Target location is provided in the order. The controlling unit can manually enter detailed target information, or if a TN has already been assigned to the target, designation of the TN results in all information associated with the track being provided automatically. The aircrew shall respond WILCO or CANTCO.

p. Laser Designation (Link 16 Only). Some controlling units can order an ASO aircraft to a laser designation mission. The controlling unit can manually enter target and Laser Illuminator Code information. If a TN has already been assigned to the target, designation of the TN results in all information associated with the track being provided automatically. The aircrew shall respond WILCO or CANTCO.

q. Beacon Bombing (Link 16 Only). Some controlling units can order an ASO aircraft to a beacon-bombing mission and provide target and beacon mission data. This includes basic location and specific beacon bombing parameters. The aircrew shall respond WILCO or CANTCO.

r. Close Air Support (Link 16 Only). Some controlling units can order an ASO aircraft to conduct CAS missions. In addition to target information provided while assigning aircraft to other ASO missions, the controlling unit may also designate a contact point where the aircraft is to contact a Forward Air Controller (FAC) for close control in the target area. Communications information necessary to contact the FAC may be provided by Link 16; however, specific close control must be provided by Voice.

s. Interdiction (Link 16 Only). Some controlling units can order an ASO aircraft to an Interdiction mission. The controlling unit can also manually enter target data and location information. The aircrew shall respond WILCO or CANTCO.

t. Aerial Reconnaissance (Link 16 Only). Some controlling units can order an aircraft to a reconnaissance mission. The controlling unit can manually enter target data and location information. The aircrew shall respond WILCO or CANTCO.

u. Escort (Link 16 Only). A controlling unit can order an aircraft to escort another aircraft or flight. The controlling unit may manually send amplifying information about the aircraft or flight. The aircrew shall respond WILCO or CANTCO.

v. Shadow (Link 16 Only). A controlling unit can order an aircraft to maintain surveillance on a designated target. The controlling unit may manually send amplifying information about the target. The aircrew shall respond WILCO or CANTCO.

w. Weapons Control Status Orders and Alert Conditions (Link 16 Only). A controlling unit may have the capability to order an aircraft to assume a weapons control status of Weapons Free or Weapons Tight and to set an alert condition of White, Yellow, or Red, IAW operational doctrine. However, for reasons stated in subparagraph 5.11.1b, some controlling C2 JUs shall not originate the Weapons Free and Weapons Tight orders.

x. Formal Alert/Counter Surprise (Link 16 Only). A controlling unit can report Formal Alert/Counter Surprise State information to nonC2 JUs under

its control. Threat Warning Alert conditions of Red, Yellow or White may also be transmitted, along with information on the threat warning environment, if known. The nonC2 JU may be requested to respond with WILCO.

y. Salvo/Clear Aircraft (Link 16 Only). A controlling unit can transmit a Clear Aircraft order to an aircraft or to all aircraft on the control channel by designating a location specified as either a track, point, or an area that may have a TN, for the aircraft to depart or avoid. The aircrew shall respond WILCO or CANTCO. This order shall be followed by a Vector, either developed automatically or manually entered by the controlling unit, which allows the aircraft to clear most rapidly at the least risk. The brevity word for this order is SCRAM.

z. Cover (Link 16 Only). A controlling unit can order an aircraft to maintain position relative to a designated track from which a successful intercept can take effect if needed. Position and amplifying information apply to the target and not the relative position to be maintained. If specific relative position is to be maintained, then it is necessary to provide that information by other means; e.g., vector message or voice. The aircrew shall respond WILCO or CANTCO.

aa. Visual Identification (Link 16 Only). A controlling unit can order an aircraft to visually identify the target. The controlling unit can manually send position and amplifying information on the target. The aircrew shall respond WILCO or CANTCO. Digital control includes no method by which the identification result may be passed to the C2 JU; this shall be passed by voice or FTM.

bb. High-Interest Track (Link 16 Only). A controlling unit can designate a TN as high interest, either to a specific aircraft or to all of its controlled aircraft. Because the aircrew has no function to perform, no manual response is required. The controlling unit has the capability to cancel the high-interest track designation.

cc. Sensor Target Reports On/Off (Link 16 Only). A controlling unit can order an aircraft to stop target reporting on the Control NPG of specific TNs if target correlation has been made, or stop all target reporting. No aircrew action is necessary as a result of receiving this order. The controlling unit can also send an order of Cease Mission canceling this order and returning the aircraft to its default mode of reporting all targets. No target designation is necessary when sending the cancel order.

dd. Cease Mission (Link 16 Only). A controlling unit can clear all previous orders against a specific target sent to a controlled nonC2 JU aircraft, except for Engage, Priority Kill, Clear to Drop, or Attack, which can only be canceled by a Break Engagement, Cease/Do Not Drop, or Cease Attack order. This action may be necessary if aircrew requests all orders be cancelled to clear his system. The aircrew shall respond WILCO or CANTCO.

ee. Suppression of Enemy Air Defenses (SEAD) (Link 16 Only). A controlling unit can order an ASO aircraft to a SEAD mission. Target location is provided in the order. The controlling unit can manually enter detailed target information, or if a TN has already been assigned to the target, designation of the TN results in all information associated with the track being automatically sent to the aircraft. The aircrew shall respond WILCO or CANTCO.

ff. Armed Reconnaissance (Link 16 Only). A controlling unit can order an ASO aircraft to an Armed Reconnaissance mission. This mission differs from Aerial Reconnaissance by intentions to deliver ordnance when targets of opportunity are located. Target location information is provided in the order. The controlling unit can manually enter detailed target information, or if a TN has already been assigned to the target, designation of the TN results in all information associated with the track being automatically sent to the aircraft. The aircrew shall respond WILCO or CANTCO.

gg. Attack (Link 16 Only). Some units can order an ASO aircraft to attack a specific target. Attack is used in two distinct ways:

(1) As final execution authority for a previously assigned mission, e.g.; Precision Bombing, SEAD, Counter Air Attack, etc. This is used only if final execution authority is required by Rules of Engagement.

(2) For ASO missions other than CAS, to assign a new target with immediate authority to complete the mission. Target location information is provided with the order. The controlling unit can manually enter detailed target information, or if a TN has already been assigned to the target, designation of the TN results in information associated with the track being automatically sent to the aircraft. The aircrew shall respond WILCO or CANTCO.

hh. Cease Attack (Link 16 Only). Following a controlling unit's order to destroy a surface target, that order can be rescinded by an order to cease attack against that specific target. Since each cease attack order is target-specific, ASO aircraft that previously received orders against more than one

target may continue to engage the remaining targets. The aircrew shall respond WILCO or CANTCO.

ii. Related Mission Data (Link 16 Only). A C2 JU can provide an ASO aircraft with target-related data on a point or laser designator. The point's position and point type can also be provided to the aircraft.

jj. Counter Air Attack (Link 16 Only). A controlling unit can order an ASO aircraft to a counter air attack mission, i.e., attack enemy air assets and installations. Target location is provided in the order. The controlling unit can manually enter detailed target information, or if a TN has already been assigned to the target, designation of the TN results in all information associated with the track being automatically sent to the aircraft. The aircrew shall respond WILCO or CANTCO.

kk. Fighter Sweep (Link 16 Only). A controlling unit can order an aircraft to a fighter sweep mission. No target data is provided as the mission is designed to seek out and destroy targets of opportunity in the air. The aircrew shall respond WILCO or CANTCO. This Mission Assignment needs to be augmented by a route or an area to be swept and needs to specify a time bracket.

6.7.1.4 ASO Mission Types. This mission area includes, but is not limited to, Air Interdiction (AI), Battlefield Air Interdiction (BAI), Tactical Air Support for Maritime Operations (TASMO), Close Air Support (CAS), Precision Bombing, Laser Bombing, Suppression of Enemy Air Defenses (SEAD), Aerial and Armed Reconnaissance, and TACAIR Transport missions.

a. Air Interdiction and Battlefield Air Interdiction. AI and BAI are related activities because targets are in the same general environment. BAI targets have higher potential for near-term effect on friendly forces. Real-time coordination of weapon systems conducting either mission may be made via Link 16 by exchanging information between JUs to support, execute and report mission results.

b. Tactical Air Support for Maritime Operations. TASMO may consist of aerial mine laying, surveillance and reconnaissance, and interdiction of enemy naval surface forces, port facilities, and shipping. Surface situational awareness information is primarily available through Surveillance NPG monitoring. Target sorting information from nonC2 JUs may also be used. This mission overlaps aspects of other ASO activities and has unique objectives.

c. Close Air Support. Tactical aircraft performing CAS missions deliver ordnance against hostile forces that are in close proximity to friendly ground forces. ASO aircraft have an operational contact point location and an airborne or ground FAC. A controlling unit change may be transmitted to provide the CAS aircraft with required information to contact the FAC. Voice communication shall be provided for final control to the target.

d. Precision Bombing (Link 16 Only). A controlling unit can order an ASO aircraft to a Precision-bombing mission. Precision bombing requires an aircraft to fly a precise delivery course under the direction of a remote, precision guidance or sensor system. The remote system may transmit vector information to the aircraft. Precision vectors and drop information may be transmitted.

e. Laser Bombing (Link 16 Only). Some tactical aircraft employ laser-guided munitions. A controlling unit can order an ASO aircraft to a Laser bombing mission. Targets for these munitions shall be illuminated by a laser target designator. The aircraft may be vectored to the general location of the target/laser designator.

f. Suppression of Enemy Air Defenses (Link 16 Only). The purpose of the SEAD mission is to neutralize enemy air defenses in a specific area by physical attack or electronic attack (EA). A controlling unit can order an ASO aircraft to a SEAD mission. Controlling units can transmit EW parametric information on the Control NPG to provide near-real-time parametric EW data necessary to the aircraft for mission accomplishment. Some aircraft on EW SEAD missions can receive the EW parametric information to update weapon/EA equipment employment parameters.

g. Aerial Reconnaissance (Link 16 Only). The purpose of this mission is to obtain intelligence information by airborne sensors or visual means. A controlling unit can order an ASO aircraft to an Aerial Reconnaissance mission. Vector information may provide heading, speed, and altitude information to the aircrew, as required. Flight path information may provide the aircraft with sequential multiple-leg flight path information.

h. Armed Reconnaissance (Link 16 Only). This mission differs from Aerial Reconnaissance by intentions to deliver ordnance when targets of opportunity are located. A controlling unit can order an ASO aircraft to an Armed Reconnaissance mission.

i. TACAIR Transport. This mission transports passenger and cargo by aircraft.

j. Counter Air Attack (Link 16 Only). This mission ensures freedom of action for friendly forces and operations by damaging or destroying, enemy assets.

6.7.1.5 ASO Procedures (Link 16 Only). Some C2 JUs can control ASO aircraft and order ASO capable aircraft to perform specific missions and provide target information, including weather over assigned targets. Mission areas that are exclusively for ASO capable aircraft are specified in paragraph 6.7.1.3.ee through jj. Missions for Precision Bombing, Laser Designation, Interdiction, Aerial and Armed Reconnaissance, and SEAD can be individually selected for transmission to the controlled ASO aircraft. ASO aircraft, operating under two-way control, shall acknowledge all mission orders with WILCO or CANTCO. The controlling unit can manually enter detailed target information, or if a TN has already been assigned to the target, designation of the TN results in all information associated with the track being automatically sent to the aircraft. The authorized controlling unit may clear the aircraft to attack a TN-designated target. The Attack order could be the only order sent to an aircraft if the mission assignment was made by pre-brief or other means; target data may be provided in the same way as the initial assignment to the mission. The controller may cancel any previous Attack order by console action of designating the target for a Cease Attack order.

6.7.1.6 Situational Awareness (SA) (Link 16 Only). All aircraft performing ASO missions shall monitor the surveillance NPG for situational awareness. Air, surface, and land tracks, as well as reference and land points are received and processed to provide surface enemy and friendly force information, target descriptions, and locations. Aircraft with SEAD mission capability may receive EW information. Aircraft conducting ASO missions receive lines and areas for situational awareness. This information is updated primarily on the Surveillance NPG.

6.7.1.7 Ordering Mission Assignments (Link 16 Only). A controlling unit can order each type of air-to-ground delivery, change missions and provide targeting data. Additionally, an aircraft conducting ASO missions may send and receive inter-flight and intra-flight orders. Missions may be assigned by using a LOB. Amplifying information on LOBs such as target elevation and bearing origin may also be provided. Aircrews in receipt of mission assignment orders are required to acknowledge the order WILCO or CANTCO, if under two-way control.

6.7.1.8 Target Location (Link 16 Only). ASO missions are supported by location information. The surveillance information on a target is the primary

source of situational awareness for aircraft. Location information may expand position and elevation to provide precision of approximately 4 feet in all three dimensions.

6.7.1.9 Target Description (Link 16 Only). Some controlling units can pass general target environment to ASO aircraft. Specific target descriptions may also be provided, e.g., environment/category and specific type. Information such as course, speed and exercise status may be passed as appropriate.

6.7.1.10 Target Defense (Link 16 Only). Target defense information is primarily available to an aircraft by monitoring the Surveillance NPG. Additionally, a controlling unit may provide target defense information directly to the controlled aircraft. Location of these defenses is also provided.

6.7.1.11 Weather (Link 16 Only). Controlling units may broadcast weather information on the Control NPG to ASO aircraft operating in the target area. Visibility, wind direction and strength, cloud cover and height, altimeter setting and time of observation may be provided if data are available.

6.7.1.12 Aircraft Status (Link 16 Only). JUs may monitor the status of ASO aircraft. Real-time status is shown through the Airborne Indicator, Exercise Indicator, Mission Commander Indicator, Flight Leader Indicator, and MC fields. Additionally, the ASO aircraft position, activity and Mode III IFF/SIF Code provide other JUs with mission tracking information. JUs may also monitor real-time data on ordnance load, fuel, operational status, and on-board systems status. JUs can also monitor the expected time on target. A flight or group as a whole may be monitored or specific elements within the flight or group may be monitored individually.

6.7.1.13 Fighter-to-Fighter Communication (Link 16 Only). ASO aircraft may simultaneously operate on the Control and Fighter-to-Fighter NPG. They may be capable of assigning the following missions to other aircraft:

a. Recall.

b. Return to Base.

c. Clear to Drop.

d. Cease/Do Not Drop.

e. Air to Surface.

f. Air to Air.

g. Search and Rescue.

h. Combat Air Patrol.

i. Precision Bombing.

j. Laser Designation.

k. Beacon Bombing.

l. Close Air Support.

m. Interdiction.

n. Aerial Reconnaissance.

o. Visual Identification.

p. Go to Voice.

q. Suppression of Enemy Air Defenses.

r. Armed Reconnaissance.

s. Attack.

t. Cease Attack.

u. Related Mission Data.

v. Counter Air Attack.

w. Fighter Sweep.

x. Cease Mission.

6.7.1.14 Reporting Mission Results (Link 16 Only). ASO aircraft can provide the controlling unit with ASO mission results as described in paragraph 6.7.4.2 Engagement/Assignment Status Reporting.

6.7.1.15 Mission Assignments Issued by Controlled Aircraft. Assignments issued by fighters on fighter sensor ASO targets are accomplished by transmitting the Index Number for the engagements on targets reported by either the transmitting or receiving unit, or a Third Party fighter. The following types of assignments may be issued:

a. A first party assignment occurs when the fighter receiving the order has derived the target via onboard local sensors and is reporting the target via the link. Target data; e.g., Latitude, Longitude, Course, and Speed, shall not be reported.

b. A second party assignment occurs when the fighter that is transmitting the order has derived the target via onboard local sensors and is reporting the target via the link. All available target data shall be included.

c. A third party assignment occurs when neither the fighter transmitting the order nor the fighter receiving the order holds the target on local sensors. The target information is provided on the link by a third fighter. All available target data shall be included. Third party assignments will not be used for CAS.

6.7.1.16 Engagements Initiated by Controlled Aircraft. Engagements may be independently initiated by an aircraft on discovery of legitimate targets. The status of all such engagements shall be reported to the controlling unit.

6.7.2 Vector Procedures. Controlling units may transmit data link vectors to controlled aircraft. The vectors provide course, speed, and altitude, together with a discrete that describes the vector purpose. The controlling unit can take a manual action to include a request for WILCO or CANTCO response in the vector message. Table 6-3 provides a list of data link vector discretes and their meanings. General vectors can also be transmitted without specifying one of the vector discretes listed in the table. Vectors may be transmitted during any stage of a mission and are normally considered to be advisory in nature. However, for some activities a vector will be treated as a command and the aircrew will be required to respond with either WILCO or CANTCO. Some C2 systems will have the capability to automatically transmit a vector following a mission assignment against a specific target, track or point that is being reported on the interface.

Table 6-3. Data Link Vector Discretes

Vector Discrete	Description
Orbit Vector	A vector to an orbit position.
Command Control	Vector information that is mandatory for the aircraft.
Not Under Command	The aircraft is no longer being vectored by the sending unit. Ignore all course, altitude, and speed data. The sending unit retains control over the aircraft.
Collision/Cutoff Vector	A vector for a nearest collision intercept to a target.
Visual ID/Target Vector	A vector to perform a visual investigation or identification of a target.
Bug-out Heading	A vector that may be used to depart the area.
Join Up/Rendezvous (Link 16 only)	Orders an aircraft to join up or rendezvous.
Pursuit Vector	A vector for placing the aircraft in a position to pursue the target to an intercept.
Refuel Vector (Link 16 only)	A vector to a refueling rendezvous point or station.
Stern Vector	A vector for placing the aircraft in a rear hemisphere approach to the target.
Altitude Change Warning	An alert to the pilot that his assigned altitude has changed.
Course Change Warning	An alert to the pilot that his assigned course has changed.
Command Course Change	Orders a mandatory course change.
Command Altitude Change	Orders a mandatory altitude change.
Command Speed Change	Orders a mandatory speed change.
Revert to Voice	Orders the aircraft to establish voice contact with its controlling unit.

Table 6-3. Data Link Vector Discretes (continued)

Vector Discrete	Description
Landing Checklist	An alert to the pilot that the landing checklist should be completed.
CV Recovery Case I	Indicates the approach and recovery routes to the aircraft carrier are under visual meteorological conditions (VMC).
CV Recovery Case II	Indicates the approach and recovery routes to the aircraft carrier are varying between instrument meteorological conditions (IMC) and VMC.
CV Recovery Case III	Indicates the approach and recovery routes to the aircraft carrier are under IMC.
Field Condition VMC	Indicates the aircraft's destination field is under VMC.
Field Condition IMC	Indicates the aircraft's destination field is under IMC.

6.7.3 Flight Path Procedures (Link 16 Only). This capability is available for use in communicating flight path planning information to enhance aircrew mission execution.

6.7.3.1 Controlling Unit Capabilities. The controlling unit may provide multiple-leg flight path information to controlled aircraft by performing console actions to select waypoints along a flight path that are identified by a position, arrival/departure altitude(s), and arrival/departure time(s) associated with the waypoints. Up to 15 waypoints can be sent by selecting a starting waypoint, several sequential intermediate points, and a last point. The waypoints can be used to establish or modify a planned flight path. It is also possible to send designated boundaries of a restricted area with effective hot altitudes, and activation and deactivation times by using the flight path function. It may be necessary to augment the flight path by voice, depending on individual platform implementation.

6.7.3.2 Controlled Aircraft Capabilities. Flight path information sent from a controlling unit is displayed to the aircrew. If points are not received in the intended sequence or if there is a point missing, the aircraft automatically responds accordingly. Upon receiving notification that a required point was not received, the controlling unit is alerted and must perform console actions to transmit the entire flight path again. When the full flight path is received, the aircrew shall respond WILCO or CANTCO. The controlling unit should use voice communication to cancel any previously transmitted flight path information.

6.7.4 Target Reporting Procedures. Controlled aircraft provide target reports via voice, Link 4A, or Link 16 to their controlling unit or to other aircraft. Target reports can provide the location, altitude, velocity, ID, and status of a target. The controlling unit correlates targets reported by data link using a process called target sorting. Target sorting consists of five interactive areas:

a. Index Number Usage. Index Numbers provide a means for fighters to distinguish individual sensor contacts. Index Numbers are a block of 63 octal numbers, 01 through 77_8, assigned by the originating fighter. Fighters manage their own Index Numbers and associated target data. Index Numbers are assigned in sequential order and are not repeated until the entire block of 63 numbers has been used.

b. Acquiring, Updating, and Canceling Targets. Fighters report sensor target data on the Fighter-to-Fighter NPG. Fighters also have the capability to report selected sensor target data on the Control NPG. The controlling unit automatically monitors the fighter originated sensor targets and attempts to correlate them to existing surveillance tracks. Upon losing sensor contact, the fighter automatically cancels the sensor target. USAF nonC^2JUs will always report/exchange targets on the fighter to fighter NPG. Currently, USAF nonC^2JUs and Navy F-14Ds cannot report targets simultaneously on both the fighter to fighter NPG and the control NPG.

c. Engagements. Engagements of sensor targets/surveillance tracks may be ordered by controlling units, independently initiated by a fighter, or directed by another fighter. Some fighters can order or direct engagements among themselves. When operating in a flight or group, only one flight member, preferably the flight leader, should report engagement status on the Control NPG. A flight or group is a unit made up of aircraft that will execute orders as a single entity. The member reporting does so for the entire flight. This prevents any ambiguity in the engagement status reporting process that could be created by related reports from multiple sources. Disengaging should not be sent until the entire flight has broken the engagement. The four types of fighter-to-fighter ordered engagements are distinguished by whether fighters are reporting the target, receiving the target, providing radar illumination of the target, or using a surveillance track.

(1) A first party engagement occurs when the fighter receiving the order has derived the subject of the engagement via onboard local sensors and is reporting the target via the link. Target data (e.g., latitude, longitude, course, and speed) shall not be included in the assignment.

(2) A second party engagement occurs when the fighter that is sending the order has derived the subject of the engagement via onboard local sensors and is reporting the target via the link. All available target data shall be included.

(3) A third party engagement occurs when neither the fighter sending the order nor the fighter receiving the order holds the target on local sensors. A third fighter provides the subject of the engagement on the link. Third party assignments will not be used for CAS missions.

(4) A surveillance engagement occurs when no fighter holds the surveillance track on local sensors. The subject of the engagement is provided by monitoring the Surveillance NPG.

d. Pointers. A pointer provides the capability to designate a geographic position or track or target on a JU's display. Voice communications should specify why the pointer was transmitted.

e. Target Bearing Reporting. Some fighters are capable of passing sensor target information that has been derived from sensors that provide a bearing to the target. Targets derived in this manner include IR, ES, EA jam-strobes, and television (TV). As a minimum, origin of angles, angles to the target and time associated with the target data are always reported.

6.7.4.1 Target/Track Correlation. NonC2 aircraft report uncorrelated sensor targets using their own index numbers. The controlling unit makes all correlations. The controlling unit may automatically correlate/decorrelate aircraft reported sensor targets with own unit local and remote surveillance tracks. Sensor target reports from controlled aircraft that fail to meet the correlation criteria may be reported by the controlling unit as a new track on the Surveillance NPG. The controlling unit should then report the correlation of the target index number and the new surveillance TN to the controlled aircraft on the Control NPG. Target/Track correlation will be reported periodically on the Control NPG by the controlling unit and when any correlation data associated with the surveillance TN changes. Subsequent decorrelations will also be reported by the controlling unit. The controlling unit may correlate sensor targets from several aircraft to the same interface track. The controlling unit may elect to combine, or group into one track, more than one aircraft sensor contact from the same aircraft and provide strength data for a Surveillance Track. See Appendix A for TDS characteristics.

6.7.4.2 Engagement/Assignment Status Reporting. The status of engagements or ASO mission results are reported by controlled aircraft in

two-way operations. The controlling unit can report these engagements on the interface. On Link 4A, controlled aircraft can only report a missile in flight or a general engaged condition. ASO aircraft can report the following additional engagement status:

a. Engaging Target. The aircraft is engaging the target.

b. Investigating Target. The aircraft is attempting to identify the target.

c. Missile in Flight. The aircraft has launched an air-to-air missile.

d. Target Destroyed. The target is no longer a threat.

e. Disengaging Target/Track. The target is no longer being engaged.

f. Target Partially Destroyed.

g. Battle Damage Assessment Unknown.

h. Recommend Re-attack.

NOTE: Controlled aircraft performing as Mission Commander or Flight Leader may report mission results for the entire mission group or flight.

6.7.4.3 Additional Statuses. The following are additional statuses:

a. Heads Up. The target constitutes a threat to friendly forces. The controlled aircraft cannot assure complete destruction of the target.

b. Lock On. A radar lock on has been achieved on the target.

6.8 Fighter-to-Fighter Procedures. Fighter aircraft may share information on Fighter-to-Fighter NPG(s). Some fighters are capable of sharing information on a fighter-to-fighter data link. Prior to shifting from either Link 4A control or Link 16 control, the aircrew shall notify the controller of intent to do so. The controller must notify other units that control has been terminated. Procedures for each fighter-to-fighter data link are provided in the following paragraphs.

a. Fighters may operate simultaneously in the fighter-to-fighter and control data link mode. For the fighter to remain under control, communications are to be maintained between the formation and the controlling unit on the Control NPG. The nature of Link 16 networks allows

PPLI information to be continuously available to all participants. Engagement and status information of Engaging, Investigating, Target Destroyed, and Disengaging are transmitted when initiated by the aircrew. The status discretes of Lock On and Missile in Flight are transmitted automatically by the aircraft if the target is being reported. Some flight leaders can send Investigate, Engage, and Disengage orders for specific targets to any member of the flight. The receiving fighter should report the status of the engagement until its conclusion or until the engagement is broken.

b. Operation of the Fighter-to-Fighter NPG is normally in a multi-net or a stacked net structure. To allow for pairing of aircraft in different nets, several nets in a stack may be associated with a single Control NPG. The pre-mission brief must include the use of these nets by the participants (i.e., the members that will work together as flight lead and wingmen). C2 JUs may receive, but do not transmit on a fighter-to-fighter NPG.

6.9 Service-Unique Air Control Considerations

6.9.1 Navy Link 4C Procedures

a. Up to four F-14 aircraft participate in a single Link 4C fighter-to-fighter net, consisting of one master aircraft, and up to three slave aircraft. The designation of particular aircraft to either designation on the net is prearranged or briefed by voice and is set into control panels as 70-series addresses, XX70 through XX73. The master aircraft must be present for the net to remain operational. Net slave members must remain within 256 miles of the most distant net participant. Once the master aircraft and at least one slave aircraft have selected their data link address numbers, information is transmitted and received by all net participants as listed below:

(1) Ownship Net Designation Letter (A, B, C, or D).

(2) Ownship Velocity, Altitude, Position (Lat/Long).

(3) Ownship Course, Fuel Quantity, Missile Load.

(4) Ownship Weapon System Status, Radar Channel.

(5) Target Range, Bearing, Altitude, Target ID Number.

(6) Target Course, Velocity, ID.

(7) Raid Size Estimate, Engaged Status, WILCO, CANTCO.

(8) Challenge Order, Bearing Only Angle, Threat Type.

b. Each participating aircraft transmits own-ship information constantly once the net is established. When targets are detected, each participant automatically reports up to four targets to all net aircraft. Any aircraft may order any other participant to challenge any target that has a Track ID being reported by any aircraft in the net.

6.9.2 USAF C2 IU/Fighter Air Control Considerations. The following paragraphs provide information about conducting air control operations with USAF C2 IUs and nonC^2JUs.

a. Link 4A. No USAF fighters are equipped with Link 4A. USAF CRC/CRE (MCE) have two-way Link 4A capability.

b. Link 16

(1) Currently, USAF C2 JUs are not able to accept radar targets transmitted on the backlink by controlled fighters for correlation with surveillance tracks.

(2) USAF fighters transmit position and status reports intra flight and to C2 JUs. USAF fighters receive air tracks broadcast by C2 units on the Surveillance NPG and engagement status broadcast by the C2 units on the Weapons Coordination and Mission Management NPG. USAF fighters exchange radar targets on the Fighter-to-Fighter NPG.

(a) Uplink/Backlink Operations. C2 JUs can send mission assignments to USAF fighters on the Control uplink. Mission assignments are to an entire flight, not to individual fighters and should be addressed to the flight leader. USAF flight leads acknowledge assignments and report engagement status to C2 JUs and other fighters on the Control backlink. USAF flights can hold only one assignment/engagement via data link at a time. If the flight leader accepts a second assignment/engagement, the first assignment will be automatically terminated and the flight leader will respond to the new mission assignment. USAF fighters do not currently report their radar targets on the Control NPG. USAF fighters correlate received fighter targets for display purposes and correlate the resulting fighter targets with surveillance tracks received from the Surveillance NPG. USAF fighters transmit on the control backlink in contention access mode whenever EMC constraints allow.

(b) Fighter-To-Fighter Operations. USAF fighters conduct control backlink and fighter-to-fighter data exchanges simultaneously. Fighter target exchange between fighters is done on the Fighter-to-Fighter NPG. USAF fighters transmit on the Fighter-to-Fighter NPG in contention access whenever EMC constraints allow. The fighters automatically transmit up to 10 tracked radar targets when in Track-While-Scan and do so at a significantly faster update rate than the rate for surveillance tracks reported by C2 units on the Surveillance NPG.

CHAPTER 7

INTERFACE TRAINING PROCEDURES

7.1 Introduction. The role of training and education is indispensable to effective command. We fight as we train and exercise. The skills of our leaders rest in large part on the quality of their military training and education. Two capabilities designed specifically for the conduct of realistic tactical training are Exercise Tracks and Simulated Tracks. These tracks are designed to support operational training at the tactical units. This chapter describes these capabilities and procedures for their use.

7.2 Exercise Tracks

a. An Exercise track is defined as "a friendly track that acts as other than a FRIEND for exercise purposes." On Link 16, any ID can be reported as an Exercise ID for any category of track or EW data. Link 11/11B only supports the reporting of Air and Surface "Exercise HOSTILE" (FAKER) and "Exercise SUSPECT" (JOKER) tracks. All other exercise tracks originated on Link 16 are forwarded to Link 11/11B only as FRIEND tracks. There are only brevity words for Exercise IDs FAKER or JOKER. The other Exercise IDs are referred to as "Exercise NEUTRAL," "Exercise UNKNOWN," "Exercise ASSUMED FRIEND," or "Exercise FRIEND." "Exercise PENDING" tracks shall not be originated on the interface.

b. Due to the above inter-link differences, the use of Exercise Tracks other than FAKERS and JOKERS must be carefully planned and coordinated by the FTC/TDC to avoid confusion and misidentification in a multi-link interface. In particular, Subsurface Exercise Tracks should not be reported on Link 16 unless it can be assured that they will not be misidentified as a friendly force support submarine when forwarded to Link 11/11B as FRIEND tracks.

c. Exercise Land Points/Tracks are reportable on Link 16 only. "Exercise FRIEND" and "Exercise HOSTILE" MEZs are reportable on Link 16. No other Exercise Reference Points are reportable. An Exercise MEZ is one that is being reported for exercise purposes only; i.e., the IU, track, or point to which the MEZ is related might not be able to actually engage targets in that MEZ, nor is it necessary to remain clear of the Exercise MEZ for actual operations.

7.2.1 Exercise Track Initiation

a. Exercise Tracks are typically used in two situations:

(1) Pre-planned Exercise Opposition. The Opposition Force consists of Friendly aircraft, ground forces, ships, or submarines specifically scheduled in advance to provide opposition in an exercise. The identification of such tracks may be initially determined and reported by an exercise participant who is aware of the general pre-planned scenario and is convinced the track is the planned opposition. In some cases, "trusted agents" in the friendly force may know the expected track profiles and be assigned to monitor them, and in some cases maintain communications with the planned opposition (These agents are referred to as "Exercise Safety" or "Exercise Controller"). They may initiate Exercise Tracks if provided with appropriate link capabilities, or advise the appropriate TDS operator to initiate an Exercise Track.

(2) Targets of Opportunity. Tracks that are not part of the friendly force or preplanned opposition force (i.e., "ambient traffic"), that an operator decides to report as Exercise Tracks, normally FAKER or JOKER, for purposes of on-the-spot training in tracking, conflict resolution, or simulated engagement.

b. The assignment of an Exercise ID automatically identifies the track as an actual confirmed FRIEND. The track is not required to be specifically reported as a FRIEND prior to being reported as an Exercise ID. To maximize training realism, this should be avoided; i.e., the typical situation should be that an ASSUMED FRIEND, UNKNOWN, or SUSPECT becomes a JOKER or FAKER. However, an operator shall not assign an Exercise ID unless he is certain the track is friendly.

7.2.2 Artificial Exercise Track Data

a. To maximize exercise realism, reporting artificial identification data for an Exercise Track, in Surveillance reports, or Intelligence reports is permitted. Besides the ID, only the following data are allowed to be artificial:

(1) Platform.

(2) Activity.

(3) Specific Type.

(4) Nationality/Alliance.

(5) Special Interest Status.

(6) Strength/Raid Size.

b. Operators receiving track reports with exercise status set should assume that values reported for the above data are artificial and for exercise purposes only. All other data should be considered real.

c. Artificial IFF/SIF codes shall not be reported.

7.2.3 Exercise FRIENDs (Link 16 Only)

a. Link 16 also allows a friendly unit to be reported as an "Exercise FRIEND", either in self-reported PPLI reports or track reports. This means that the friendly unit is participating in an exercise. Certain status data on these friendly units may also be artificial and must be considered as artificial by receiving JUs. These status data are:

(1) Surface/Land Missile Types and Inventory.

(2) Aircraft Weapon Types and Inventory.

(3) Aircraft Gun Capability.

b. Because "Exercise FRIENDs" are forwarded to Link 11/11B only as FRIENDs, PU/RUs will not be aware that the above status information may be artificial. Therefore, any status information on a friendly unit known to be participating in an exercise should be considered artificial. This may require voice coordination to ascertain actual status when necessary to assist in engagement decisions.

7.2.4 Exercise EW Data (Link 16 Only)

a. EW intercepts that are determined to emanate from an electronic device being utilized by friendly forces to simulate an emitter, normally a threat emitter, can be reported as EW Products on the Link 16 Surveillance NPG with an Exercise ID. Reporting of emitters simulated by special EW training units for exercise purposes is an example of this capability. Receiving JUs should interpret all EW data pertaining to the reported TN as artificial and for exercise purposes only.

b. Exercise EW Parametric Data cannot be reported on the Link 16 EW NPG. Exercise EW Products reported on the Surveillance NPG are forwarded to Link 11/11B as NONTHREAT. When received by PU/RUs, the product information may appear to represent a threat emitter, causing conflict and confusion. Planning and/or voice coordination must ensure that the reporting of Exercise EW emitters are carefully controlled and clarified to all interface participants.

7.2.5 Exercise Status Order (Link 16 Only)

a. C2 JUs are capable of directing the cessation of Exercise Track reporting. This capability enables the FTC/TDC to eliminate exercise artificialities and to revert the interface to full operational status when an actual HOSTILE is detected. It should also be used at the end of an exercise. Only the FTC/TDC should originate the Exercise Status Order. However, if the FTC/TDC is not in a C2 JU, he may direct an appropriate C2 JU to transmit it. Other IUs must be alert to recommend its use via voice when conditions warrant.

b. Upon receipt of an Exercise Status Order, systems automatically take the following actions:

(1) Alert the operator.

(2) Revert all Exercise Tracks to an ID of FRIEND with no exercise indication.

(3) Change all of the potentially artificial data listed in the foregoing paragraphs to the No Statement, default values, or actual values. Such data remains set until changed by local operator action or receipt of a remote non-exercise track report.

(4) (C2 JU only) Break all engagements involving former Exercise Tracks by reporting “Engagement Broken.”

(5) (C2 JU only) Order “Hold Fire” for all engagements they have ordered involving former Exercise Tracks for which the last reported status was “Engaging/Firing”. Order “Cease Mission” for all other engagements they have ordered involving former Exercise Tracks.

c. In a multi-link interface, the FTC/TDC must parallel the Link 16 Exercise Status Order with a voice order “Cease Exercise Track Reporting” to all PU/RUs, if the Exercise Status Order is transmitted prior to the scheduled

or intended finish of the exercise. The voice end of exercise order has the same effect as the Exercise Status Order for interface track reporting. PU/RU operators must take the above actions manually for all FAKERS and JOKERS for which they have R^2 or are reporting engagement status. PU/RUs will eventually receive non-exercise reports for the exercise tracks for which they do not have R^2. However, because most systems do not accept No Statement over other information, PU/RU operators may have to revert the potentially artificial data to No Statement on remote formerly exercise tracks.

7.2.6 Exercise ID Difference Resolution. Differences between two Exercise IDs are resolved in the same manner as for actual IDs as specified in paragraph 5.10.4. However, all differences between an Exercise ID and an actual ID are considered ID conflicts and must be resolved by manual operator action. That is, any difference in opinion about whether or not a track is a FRIEND acting as other than a FRIEND for exercise purposes, regardless of the IDs involved, is important enough to require operator resolution. Normally a track is reported without an Exercise ID, then recognized and reported as an Exercise Track. When Exercise Tracks are expected, operators should be alert to promptly accept the initial Exercise ID unless they have firm evidence that the track is not a FRIEND or is a FRIEND but not an expected exercise participant.

7.2.7 Emergency Indicator on Exercise Tracks. Operators shall only set the Emergency Indicator on a track with exercise status to report a real emergency. Where there is a requirement for training purposes to report a platform with a practice emergency, voice procedures must be used. Alternatively, an exercise emergency point may be established specifically for training purposes.

7.2.8 Force Tell Indicator on Exercise Tracks. Operators may set the Force Tell Indicator on a track with exercise status. The Force Tell Indicator is always real and never artificial.

7.2.9 Special Processing Indicator on Exercise Tracks. The SPI should not be set on a track with exercise status.

7.2.10 Exercise Threat Warning Reports. When a threat warning report is transmitted to report threat information on a track with exercise status, receiving IUs should interpret all threat data pertaining to the reported TN as artificial and for exercise purpose only.

7.2.11 Exercise Reference Points/Line/Areas. Operators may initiate ALLIED or HOSTILE MEZs with exercise status for reporting on the interface. Exercise MEZ definitions should be considered artificial and for exercise purposes only. No other reference points/lines/areas can be reported with exercise status.

Operators shall not change the Exercise Indicator to Exercise if the ALLIED or HOSTILE MEZ has been previously established with the Exercise Indicator set to Non-Exercise.

7.2.12 Exercise Emergency Points. Operators may initiate emergency points with exercise status for reporting on the interface. All data associated with exercise emergency points should be considered artificial and for exercise purposes only. Operators shall not change the Exercise Indicator to Exercise if the emergency point has been previously established with the Exercise Indicator set to Non-Exercise.

7.3 Simulated Tracks. The interface supports the full exchange of simulated tracks. This capability permits fully realistic operational training scenarios without live opposition forces. Furthermore, FRIEND Tracks can be simulated in order to provide a full Joint Force scenario. Simulated tracks can be reported simultaneously with live tracks.

7.3.1 Simulation Capabilities. In addition to the capability to initiate simulated Space, Air, Surface, and Subsurface Tracks based on operator input, the interface supports the exchange of the following simulated data:

a. Reference Points, Lines, and Areas may be simulated. However, since points are normally imaginary, care should be taken to ensure that the difference between the intended use of real and simulated points is clear.

b. Land Points and Tracks may be simulated.

c. EW Product data may be simulated. A simulated EW Product report means that the product and all associated EW data are simulated; i.e., not based on live intercepts. EW Parametric reports for transmission on the EW NPG, as described in paragraph 5.8, cannot be simulated, although all EW data can be simulated on Link 11/11B.

d. Simulated tracks may be uplinked to controlled aircraft, and simulated targets may be backlinked by controlled aircraft on the Link 16 Control Channel. However, simulated tracks/targets cannot be reported on Link 4A.

e. IUs may also be simulated. Reporting simulated IUs is useful in simulating a full Joint Force environment when only a few IUs are actually participating in training. Some scenario generators are capable of including simulated IUs in pre-scripted scenarios, as well as tracks, points, and other

data reported by the simulated IUs. This provides maximum training realism, and a realistic and challenging test environment.

7.3.2 Simulation Procedures. Simulated and live data may be reported concurrently. All procedures and capabilities in Chapters 5 and 6 for live tracks, points, EW Product data, and IUs apply equally to simulated tracks, points, EW Product data, and IUs except as follows:

a. Simulated data are clearly distinguished from live data on displays.

b. Simulated tracks shall not be correlated with live tracks.

c. Simulated data may be paired or associated with live data, and a simulated track may be engaged with a live track.

d. Track alerts do not force simulated data through simulation filters.

7.3.3 Simulation Restrictions

a. The capability to simulate tracks, points, and EW data ("Simulated Tracks") differs technically from the capability to simulate IUs ("Simulated IUs"). All JUs are capable of recognizing Simulated Tracks and Simulated IUs. However, some PU/RUs cannot recognize Simulated Tracks and/or Simulated IUs. These are referred to as "Simulated Track limited" and "Simulated IU limited" PU/RUs. Such PU/RUs will believe that a Simulated Track or Simulated IU is a live track or IU. This is operationally undesirable.

b. Whenever PU/RUs will be in the interface, the FTC/TDC must determine whether any of them are Simulated Track limited and/or Simulated IU limited. If such PU/RUs are in the interface, the FTC/TDC should limit the reporting of Simulated Tracks and Simulated IUs as follows:

(1) In a Link 11/11B only interface: The FTC/TDC should direct that Simulated Tracks not be originated if Simulated Track limited PU/RUs are present and that Simulated IUs not be originated if Simulated IU limited PU/RUs are present.

(2) In a multi-link interface: A simulation forwarding filter inhibits the forwarding of all simulated data, both tracks and IUs. Therefore, if any Simulated Track or Simulated IU limited PU/RUs are present, the FTC/TDC should direct the FJU to insert a Simulation filter and direct Link 11/11B limitations IAW subparagraph (1) above.

c. A live track shall not be initiated based on simulated video, nor shall a simulated track be initiated based on live video.

d. A simulated track shall not be changed to a live track, nor shall a live track be changed to a simulated track. If it is necessary to make such a change, due to operator error or other reason, the original simulated or live track must be dropped and a new live or simulated track initiated. However, due to reception problems on Link 11/11B, it is possible that a track initially received as a live track may be subsequently changed to a simulated track.

7.4 Joint Data Link Fidelity Drills. The Joint Data Link Fidelity Drills are designed to refine operator proficiency in initiating and recognizing interface data elements; refine operator skills in recognizing and resolving conditions that degrade the effectiveness of interface operations; and exercise hardware and software components of the interface. These drills are meant to support the training needs of a broad variety of units and missions. Effective use of these drills requires deliberate preparation and coordination by training managers at participating units. (See Appendix J.)

APPENDIX A TO ENCLOSURE A

SERVICE APPENDICES

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TAB 1

LINK PLATFORM CAPABILITIES

A1.1 US Army

INTERFACE CHARACTERISTIC	ARMY AMDPCS ADSI	ARMY PATRIOT ICC	ARMY FAAD C^2I
1. Missions	• Threat Detection and Warning • SAM Control • Air Battle Management • Tracking • Identification	• Threat Detection • Tracking • Identification • SAM Control • Air Battle Management	• Threat Detection • Tracking • Dissemination • Warning • Air Battle Management
2. Technical Functions (Includes Mission Categories for Weapons Coord and Mgmt and Control)	• PPLI • Air Surveillance • Weapons Coord and Management • Information Mgmt • Mission Mgmt • Point Surveillance	• PPLI • Air Surveillance • Weapons Coord and Management • Information Mgmt • Point Surveillance	• PPLI • Air Surveillance • Weapons Coord and Management • Information Mgmt • Mission Mgmt • Point Surveillance
3. Combat System			
4. Types of Tracks Maintained and Reported to Interface	• Air • Points • EW	• Air • Points • EW • Space (Patriot PDB-5)	• Air
5. Interface Data Link Capability	• Link 11B (16 Links) • Link 16 • ATDL-1 • Link 11	• Link 11 • Link 11B (4 links) • Link 16 • ATDL-1	• Link 16 • Link 11B (1 Link)
6. Track Position Data Limits	Within 1024 dm of system coordinate center.	For Unit locations - ± 1023.5 dm from own SCC. The other track positional data ± 511.75 dm from own SCC.	410 km
7. Track Capacity (see classified supplement if blank)	4095		210
8. Maximum Display Area	1024 dm radius	1024 km x 768 km	400 km x 400 km
9. Data Registration	Done automatically with respect to the DLRP.	Done automatically with respect to the DLRP.	Manual input to coordinate converting parameters.
10. Track Number	Assigned sequentially from assigned block.	Assigned sequentially from assigned block.	Assigned sequentially from assigned block.
11. Track Identity	Manual override. Otherwise accepts HEU and subordinate unit IDs.	Automatic (passive/active) Manually (passive/active)	Automatic with manual override. Adjustable parameters.

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	ARMY AMDPCS ADSI	ARMY PATRIOT ICC	ARMY FAAD C^2I
12. Track Quality Maximum Value (Link 16/Link 11/11B)	• Air N/A • Surface N/A • Land N/A Maintains and forwards HEU and subordinate unit TQs.	• Air 14/7 • Surface N/A • Land N/A • Space 12/-	• Air 11/7 • Surface N/A • Land N/A
13. Variable Track Quality Details	None	None	None
14. Correlation	No correlation performed. Correlation performed by HEU and subordinate unit sensors and computers.	Automatic (correlation block size is variable as a function of aircraft position).	Automatic within limitation of sensors.
15. Decorrelation (see classified supplement if blank)	No decorrelation performed. Decorrelation performed by HEU and subordinate unit sensors and computers.	Automatic (decorrelation block size is variable as a function of aircraft position).	
16. Use of Pointer	Displayed at all consoles. Only one may be displayed at a time.	Displayed on both consoles (only one at a time).	None
17. Handover	None; voice or digital	None; voice or digital	None; voice or digital
18. C2 Control Capability			
19. Transmit Filters	Concurrent filtering for Tx and Rx data by three types of independent filters. • Geographic Filter--Inhibits all tracks outside of a selected area. Identity filter can inhibit tracks with SIM, SPI, SPPT, FRD, UNK, Air, Surface and Subsurface Identities. • Height Filter-- Inhibits all tracks above or below a selected altitude.	Filtering to inhibit transmission from the ICC is done during initialization with each unit. Transmit Filters: • Hawk Unit: Operator specifies the circular geographic area (centered on the units reported position), altitude, and identity filters. • Other ATDL-1, Link 11/11B, or Link 16 Units: Operator specifies the square/rectangular geographical area (centered on an operator entered position), altitude, bearing, and identity filters. Receive Filters: For Link 11 and 16, operator specified geographical filter.	Automatic for receive and transmit. • Filters on geographic ID and type aircraft. • Height - Inhibits all tracks above or below a selected altitude. • Saturation alleviation - friendly tracks beyond 10 km of division boundary, air tracks beyond alert thresholds, and air tracks outside supported unit flank and rear boundaries.
20. Link 11 Waveform (CLEW/SLEW Capability)	• CLEW	• CLEW	N/A
21. Track Purging (time after receipt of last position update message, track automatically dropped from database)	• Manually adjustable during initialization from 1-120 seconds.	• Air Tracks - Local 16 secs. - Remote 28 secs.	• Automatic function with multiple manual input parameters.
22. Link 16 Uplink/Backlink Capability			

A1.2 US Navy

INTERFACE CHARACTERISTIC	NAVY Model 5 E-2C Group II	NAVY Model 5 F-14D (ACR)	NAVY Model 5 ACDS BLK 1 (CV)/LHD
1. Missions	• AEW • Air Intercept Control • Air Support Operations (ASO) • SAM Coord and Control • Airspace Control • CATCC Extension • PIRAZ Control • AW/SUW • Air/Surface/Subsurface/ Land/Surveillance • SAR Coord and Control • EW Support	• AAW • RECCE • SAR	• Air Intercept Control • Air Support Operations (ASO) • SAM Coord and Control • Air Traffic Control • EW Control • USW/AAW/ASUW/TBMD Control • Air/Surface/Subsurface/ Land/Surveillance
2. Technical Functions (Includes Mission Categories for Weapons Coord and Mgmt and Control) (R = Receive Only)	• PPLI • Air/Surface/Subsurface/ Land/EW Surveillance • EW/Param/Coord • Intelligence (R) • Weapons Coord and Mgmt • Information Mgmt • Control	• PPLI • Control	• PPLI • Air/Surface/Subsurface/Land/ EW Surveillance • EW/Param/Coord • Intelligence • Weapons Coord and Mgmt • Information Mgmt • Control
3. Combat System	• ATDS		• ACDS
4. Types of Tracks Maintained and Reported to Interface (R = Receive Only)	• Air • Surface • Subsurface • Land • Points/Lines/Areas • EW LOBs/Fixes	• Air • Surface • Subsurface (R) • Land	• Air • Surface • Subsurface • Land • Points/Lines/Areas • EW LOBs/AOPs/Fixes
5. Interface Data Link Capability	• Link 4A • Link 11 • Link 16 • CIU	• Link 4A • Link 16	• Link 4A • Link 11 • Link 16 • FJUA • CIU
6. Track Position Data Limits	±1024 nm	±200 nm on transmit No limit on receive. Data maintained and can be retrieved by display offset.	±1024 nm
7. Track Capacity (see classified supplement if blank)			
8. Maximum Display Area	1024 nm	200 nm radius from own position or centered about any target of interest.	1024 nm

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	NAVY Model 5 E-2C Group II	NAVY Model 5 F-14D (ACR)	NAVY Model 5 ACDS BLK 1 (CV)/LHD
9. Data Registration	Manual or automatic gridlock or IU registration.	RELNAV	Manual or automatic (SGS) gridlock or IU registration.
10. Track Number	Assigned sequentially from allocated block. TN can be assigned manually. Can operate in a Link 11 TN Pool.	N/A	Assigned sequentially from allocated block. TN cannot be assigned manually. Can operate in a Link 11 Pool except when assigned as FJUA or SFJUA.
11. Track Identity	Auto with manual override (operator option). Adjustable parameters.	Auto with manual override (operator option). Adjustable parameters.	Auto with manual override (operator option). Adjustable parameters.
12. Track Quality Maximum Value (Links 16/11/11B)	• Air 11/7 • Surface 11/7 • Land 0(NRT)/ -	• Air N/A • Surface N/A • Land N/A	• Air 15/7 • Surface 15/7 • Land 0(NRT)/ -
13. Variable Track Quality Details			
14. Correlation	Automatic or manual.	N/A	Automatic or manual.
15. Decorrelation (see classified supplement if blank)			
16. Use of Pointer	Displayed at all consoles regardless of operator position designated in pointer message. When transmitted, only weapons operator position is designated.	Target Sorting pointer received and displayed.	Displayed at Track Supervisor, ESM Supervisor, Ship Weapons Coordinator, Tactical Signals Officer, and Force Weapons Coordinator consoles depending on operator position designated in pointer message. Only one pointer can be displayed at a time.
17. Handover	• Voice • Digital	• Voice • Digital	• Voice • Digital
18. C2 Control Capability	• Link 16 • Link 4A	None	• Link 16 • Link 4A
19. Transmit Filters	• Geographic - Circle - Nested - Annulus - Line - Sector - Area - Rectangle • Environment - Air - Surface - Land - Subsurface • Ref Points • EW • Identity	• Geographic - Circle - Nested - Annulus - Line - Sector - Rectangle • Environment - Air - Surface - Land - Subsurface • Ref Points • EW • Identity	• Geographic - Circle - Nested - Annulus - Line - Sector - Rectangle • Environment - Air - Surface - Land - Subsurface • Ref Points • EW • Identity
20. Link 11 Waveform (CLEW/SLEW Capability)	• CLEW		• CLEW/SLEW* *If CSDTS/AN/USQ 125 or 120 SLEW capable DTS equipped.

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	NAVY Model 5 E-2C Group II	NAVY Model 5 F-14D (ACR)	NAVY Model 5 ACDS BLK 1 (CV)/LHD
21. Track Purging (time after receipt of last position update message, track automatically dropped from database)	• Air Tracks 96 secs. • Surface Tracks 6 mins. • Pointer 80 secs.	• Air Tracks 96 secs.	• Air Tracks 96 secs. • Surface Tracks 6 mins.
22. Link 16 Uplink/Backlink Capability	Transmit/Receive	Receive/Transmit	Transmit/Receive

INTERFACE CHARACTERISTIC	NAVY Model 5 AEGIS (CG, DDG)	NAVY Model 4 ACDS BLK 0 (CV/LHD/LHA)
1. Missions	• Air Intercept Control • Air Support Operations (ASO) • SAM Coord and Control • Air Traffic Control • EW Control • Gunfire Control • USW/AAW/ASUW/TBMD Control • Air/Surface/Subsurface/ Land/Space/Surveillance • Theater Ballistic Missile Defense (TBMD)	• Air Intercept Control • Air Support Operations (ASO) • SAM Coord and Control • Air Traffic Control • EW Control • USW/AAW/ASUW/TBMD Control • Air/Surface/Subsurface/ Surveillance
2. Technical Functions (Includes Mission Categories for Weapons Coord and Mgmt and Control))	• PPLI • Air/Surface/Subsurface/ Land/Space/EW Surveillance • EW/Param/Coord • Intelligence • Weapons Coord and Mgmt • Information Mgmt • Control	• PPLI • Air/Surface/Subsurface/ EW Surveillance • EW/Param/Coord • Intelligence • Weapons Coord and Mgmt • Information Mgmt • Control
3. Combat System	• AEGIS	• ACDS
4. Types of Tracks Maintained and Reported to Interface	• Air • Surface • Subsurface • Land • Points/Lines/Areas • EW LOBs/AOPs/Fixes • Space	• Air • Surface • Subsurface • Land • Points • EW LOBs/Fixes
5. Interface Data Link Capability	• Link 4A • Link 11 • Link 16 • FJUA • CIU	• Link 4A • Link 11 • Link 16 * • FJUA * (Some Model 4 ACDS LHDs/LHAs are not Link 16 equipped)

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	NAVY Model 5 AEGIS (CG, DDG)	NAVY Model 4 ACDS BLK 0 (CV/LHD/LHA)
6. Track Position Data Limits	±1024 nm	±512 nm
7. Track Capacity (see classified supplement if blank)		
8. Maximum Display Area	1024 nm	1024 nm
9. Data Registration	Manual or automatic (SGS) gridlock or IU registration.	Manual or automatic (SGS) gridlock.
10. Track Number	Assigned sequentially from allocated block. TN cannot be assigned manually. Can operate in a Link 11 Pool except when assigned as FJUA or SFJUA.	Assigned sequentially from allocated block, or any TN can be assigned manually. Can operate in a Link 11 Pool.
11. Track Identity	Auto with manual override (operator option). Adjustable parameters.	Auto with manual override (operator option). Adjustable parameters.
12. Track Quality Maximum Value (Links 16/11/11B)	• Air 15/7 • Surface 15/7 • Land 0(NRT)/- • Space 15/7	• Air 7/7 • Surface 7/7 • Land 0(NRT)/-
13. Variable Track Quality Details	3 to 6 Maximum	3 to 6 Maximum
14. Correlation	Automatic or manual.	Automatic or manual.
15. Decorrelation (see classified supplement if blank)		
16. Use of Pointer	Displayed at Track Supervisor, ESM Supervisor, Ship Weapons Coord, Tactical Signals Officer, and Force Weapons Coord consoles depending on operator position designated in pointer message. Only one pointer can be displayed at a time.	Displayed at Track Supervisor, ESM Supervisor, Ship Weapons Coord, Tactical Signals Officer, and Force Weapons Coord consoles depending on operator position designated in pointer message. Only one pointer can be displayed at a time.
17. Handover	• Voice • Digital	• Voice • Digital
18. C2 Control Capability	• Link 16 • Link 4A	• Link 16 • Link 4A

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	NAVY Model 5 AEGIS (CG, DDG)	NAVY Model 4 ACDS BLK 0 (CV/LHD/LHA)
19. Transmit Filters	• Geographic - Circle - Nested - Annulus - Line - Sector - Rectangle • Environment - Air - Surface - Land - Subsurface • Ref Points • EW • Identity	• Geographic - Circle - Nested - Annulus - Line - Sector - Rectangle • Environment - Air - Surface - Land - Subsurface • Ref Points • EW • Identity Note: Filter implementation varies by platform.
20. Link 11 Waveform (CLEW/SLEW Capability)	• CLEW/SLEW* *If CSDTS/AN/USQ 125 or 120 SLEW capable DTS equipped.	• CLEW/SLEW* *If CSDTS/AN/USQ 125 or 120 SLEW capable DTS equipped.
21. Track Purging (time after receipt of last position update message, track automatically dropped from database)	• Air Tracks 96 secs. • Surface Tracks 6 mins.	• Air Tracks 96 secs. • Surface Tracks 6 mins.
22. Link 16 Uplink/Backlink Capability	Transmit/Receive	Transmit/Receive

INTERFACE CHARACTERISTIC	NAVY Model 4 AEGIS (CD, DDG)	NAVY Model 4 FFG/DD963	NAVY Model 4 LHA/LCC
1. Missions	• Intercept Control • Air Support Operations (ASO) • SAM Coord and Control • Air Traffic Control • EW Control • Gunfire Control • USW/AW/SUW/TBMD Control • Air/Surface/Subsurface/ Surveillance	• Intercept Control • USW • AW • SUW • EW • NSFS	• Amphibious Operations • SUW • AW
2. Technical Functions (Includes Mission Categories for Weapons Coord and Mgmt and Control)	• PPLI • Air/Surface/Subsurface/ • Land/Space/EW Surveillance • EW/Param/Coord • Intelligence • Weapons Coord and Mgmt Information Mgmt Control	• USW • AW • SUW • EW • NSFS • Own unit Position	• Amphibious Operations • SUW • AW • Own unit Position
3.Combat System	• AEGIS	• NTDS	• NTDS

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	NAVY Model 4 AEGIS (CD, DDG)	NAVY Model 4 FFG/DD963	NAVY Model 4 LHA/LCC
4. Types of Tracks Maintained and Reported to Interface	• Air • Surface • Subsurface • Land • Points • EW	• Air • Surface • Subsurface • Land • Points • EW	• Air • Surface • Subsurface • Land • Points • EW
5. Interface Data Link Capability	• Link 4A • Link 11 • Link 16 * • FJUA • All Model 4 AEGIS not Link 16 equipped	• Link 11	• Link 4A • Link 11
6. Track Position Data Limits	±512 nm	±512 nm	±500 nm
7. Track Capacity (see classified supplement if blank)			
8. Maximum Display Area	1024 nm	512 nm	512 nm
9. Data Registration	Manual or automatic (SGS) gridlock.	Manual or automatic (SGS) gridlock.	Manual or automatic (SGS) gridlock.
10. Track Number	Assigned sequentially from allocated block or any TN can be assigned manually. Can operate in a Link 11 TN Pool.* *If C2P installed same as Model 5 AEGIS.	Assigned sequentially from allocated block or any TN can be assigned manually. Can operate in a Link 11 TN Pool.*	Assigned sequentially from allocated block or any TN can be assigned manually. Can operate in a Link 11 TN Pool.*
11. Track Identity	Auto with manual override (operator option). Adjustable parameters.	Manual.	Auto with manual override (operator option). Adjustable parameters.
12. Track Quality Maximum Value (Links 16/11/11B)	• Air 7/7 • Surface 7/7 • Land 0(NRT)/-	• Air -/7 • Surface -/7 • Land 0(NRT)/-	• Air -/7 • Surface -/7 • Land 0(NRT)/-
13. Variable Track Quality	3 to 6 Maximum	3 to 6 Maximum	3 to 6 Maximum
14. Correlation	Automatic or manual	Automatic or manual	Automatic or manual
15. Decorrelation (see classified supplement if blank)			
16. Use of Pointer	Displayed at Track Supervisor, ESM Supervisor, Ship Weapons Coord, Tactical Signals Officer, and Force Weapons Coord consoles depending on operator position designated in pointer message. Only one pointer can be displayed at a time.	Displayed at Track Supervisor, ESM Supervisor, Ship Weapons Coord, Tactical Signals Officer, and Force Weapons Coord consoles depending on operator position designated in pointer message. Only one pointer can be displayed at a time.	Displayed at Track Supervisor, ESM Supervisor, Ship Weapons Coord, Tactical Signals Officer, and Force Weapons Coord consoles depending on operator position designated in pointer message. Only one pointer can be displayed at a time.
17. Handover	• Voice • Digital	• Voice	• Voice • Digital
18. C2 Control Capability	• Link 16 • Link 4A	Voice Only	• Link 4A

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	NAVY Model 4 AEGIS (CD, DDG)	NAVY Model 4 FFG/DD963	NAVY Model 4 LHA/LCC
19. Transmit Filters	• Geographic - Circle - Nested - Annulus - Line - Sector - Rectangle • Environment - Air - Surface - Land - Subsurface • Ref Points • EW • Identity Note: Filter implementation varies by platform.	• Geographic - Circle - Nested - Annulus - Line - Sector - Rectangle • Environment - Air - Surface - Land - Subsurface • Ref Points • EW • Identity Note: Filter implementation varies by platform.	• Geographic - Circle - Nested - Annulus - Line - Sector - Rectangle • Environment - Air - Surface - Land - Subsurface • Ref Points • EW • Identity Note: Filter implementation varies by platform.
20.Link 11 Waveform (CLEW/SLEW Capability)	• CLEW/SLEW* *If CSDTS/AN/USQ 125 or 120 SLEW capable, DTS equipped.	• CLEW/SLEW* *If CSDTS/AN/USQ 125 or 120 SLEW capable DTS equipped.	• CLEW/SLEW* *If CSDTS/AN/USQ 125 or 120 SLEW capable DTS equipped.
21. Track Purging (time after receipt of last position update message, track automatically dropped from database)	• Air Tracks 96 secs. • Surface Tracks 6 mins.	• Air Tracks 96 secs. • Surface Tracks 6 mins.	• Air Tracks 96 secs. • Surface Tracks 6 mins.
22. Link 16 Uplink/Backlink Capability	Transmit/Receive	None	None

INTERFACE CHARACTERISTIC	NAVY Model 4 P-3C	NAVY Model 4 S-3B	NAVY Model 4 SSN
1. Missions	• USW • SUW • EW	• USW • SUW • EW	• USW • SUW • EW
2. Technical Functions (Includes Mission Categories for Weapons Coord and Mgmt and Control) (R = Receive Only)	• USW • SUW • EW • Own unit Position	• USW • SUW • EW • Own unit Position	• USW • SUW • EW • Own unit Position
3. Combat System	• ATDS	• ATDS	
4. Types of Tracks Maintained and Reported to Interface (R = Receive Only)	• Air (R) • Surface • Subsurface • Points	• Air (R) • Surface • Subsurface • Points	• Air (R) • Surface • Subsurface • Points • EW
5. Interface Data Link Capability	• Link 11	• Link 11	• Link 11 • Link 16 roll on/roll off capability
6. Track Position Data Limits	1024 nm	1024 nm	±512 nm (OTH 3.2.0) ±1024 nm (OTH 5.0.1)

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	NAVY Model 4 P-3C	NAVY Model 4 S-3B	NAVY Model 4 SSN
7. Track Capacity (see classified supplement if blank)			
8. Maximum Display Area	1024 nm	1024 nm	512 nm
9. Data Registration	Manual	Manual	Manual
10. Track Number	Assigned sequentially from allocated block or any TN can be assigned manually. Can operate in a Link 11 TN Pool.	Assigned sequentially from allocated block or any TN can be assigned manually. Can operate in a Link 11 TN Pool.	Assigned sequentially from allocated block or any TN can be assigned manually. Can operate in a Link 11 TN Pool.
11. Track Identity	Auto with manual override (operator option). Adjustable parameters.	Auto with manual override (operator option). Adjustable parameters.	Auto with manual override (operator option). Adjustable parameters.
12. Track Quality Maximum Value (Links 16/11/11B) (R) = Receive Only	• Air -/7 (R) • Surface -/7 • Land N/A	• Air -/7 (R) • Surface -/7 • Land N/A	• Air -/7 (R) • Surface -/7 • Land N/A
13. Variable Track Quality Details	N/A	N/A	3 to 6 Maximum
14. Correlation	Manual	Manual	Manual (Local to Remote)
15. Decorrelation (see classified supplement if blank)			
16. Use of Pointer	Receive Only	None	Displayed at Track Supervisor, ESM Supervisor, Ship Weapons Coord, Tactical Signals Officer, and Force Weapons Coord consoles depending on operator position designated in pointer message. Only one pointer can be displayed at a time.
17. Handover	None	None	None
18. C2 Control Capability	None	None	None
19. Transmit Filters	All Link Track assignment is manual (operator initiated). There is a manual "filter" control of transmitted tracks.	All Link Track assignment is manual (operator initiated). There is a manual "filter" control of transmitted tracks.	• Geographic - Circle - Nested - Annulus - Line - Sector - Rectangle • Environment - Air - Surface - Land - Subsurface • Ref Points • EW • Identity Note: Filter implementation varies by platform.
20. Link 11 Waveform (CLEW/SLEW Capability)	• CLEW	• CLEW	
21. Track Purging (time after receipt of last position update message, track automatically dropped from database)	• Air Tracks - 40 secs., except Local NRTs are not purged.	• Air Tracks - 40 secs., except Local NRTs are not purged.	• Air Tracks - 70-150 secs., except Local NRTs are not purged.
22. Link 16 Uplink/Backlink Capability	None	None	None

A1.3 US Air Force

INTERFACE CHARACTERISTIC	AIR FORCE (CRC/CRE) MCE	AIR FORCE E-3 B/C AWACS	AIR FORCE F-15A/B/C/D/E
1. Missions	• Theater Air Defense • Theater Missile Defense • Surveillance/AEW/Surface • Strike Control • Aerial Refueling • CSAR • Tactical Airlift • Battle Management • SAM Control • Air Intercept Control • Tactical Airspace Control • SAR Coordination/Control • Enroute Air Traffic and Control • Tactical Data Management	• ESM (R) • Theater Air Defense • Theater Missile Defense • Surveillance/AEW/Surface • Strike Control • Aerial Refueling • CSAR • Tactical Airlift • Battle Management • SAM Control • Air Intercept Control • Tactical Airspace Control • SAR Coordination/Control • Enroute Air Traffic and Control • Tactical Data Management	• Offensive Counter Air • Defensive Counter Air • CSAR • CAS (F-15E) • Interdiction (F-15E)
2. Technical Functions (Includes Mission Categories for Weapons Coord and Mgmt and Control) (R = Receive Only)	• PPLI • ID • Weapons • Surveillance • EW/Intelligence • Weapons Coord (AIC) • Control (ATC, AIC) • Information Management • Mission Management	• PPLI • Air/Surface/Land Surveillance • ID • Weapons • Surveillance • EW/Intelligence • Weapons Coord (AIC) • Control (ATC, AIC) • Information Management • Mission Management	• PPLI • Air/Surface/Land Surveillance (R) • Information Management (R) • Weapons Coord Management (R) • Control (R)
3. Combat Systems	MCE	E-3	F-15
4. Types of Tracks Maintained and Reported to Interface (R = Receive Only)	• Air • Surface (R) • Points/Land	• Air • Surface • Points • EW • Land	• Air (R) • Points (R) • Surface (R) • Land (R)
5. Interface Data Link Capability	Reference SCC is within 1024 data miles of own SCC. • Link 11 • Link 11B • Link 4A • ATDL-1 • NATO LINK 1 • Link 16	• Link 11 • IJMS • Link 16 • CIU	• Link 16 • IJMS (limited to translation capability, of the JTIDS Class 2 or MIDS FDL)

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	AIR FORCE (CRC/CRE) MCE	AIR FORCE E-3 B/C AWACS	AIR FORCE F-15A/B/C/D/E
6. Track Position Data Limits	Positional data is within 512 dm of own unit location.	Other unit location data within 1024 nm of SCC. Tracks 1024 nm from SCC.	± 320 nm from own unit position
7. Track Capacity (see classified supplement if blank)			
8. Maximum Display Area	1024 X 1024 nm	2048 nm square	320 nm radius
9. Data Registration	Automatic or manual with inputs from own radars or from supporting units.	Auto gridlock capability, manually selected registration function computes translation and rotation corrections for individual data source and applies correction to received data.	JTIDS/MIDS geodetic or relative NAV with inertial backup.
10. Track Number	Assigned sequentially from assigned block until all numbers used at least once.	Auto assigned sequentially from assigned block or any TN may be assigned manually.	Use target index numbers for target exchanges. Exchange up to 10 targets. Can display track numbers for all tracks.
11. Track Identity	Automatic identification is based on a valid Mode 2 IFF correlated to a time window based on the Air Tasking order. Manual identification is based on track origin, IFF, flight profile, and aircraft control. Theater ROE dictate ID criteria.	Initially Pending. Assumed Friend, Assumed Hostile, Friend, and Hostile determinations can be made as a result of electronic or procedural methods. Manual designation on any track is allowed.	• Unknown • Hostile • Friend
12. Track Quality Maximum Value (Links 16/11/11B)	• Air 7/7 • Surface N/A • Land N/A	• Air 7/7 • Surface 7/7 • Land N/A	• Air N/A • Surface N/A • Land N/A
13. Variable Track Quality Details	N/A	N/A	N/A
14. Correlation	Manual and automatic capability within 2-3 miles with IFF match, and 7-8 miles without IFF match.	Manually initiated, machine monitored.	On-board special correlation for display only.
15. Decorrelation (see classified supplement if blank)			
16. Use of Pointer	Display at consoles as designated in pointer message and dropped by local procedure. (Pointers will be transmitted or received by Weapons, Tracking, Electronic Warfare, and Special Processing Display).	Display at consoles as designated in pointer message and dropped by local procedure. (Pointers will be transmitted or received by Weapons, Tracking, Electronic Warfare, and Special Processing Display).	Received and displayed. No text displayed, symbol only.
17. Handover	• Digital Handover • Voice	• Digital Handover • Voice	• Voice • Digital (But not digital check-in)
18. C2 Control Capability	• Link 16 • Link 4A	• Link 16	None

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	AIR FORCE (CRC/CRE) MCE	AIR FORCE E-3 B/C AWACS	AIR FORCE F-15A/B/C/D/E
19. Transmit Filters	Independent Geographic and Identity filters are available for each link. These types of filters are transmit, or transmit and receive. Geographic filters can be any shape (circular, rectangular) and are entered point-by-point. Identity filters are independent of geographic location. Tracks may be exempted from geographic filtering by identity. Individual tracks may be exempted from both types of filtering by the use of track alerts. Identity filters and geographic exemption are operator selectable by identity as listed below: • Friend-Special Mission • Friend-Helo • Friend-Strike Support • Friend-General • Unknown-Assumed Friend • Pending Security filters are operator selectable during link activation for each Link 11B link and for Link 11. The default for these links is "On." The security filter is automatically invoked for Link 1 during link activation. The required condition for Link 1 is "On." Activation or deactivation of Security filters on operational Link 11 or Link 11B links require the link to be manually deactivated and then reactivated.	Data may be filtered by track category, classification identity, range, or geographical area for Link 11, Link 16, or IJMS. For Link 11 and Link 16, a maximum four, north/south-oriented geographical area filters may be defined and are transmit/receive. For IJMS, a maximum of three transmit and one north/south-oriented, receive geographical area filters may be defined. All IJMS geographical area filters must be of the same type (i.e., inclusive or exclusive), and only one IJMS inside transmit filter is allowed. IJMS geographical area filters may include filterable parameters for heading, altitude, and speed. Track category and classification identity filters are as follows for Link 11, Link 16, and IJMS: • Air Unknown • Air Friend • Air Special Friend • Surface Unknown • Surface Friend • Surface Special Friend • Special Points • ESM Data	• Geographic filters through F-15 expand mode. Priority is range over range rate.
20. Link 11 Waveform (CLEW/SLEW Capability)	• CLEW	• CLEW	

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	AIR FORCE (CRC/CRE) MCE	AIR FORCE E-3 B/C AWACS	AIR FORCE F-15A/B/C/D/E
21. Track Purging (time after receipt of last position update message, track automatically dropped from database)	• Real-Time Auto Tracks purged in approximately 100 seconds without new inputs. • NRTs and Manual Tracks must be dropped manually by the operator. • Air Tracks - 60 seconds for real-time tracks; 2.5 minutes for NRTs. • Surface Tracks - 1.5 minutes for real-time tracks; 3.5 minutes for NRTs. • Unit Position - 60 seconds. • ECM Reports - 60 seconds.	• Automatic, Manual, or NRTs must be dropped automatically or manually.	• 25 seconds for tracks. • 13 seconds for targets.
22. Link 16 Uplink/Backlink Capability			

INTERFACE CHARACTERISTIC	AIR FORCE EC-130E ABCCC	AIR FORCE RAOC/SAOC (RADIL)	AIR FORCE RADIC
1. Missions	• Battle Management • Alternate ASOC • AOC Extension • Crisis Management • CSAR • Battle Information Analysis • Coordination of Joint Forces	• Threat Detection/Warning • Air Defense • Tracking • Identification	• Threat Detection/Warning • Air Defense • Identification • Forwarder – No Sensor
2. Technical Functions (Includes Mission Categories for Weapons Coord and Mgmt and Control) (R = Receive Only)	• PPLI (Transmit) • Alternate Net Entry • JTIDS/MIDS Relay Transmitter	• Air Surveillance • EPM • ESM • Weapons Control/Status • Identification	• Air Surveillance • EPM • ESM • Weapons Control/Status • Identification
3. Combat System	EC-130E		
4. Types of Tracks Maintained and Reported to Interface (R = Receive Only)	• Air (R) • PPLI • Points • Land	• Air • Surface (R) • Subsurface (R) • Points	• Air • Surface • Subsurface • Points • (No organic sensor)
5. Interface Data Link Capability	• Link 16 • IJMS (Capability is limited to the translation capability of the Class 2 terminal)	• Link 11 FPU • Link 11B FRU	• Link 11 FPU • Link 11B FRU
6. Track Position Data Limits	Receive except any crosstold value.	512 nm off SCC 1024 nm from DLRP	512 nm off SCC 1024 nm from DLRP
7. Track Capacity (see classified supplement if blank)			
8. Maximum Display Area	1170 X 1024 nm	1024 nm radius	1024 nm radius

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	AIR FORCE EC-130E ABCCC	AIR FORCE RAOC/SAOC (RADIL)	AIR FORCE RADIC
9. Data Registration	Within 1 nm of reported location.	Auto with respect to DLRP.	Auto with respect to DLRP.
10. Track Number	Assigned sequentially from assigned block.	Assigned sequentially from assigned block.	Assigned sequentially from assigned block.
11. Track Identity	Manual or automatic cross reference to SIF Mode 2, Mode 3	Automatically "PENDING." Manual for all others.	Automatically "PENDING". Manual for all others.
12. Track Quality Maximum Value (Links 16/11/11B)	• Air N/A • Surface N/A • Land 0 (NRT)/ -	• Air -/7 • Surface N/A • Land N/A	• Air N/A • Surface N/A • Land N/A
13. Variable Track Quality Details			
14. Correlation	Manual or automatic with ATO	None	None
15. Decorrelation (see classified supplement if blank)			
16. Use of Pointer	Both TX/RX as supported by data links.	Both TX/RX as supported by data links.	Both TX/RX as supported by data links.
17. Handover	N/A	• Voice • Digital	N/A
18. C2 Control Capability	None	Voice only	None
19. Transmit Filters	No JTIDS/MIDS filters implemented	• Geographic • Identity • Individual Track	• Geographic • Identity • Individual Track
20. Link 11 Waveform (CLEW/SLEW Capability)	N/A	• CLEW	• CLEW
21. Track Purging (time after receipt of last position update message, track automatically dropped from database)	• Automatic after 5 minutes without update.	• Air Tracks at 60 seconds. • Surface/subsurface at 3 minutes.	• Air Tracks at 60 seconds. • Surface/subsurface at 3 minutes.
22. Link 16 Uplink/Backlink Capability			

INTERFACE CHARACTERISTIC	AIR FORCE ASIT
1. Missions	Data Translator
2. Technical Functions (Includes Mission Categories for Weapons Coord and Mgmt and Control) (R = Receive Only)	• IJMS/Link 11B Data Forwarding
3. Combat System	
4. Types of Tracks Maintained and Reported to Interface (R = Receive Only)	
5. Interface Data Link Capability	• IJMS • Link 11B
6. Track Position Data Limits	
7. Track Capacity (see classified supplement if blank)	No Data
8. Maximum Display Area	N/A
9. Data Registration	N/A

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	AIR FORCE ASIT
10. Track Number	From Assigned block
11. Track Identity	N/A
12. Track Quality Maximum Value (Links 16/11/11B)	• Air N/A • Surface N/A • Land N/A
13. Variable Track Quality Details	N/A
14. Correlation	N/A
15. Decorrelation (see classified supplement if blank)	No Data
16. Use of Pointer	N/A
17. Handover	N/A
18. C2 Control Capability	
19. Transmit Filters	Yes, all geographic and identity.
20. Link 11 Waveform (SLEW/CLEW Capability)	
21. Track Purging (time after receipt of last position update message, track automatically dropped from database)	N/A
22. Link 16 Uplink/Backlink Capability	

INTERFACE CHARACTERISTIC	AIR FORCE E-8C JOINT STARS	AIR FORCE RC-135 V/W RIVET JOINT	AIR FORCE CARS MULTIPLE SOURCE CORRELATIONS SYSTEM (MSCS)
1. Missions	• Land Surveillance • Targeting • Theater Missile Defense	• Intel • Surveillance • EW/SEAD • TMD	• Surveillance/AEW • Intel
2. Technical Functions (Includes Mission Categories for Weapons Coord and Mgmt and Control) (R = Receive Only)	• Land Surveillance • Air & Surface Surveillance (R) • Air PPLI • Land & Surface PPLI (R)	• PPLI • EW/Intel • Air/Surface/Land Surveillance	• PPLI • Air/Surface/Land Surveillance • EW/Intel • Information Management • Mission Management
3. Combat System			
4. Types of Tracks Maintained and Reported to Interface (R = Receive Only)	• Land • Air (R) • Surface (R) • Points	• EW • Air • Surface • Subsurface • Land (Points)/Tracks Rx only) • Space	• EW • Air • Surface • Subsurface • Land (Points)/Tracks Rx only)

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	AIR FORCE E-8C JOINT STARS	AIR FORCE RC-135 V/W RIVET JOINT	AIR FORCE CARS MULTIPLE SOURCE CORRELATIONS SYSTEM (MSCS)
5. Interface Data Link Capability	• Link 16 • IJMS (Capability is limited to the translation capability of the Class 2 terminal).	• Link 11 • TIBS • Link 16 • IJMS (Capability is limited to the translation capability of the Class 2 terminal).	• Link 16 • Link 11 • Link 11B • TIBS • TRAP/TADIXS-B
6. Track Position Data Limits	Secret		None
7. Track Capacity (see classified supplement if blank)		1024 Local, 1024 Remote, 2048 Total	1024 tracks, 250 Special Points
8. Maximum Display Area	TBD	Entire world (dependent upon selection of area of interest)	2048 dm square per workstation (2). Workstations can display different Areas of Responsibility simultaneously.
9. Data Registration	GPS		None
10. Track Number	Assigned sequentially from assigned Block or any TN can be assigned manually.	Assigned sequentially from a block of numbers.	Assigned sequentially from a block of numbers.
11. Track Identity	Automatically "pending" manual for others.	Remote tracks are automatically displayed as "Unknown," unless identified by another system. Identity cannot be changed on remote tracks. Local tracks will be identified by operator.	Remote tracks are automatically displayed as "Unknown," unless identified by another system. Identity cannot be changed on remote tracks. Local tracks will be identified by operator.
12. Track Quality Maximum Value (Links 16/11/11B)	• Air N/A • Surface N/A • Land 15/-	• Air 7/7 • Surface 0 (NRT)/0 (NRT) • Land N/A	• Air 0 (NRT)/0 (NRT) • Surface 0 (NRT)/0 (NRT) • Land 0 (NRT)/0 (NRT)
13. Variable Track Quality Details			
14. Correlation	Manual	Automatic or manual - operator receives alert message.	Automatic or manual - operator receives alert message.
15. Decorrelation (see classified supplement if blank)		Automatic and Manual	
16. Use of Pointer	Not Implemented	Displayed on Console - operator receives alert message.	Displayed on Console - operator receives alert message.
17. Handover	N/A	N/A	N/A
18. C2 Control Capability	N/A	N/A	N/A
19. Transmit Filters	None (Display options only)	Uses Receive/Transmit filters	Uses Receive/Transmit filters
20. Link 11 Waveform (SLEW/CLEW Capability)			

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	AIR FORCE E-8C JOINT STARS	AIR FORCE RC-135 V/W RIVET JOINT	AIR FORCE CARS MULTIPLE SOURCE CORRELATIONS SYSTEM (MSCS)
21. Track Purging (time after receipt of last position update message, track automatically dropped from database)	All purges produce operator alert. • 20 seconds to take action before being dropped. • Air Tracks 60 seconds • Surface Tracks 60 seconds • Land Track 144 seconds • Points/Areas 144 seconds	• 40 seconds for real-time track. • 4 minutes for non-real-time track. Values can be modified.	• 40 seconds for real-time track. • 4 minutes for non-real-time track. Values can be modified.
22. Link 16 Uplink/Backlink Capability			

INTERFACE CHARACTERISTIC	AIR FORCE C-130E SENIOR SCOUT	AIR FORCE SENIOR TROUPE	ICELAND AIR DEFENSE SYSTEM (IADS)
1. Missions	• Intel	• Situational Awareness • Threat Warning • Search and Rescue	• Theater Air Defense • Theater Missile Defense • Surveillance • Air Intercept Control • Aerial Refueling • CSAR • Battle Management • SAM Control • AEW/Subsurface • Tactical Airspace Control • SAR Coordination/Control • Tactical Data Management • Data Link Manager
2. Technical Functions (Includes Mission Categories for Weapons Coord and Mgmt and Control) (R = Receive Only)	• EW/SIGINT	• Air/Surface/Land Surveillance • EW/Intelligence • Information Management	• ID • Weapons • Surveillance • Weapons Coord (AIC) • Control (ATC, AIC) • Information Management • Mission Management
3. Combat System			
4. Types of Tracks Maintained and Reported to Interface (R = Receive Only)	• EW	• Air • Special Points • Surface Maritime (R). Cannot generate, but can amplify. • Subsurface (R)	• Air • Surface (R) • Subsurface (R) • Points/Land

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	AIR FORCE C-130E SENIOR SCOUT	AIR FORCE SENIOR TROUPE	ICELAND AIR DEFENSE SYSTEM (IADS)
5. Interface Data Link Capability	• Link 11 • TIBS SATCOM	• Link 11 • Link 11B	• Link 11 (3) • Link 11B (2) • ATDL-1 • Link 1 (2) • Forward tell (2) • Lateral tell (2)
6. Track Position Data Limits		For unit locations 1024 nm from own SCC. The other track position data 512 nm from own SCC.	2048 nm of own location and 1048 nm from data locations.
7. Track Capacity (see classified supplement if blank)			No Data
8. Maximum Display Area		1024 nm square	2048 nm square
9. Data Registration		None	Automatic and manual with inputs from own radars or from supporting units.
10. Track Number		Assigned sequentially from assigned block.	Assigned sequentially from assigned block until all numbers used at least once.
11. Track Identity		As required unless Intel sources warrant manual modification. Locally generated tracks are manually assigned appropriate designators.	Manual identification is based on track origin, IFF, flight profile, and aircraft control. Theater ROE dictate ID criteria
12. Track Quality Maximum Value (Links16/11/11B)	• Air N/A • Surface N/A • Land N/A	• Air N/A • Surface N/A • Land N/A	• Air -/7 • Surface -/7 • Land -/7
13. Variable Track Quality Details			
14. Correlation		Automatic. May be accepted, rejected, or shut off.	Automatic and manual capability, up to 8 regions, that are operator defined.
15. Decorrelation (see classified supplement if blank)	No Data		No Data
16. Use of Pointer		Displayed at specific consoles.	Display at consoles as designated in pointer message and dropped by local procedure. (Pointers will be transmitted or received by Weapons, Tracking, Electronic Warfare, and Special Processing Display).
17. Handover			• Digital • Voice
18. C2 Control Capability	None	None	Voice

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	AIR FORCE C-130E SENIOR SCOUT	AIR FORCE SENIOR TROUPE	ICELAND AIR DEFENSE SYSTEM (IADS)
19. Transmit Filters		• Geographic. Both locally and for data passed to JTAO.	The transmission filter is used to present, create and update information concerning all transmission filters for each link. Transmission filters establish criteria for controlling the amount of information told-out by the control centers. The transmission filter display shall contain the following information and filter type associated with each operational data link: • Applicable data link(s) • Activated or deactivated indicator • Geographic filters • Identity filters • Category filters • Data sources • Special Processing Indicator • ECM • Simulation
20. Link 11 Waveform (CLEW/SLEW Capability)			
21. Track Purging (time after receipt of last position update message, track automatically dropped from database)			• Tracks may be dropped either automatically or manually. • Non-fighter tracks are automatically dropped when they reach the edge of the displayable regions (see 7 above). • 12 seconds after a track has been categorized as in drop status (due to extreme low quality or operator action) it will be automatically purged from the system.
22. Link 16 Uplink/Backlink Capability			

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	AIR FORCE PUERTO RICAN OPERATIONS CENTER (PROC)
1. Missions	
2. Technical Functions (Includes Mission Categories for Weapons Coord and Mgmt and Control) (R = Receive Only)	
3. Combat System	
4. Types of Tracks Maintained and Reported to Interface (R = Receive Only)	• Air (R)
5. Interface Data Link Capability	Link 11 Receive only. (Not process data from RU)
6. Track Position Data Limits	
7. Track Capacity (see classified supplement if blank)	No Data
8. Maximum Display Area	
9. Data Registration	
10. Track Number	
11. Track Identity	As Received
12. Track Quality Maximum Value (Links 16/11/11B)	• Air N/A • Surface N/A • Land N/A
13. Variable Track Quality Details	
14. Correlation	
15. Decorrelation (see classified supplement if blank)	No Data
16. Use of Pointer	Receive only.
17. Handover	
18. C2 Control Capability	Voice
19. Transmit Filters	
20. Link 11 Waveform (CLEW/SLEW Capability)	
21. Track Purging (time after receipt of last position update message, track automatically dropped from database)	
22. Link 16 Uplink/Backlink Capability	

A1.4 US Marine Corps

INTERFACE CHARACTERISTIC	MARINE AIR TRAFFIC CONTROL AND LANDING SYSTEM (MATCALS)	TACTICAL ELECTRONIC RECONNAISSANCE AND PROCESSING SYSTEM (TERPES)
1. Missions in order of priority	• Air traffic control	• Mission Planning/Post Mission Processing Support • EW Intelligence • ESM Correlation • ECM Correlation
2. Technical Functions (Includes Mission Categories for Weapons Coord & Mgmt and Control) (R = Receive Only)	• Air surveillance	• EW ESM Support • EW ECM Support • Intelligence • Weapons Control • Information Management • EA-6B Support
3. Combat System	• AN/TSQ-131Command and Control Subsystem • AN/TSQ-120 Air Traffic Control Tower • AN/TRC-195 Control Central	• AN/TSQ-90D • AN/USQ-101(V)5 Tactical Receive Equipment
4. Types of Tracks Maintained and Reported to Interface (R = Receive Only)	• Air • Surface (R) • Points	• Points • EW
5. Interface Data Link Capability	• Link 11B (2 links) • Link 4A (one or two way)	• Link 11 • Link 11B
6. Track Position Data Limits	• Unit locations 1023.5 nm from own SCC. • Track position data 511.75 nm from own SCC.	• Unit locations 1023.5 nm from own SCC. • Track position data 511.75 nm from own SCC.
7. Track Capacity (see classified supplement if blank)	• 600 tracks (AN/TPS-73 ATCS)	TERPES memory is dynamically allocated to accommodate track loading.
8. Maximum Display Area	• 120 nm +/- X & Y	
9. Data Registration	Precision survey	Does not perform data registration.
10. Track Number	Assigned from allocated TN block in sequence until all numbers used once.	Assigned from allocated TN block in sequence until all numbers used once.
11. Track Identity	Friend identity based on control.	Does not originate track identification.
12. Track Quality Maximum Value (Links 16/11/11B)	• Air NA / 7	• Air NA / 7
13. Variable Track Quality details	• None	• None
14. Correlation	• Manual	• None
15. Decorrelation (see classified supplement if blank)	An operator may manually decorrelate any correlated track.	No capability to manually or automatically decorrelate.

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	MARINE AIR TRAFFIC CONTROL AND LANDING SYSTEM (MATCALS)	TACTICAL ELECTRONIC RECONNAISSANCE AND PROCESSING SYSTEM (TERPES)
16. Use of Pointer	Displayed on all consoles regardless of Operator Position in message. Pointer symbology is cleared by local operator action. When transmitting, only weapons operator position is designated.	Can process up to 256 pointers.
17. Handover	MATCALS will accept handover request based on operator decision. If unit requesting handover is not known or track is not in the database, the handover request will be CANTPRO.	TERPES does not accept control of aircraft.
18. C2 Control Capability		
19. Transmit Filters	• None	• Independent filter for each data link. • Combined Geo-ID filters inhibit Tx and Rx beyond an operator selected range and sectors for selected identities.
20. Link 11 Waveform (CLEW/ SLEW capability)	• No Link 11 capability.	CLEW (MX512P)
21. Track Purging (time in seconds) after receipt of last position update message, track automatically dropped from database.	• Real time Air and Surface tracks – 60 to 80 seconds. • Non-real time tracks 2.5 minutes. • Unit position 60 to 80 seconds.	• Air, Surface, Subsurface tracks – Upon receipt of drop track. • Unit Position – Link 11 – None • Unit Position – Link 11B Operator alert after 60 seconds. Unit is not dropped.
22. Link 16 Uplink/Backlink Capability		

INTERFACE CHARACTERISTIC	TACTICAL AIR COMMAND CENTER (TACC)	TACTICAL AIR OPERATIONS CENTER (TAOC)
1. Missions in order of priority	• Command Planning & Direction • Aviation Combat Element Command Post • Resource Assignment & Allocation	• Threat Detection & Warning • Interceptor Control • SAM Control • Air Traffic Control • Airspace Control • EPM Control

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	TACTICAL AIR COMMAND CENTER (TACC)	TACTICAL AIR OPERATIONS CENTER (TAOC)
2. Technical Functions (Includes Mission Categories for Weapons Coord & Mgmt and Control) (R = Receive Only)	• Land PPLI • Air Surveillance • Surface Surveillance • Land Surveillance • Electronic Surveillance • Information Management • Weapon Coordination	• Land PPLI • Air Surveillance • Space Surveillance • Surface Surveillance (R) • Land Surveillance (R) • Electronic Surveillance (R) • Information Management • Weapon Coordination
3. Combat System	• AN/TYQ-101 (MSCS) • AN/TYY-2 (TBMCS)	• AN/TYQ-23(V)4 (TAOM) • AN/TYQ-87 (SAAWF) • AN/TPS-59 3D Radar • AN/TPS-63 2D Radar • AN/MSQ-124 (ADCP)
4. Types of Tracks Maintained and Reported to Interface (R = Receive Only)	• Air • Space (R) • Surface • Subsurface • Land • Points • EW	• Air • Space (R) • Surface (R) • Points • EW
5. Interface Data Link Capability	• Link 1 • Link 11 • Link 11B	• Link 1 • Link 4A • Link 11 • Link 11B • Link 16 • ATDL-1
6. Track Position Data Limits	• None	• Unit locations +/- 1023.5nm from own SCC. • Track positions 511.75nm X & Y from own SCC
7. Track Capacity (see classified supplement if blank)	• 1000 tracks or points	
8. Maximum Display Area	• 2048 x 2048 data miles per workstation. Workstations can display different areas simultaneously.	• 512 nm +/- X & Y from SCC
9. Data Registration	Does not perform data registration.	Automatic or manual with inputs from own radar or supporting units.
10. Track Number	Assigned from allocated Tactical Data Link TN block in sequence until all numbers used once. Allocates a TN block for TIBS.	Assigned from allocated TN block in sequence until all numbers used once.

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	TACTICAL AIR COMMAND CENTER (TACC)	TACTICAL AIR OPERATIONS CENTER (TAOC)
11. Track Identity	Track initiated are non-real time. Operator designates tracks & points for Tx on TDL. Manual ID designation of Unknown, Assumed Friend, Suspect, Friend, Hostile & Neutral determined by electronic and procedural methods.	Initial ID "Pending". Assumed Friend, Suspect, Friend, Hostile and Neutral determined by electronic & procedural methods. Auto ID capability based on Mode 2 IFF and ATO correlated time. Manual designation is allowed.
12. Track Quality Maximum Value (Links16/11/11B)	• Air NA/0 (NRT) • Surface NA/0 (NRT) • Land NA/0 (NRT)	• Air 12* / 7 * Based on TPS-59 radar
13. Variable Track Quality details	• None	• None
14. Correlation	Automatic or manual, based on operator selected criteria. Manual emitter correlation.	Manual by dropping local track and taking remote track local.
15. Decorrelation (see classified supplement if blank)	An operator may manually decorrelate any correlated track.	Manually by dropping the Local Track and initiating a new track on the sensor report. Automatic based on IFF, ID or Position Reports.
16. Use of Pointer	Displayed on Graphic window. Pointer symbology is cleared by local operator action. Maximum of 5 geographic pointers displayed per TDL.	Displayed at all consoles regardless of operator position in message. Pointer symbology is cleared by operator action. When transmitting pointers, only Weapons Operator Position is designated on Link 11 and Link 11B.
17. Handover	TACC does not accept control of aircraft.	TACC will accept handover requests bases on operator decision. If unit requesting handover is not known or the track is not in the database, the handover will be CANTPRO.
18. C2 Control Capability		

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	TACTICAL AIR COMMAND CENTER (TACC)	TACTICAL AIR OPERATIONS CENTER (TAOC)

19. Transmit Filters	• Independent filters for each Tactical Data Link
	• Geographic, ID, & Accepted Unit filter inhibits Tx & Rx of track & point data.
	• Inhibited identities are specified by link and identity type of:
	  • Friend
	  • Friend-Special
	  • Unknown
	• SPI filter restricts Tx of track data. Sim filter restricts Tx of simulated data.
	• Forwarding filter inhibits Tx of data from one link to another.
	• TIBS filter criteria: Geographic, ID, altitude, speed, ELNOT number and track classification.
		• Independent filters for each Tactical Data Link
		• Combined Geo-ID filter inhibits Tx or Rx beyond an operator selected range and sectors for selected identities.
		• Inhibited identities are selected by exception, i.e., operator selects identities in addition to those listed in IOP that are not to be inhibited.
		• Selection options are:
		  • Friend-Special
		  • Friend-Helo
		  • Friend-Strike
		  • Unknown-Assumed Friend
		  • Friend-General
		• Available for internal display and forwarding to PU/RU/JU and supporting units.

20. Link 11 Waveform (CLEW/ SLEW capability)	• CLEW (MX512P)	• CLEW (AN/USQ-125)
21. Track Purging (time in seconds) after receipt of last position update message, track automatically dropped from database.	• Real time Air and Surface tracks - 40 seconds. • Non-real time tracks - 4 minutes.	• Real time air tracks - 60 to 80 seconds. • Non-real time tracks - 2.5 minutes.
22. Link 16 Uplink/Backlink Capability		

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	AIR DEFENSE COMMUNICATIONS PLATFORM (ADCP)	F/A-18 HORNET (MIDS Configured)
1. Missions in order of priority	• Low Altitude Air Defense (LAAD) early warning and target cueing. • Theater Ballistic Missile early warning and cueing.	• All weather day/night mission: • Close Air Support (CAS) • Deep Air Support (DAS) • Air Defense (CAP) • Multi-sensory imagery recce • Supporting arms coordination (FAC-A)
2. Technical Functions (Includes Mission Categories for Weapons Coord & Mgmt and Control) (R = Receive Only)	• Land PPLI • Air surveillance • Space surveillance • Points • EW Intelligence information • Information management • Weapons control	• Air PPLI • Air Surveillance (R) • Surface surveillance(R) • Land surveillance (R) • Points (T/R) • EW (R)
3. Combat System	• AN/TYQ-124	• F/A-18A Single seat all weather • F/A-18B Dual seat all weather • F/A-18C Single seat all weather • F/A-18D Dual seat all weather day & night • F/A-18E Single seat all weather • F/A-18F Dual seat all weather
4. Types of Tracks Maintained and Reported to Interface (R = Receive Only)	• Air • Space • Surface • Points • Subsurface • Land	• Air (R) • Surface (R) • Land (R) • Points (T/R) • EW (R)
5. Interface Data Link Capability	• Link 16 • Ground Based Data Link (GBDL)	• Link 4A (one & two way) • Link 16 (FY 2003) • VMF
6. Track Position Data Limits	• Unit locations 1023.5 nm from own SCC. • Track position data 511.75 nm from own SCC.	
7. Track Capacity (see classified supplement if blank)	• 1000 tracks	Display 24 Tracks
8. Maximum Display Area	• 512 nm +/- X & Y from SCC	
9. Data Registration	• Performs data registration for Link 16 via radar site registration & GPS alignment.	• GPS position updates • Link 16 Geo/RELNAV

Tactical Data Systems and Their Interface Related Characteristics

INTERFACE CHARACTERISTIC	AIR DEFENSE COMMUNICATIONS PLATFORM (ADCP)	F/A-18 HORNET (MIDS Configured)
10. Track Number	Assigned from allocated TN block in sequence until all numbers used once	Track report on Link 4A us a Track Index Number (TIN) internal to aircraft flight and Controlling Unit.
11. Track Identity	Originates Hostile Theatre Ballistic Missile ID on Link 16. All other values processed Receive-Only.	Does not currently originate track ID.
12. Track Quality Maximum Value (Links 16/11/11B)	• Air 12/NA • Space 12/NA	• N/A
13. Variable Track Quality details	None	None
14. Correlation	Automatic	Back link track reports are correlated by Controlling Unit.
15. Decorrelation (see classified supplement if blank)	Automatic	No Data
16. Use of Pointer	Displayed on all consoles regardless of Operator Position in message. Pointer symbology is cleared by local operator action.	Displayed on multifunctional CRT.
17. Handover	ADCP does not accept control of aircraft.	Handover message displayed to aircrew with controlling unit data.
18. C2 Control Capability		
19. Transmit Filters	Air, Surface, and ESM tracks are subjected to filter processing. ADCP filter capability is limited to Geo filters. Tracks can be filtered for display by Category/Identification.	N/A
20. Link 11 Waveform (CLEW/ SLEW capability)	No Link 11 capability.	No Link 11 capability.
21. Track Purging (time in seconds) after receipt of last position update message, track automatically dropped from database.	Default for ENV/CAT 2 minutes.	
22. Link 16 Uplink/Backlink Capability		

TAB 2

SERVICE SPECIFIC PROCEDURES

A2.1 US Army Procedures

None

A2.2 US Navy Procedures

A2.2.1 Paragraph 2.4.3 Data Forwarding. (Additional information describing USN Model 4 and 5.) The Command and Control Processor (C2P). The C2P performs the necessary translations and forwarding functions to allow the ship to act as an FJU. This function is performed completely independent of the host CDS. The C2P also provides an interface between the host CDS and the Link 16, Link 11, and Link 4 data terminals for communications purposes. In Model 5 platforms, the C2P relieves the host CDS of the burden of all data link message formatting and transmission processing functions. When the host CDS is active, the FJU's ship operates as both a PU and a C2 JU. However, a C2P-equipped ship can perform the full forwarding function even when its CDS is inactive. Figures A2-1 and A2-2 illustrate the C2P installation in Model 4 and Model 5 ships. The shaded areas in the figures represent new hardware/software.

A2.2.2 CDS Model Designations. To understand the differences between platforms operating on Link 11 and those operating on Link 16, it is most important to understand the difference between Model 4 and Model 5 CDSs. These are explained below. The Link 4A capabilities of Model 4 and Model 5 are explained in Classified Supplement.

A2.2.3 Model 5 (Link 16). This manual uses the term (Link 16) to describe an IU that has a full Link 16 capability. By definition, a Model 5 CDS is one that has a Link 16 capability and whose database and HCI (i.e., displays and manual data input provisions) conform to Link 16 (J-series messages) data elements and terminology. Model 5 E-2Cs are referred to as Group II E-2Cs. All USN Model 5 C2 IUs have both Link 16 and Link 11. Their capabilities differ depending on the Link upon which they are operating, as follows:

a. Model 5 JU (Operating on Link 16). A Model 5 JU has the full Link 16 information exchange capability, limited only by the individual platform's implementation.

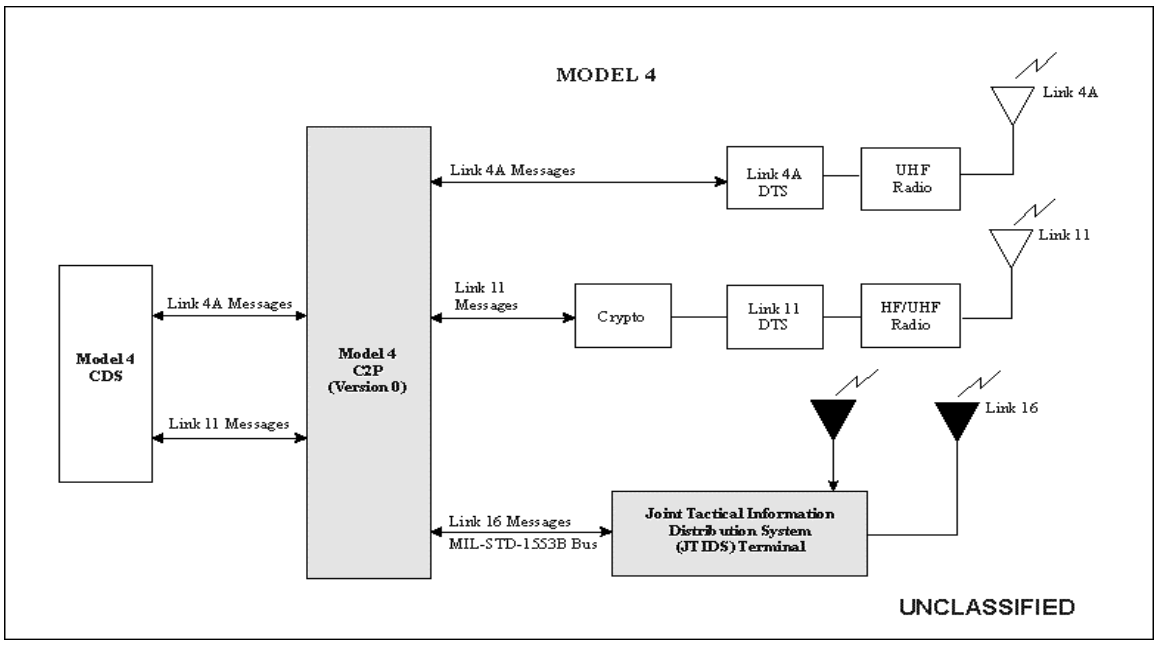

Figure A2-1. US Model 4 Ship Configuration

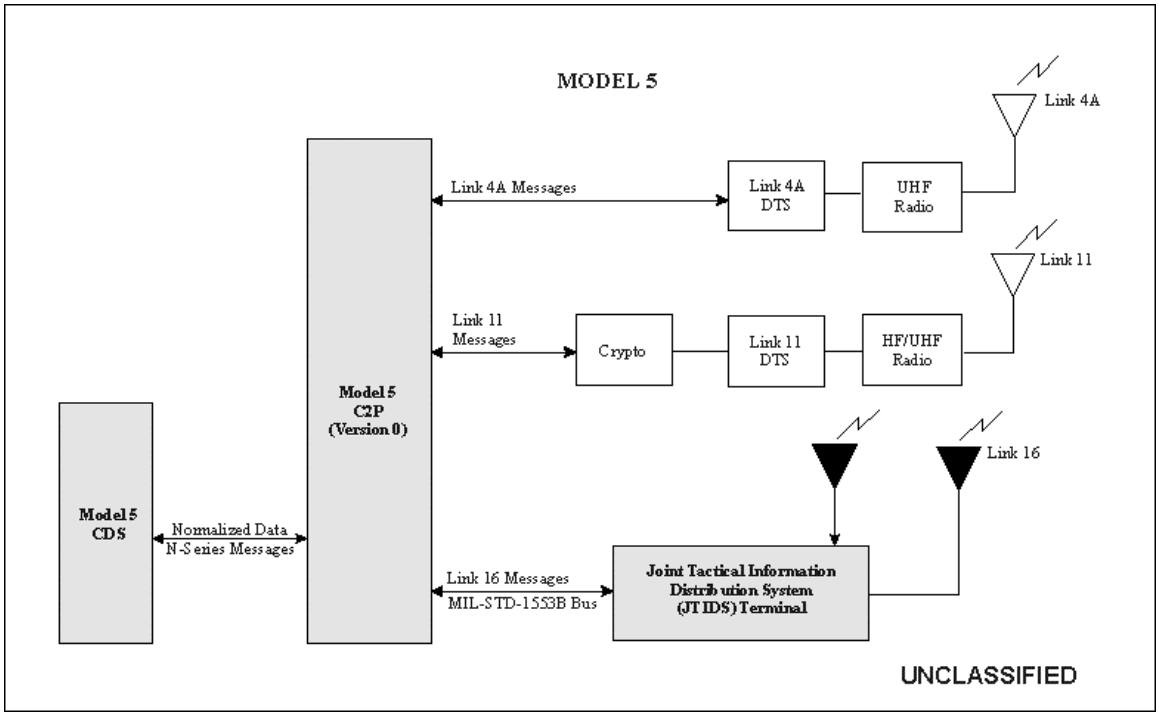

Figure A2-2. US Model 5 Ship Configuration

b. Model 5 PU (Operating on Link 11): A Model 5 PU is limited by the Link 11 message standard, in addition to its individual platform implementation. Although the operators see the Model 5 (J-series messages) terms and take actions to transmit Model 5 data, the data is converted (by the C2P in ships) to the Link 11 (M-series messages) equivalent for transmission. In some cases where the Model 5 data has no Link 11 equivalent, this results in no data being transmitted, even though the operator may believe he has caused data to be transmitted. For example, if an operator in a Model 5 PU designates a Surface Track as an Exercise Neutral Merchant Vessel, it is transmitted as a Friend General, ignoring the fact that it is acting as a Neutral Merchant Vessel for exercise purposes.

A2.2.4 Model 4 (PU)

a. This manual uses the term PU to describe a Model 4 CDS that still utilizes a Model 4 database and HCI, based on Link 11 (M-series messages) data elements and terminology. Model 4 E-2Cs are also referred to as Group O or Group I E-2Cs. In all Model 4 platforms, the Link 11 message formatting and transmission function is integral to the CDS. No significant changes have been made to the CDS in Model 4 platforms to accommodate the introduction of Link 16. In some Model 4 ships, a C2P and JTIDS/MIDS terminal have been installed in order to provide the jam resistance, reliability, and throughput improvements inherent in JTIDS/MIDS earlier than a full conversion to a Model 5 CDS could be accomplished. However, when these ships operate on Link 16, the C2P only acts as an FJU between ownship's host CDS and the Link 16 network. Thus, the data link information exchange capabilities of Model 4 platforms are exactly the same as their current Link 11 capabilities, regardless of whether the ship is operating on Link 11 or Link 16.

b. The above relationship also exists between Link 4A and Link 16 in Model 4 ships. When the ship operates on Link 16, the C2P translates between the CDS Link 4A capability and Link 16. Thus, the Model 4 ship is limited to its currently implemented Link 4A capabilities when controlling aircraft on Link 16.

A2.2.5 Model 5 Link 16 Unique Capabilities And Procedures. Throughout this section, capabilities and procedures that are unique to Link 16, and thus implemented only in USN Model 5 IUs, are indicated by the notation “(Link 16)”. This means that the capability is only available to, or procedure is only applicable to, Model 5 IUs, and only when they are operating on Link 16.

A2.2.6 Joint Service and Allied Systems. The “Model” terminology is not used by other U.S. Joint Services. The NATO term “Model C” is equivalent to USN

"Model 5." All Joint Service and Allied systems that implement Link 16 are equivalent to USN Model 5, in the sense that they have a fully upgraded TDS based on J-series data elements. However, the implementation of Link 16 differs significantly among the various TDSs, and will be reflected in the STIR for each interface operation.

A2.2.7 Paragraph 4.3.1.2 Multiple FJUs. Master FJU (MFJU) and Master Link 11 TN Assignment Unit (MLETNAU).

a. MFJU. Section 5 specifies procedures for the use of a Common Track Number (CTN) for voice coordination whenever tracks are assigned more than one TN due to forwarding from Link 16 to Link 11/11B. When the Link 11/11B 12-bit TN ("Low TN") is the designated CTN in an interface, and multiple FJUs are assigned, one of these FJUs must be designated as the MFJU. When a track with a TN greater than 07777 ("High TN") is received on Link 16, the MFJU reassigns a Low TN to forward the track to Link 11/11B, and reports the Low TN he has assigned onto Link 16. All other FJUs, referred to as Slave FJUs, withhold forwarding the track until they receive this report from the MFJU, then use the same TN to forward the track to Link 11 and/or Link 11B. Thus, all IUs hold the same Low TN for the track, and it is the CTN to be used in voice coordination.

b. MLETNAU. The C2P in a Model 4 ship operating as a JU essentially acts as an FJU between its host platform and Link 16. Thus, whenever the Low TN is the designated CTN and two or more Model 4 ships are operating as JUs, one of them must be designated as a MLETNAU, functioning in the same manner as an MFJU for all of the other Model 4 JU ships, which function in the same manner as Slave FJUs. Furthermore, in a multi-link interface, this MLETNAU must also be designated as the FJU, and as the MFJU if multiple FJUs are assigned.

c. Joint FJUs. Other Joint Service FJUs do not have the MFJU, SFJU, and MLETNAU capabilities. Therefore, when there are multiple FJUs assigned in a Joint interface and any one of them is not USN, some tracks may not have TN held in common by all IUs. If there is only one FJU, and it is not USN, that FJU must be considered to be the MLETNAU, and all Model 4 C2Ps must operate in the same manner as SFJUs.

A2.2.7.1 FJU Initialization Data. In addition to the normal initialization of Link 11 and Link 16, as specified in Appendixes C and D, the FJU must be initialized with the following data prior to commencement of data forwarding:

a. Data forwarding TN Block (see paragraph 4.4.2.2j, k, and l).

b. MFJU TN, if multiple FJUs assigned and Low TN is CTN (see paragraph 4.3.1.2).

c. FJU Link 16 Time Slots (Surveillance, EW, Weapons Coordination and Management, Indirect PPLI NPGs). (A method of distinguishing FJU time slots from the FJU's ownship IU time slots is TBD.)

d. EW Data Forwarding Mode (see paragraph 5.8.3.2).

A2.2.7.2 Standby FJU (SFJU)

a. An SFJU shall be designated whenever an FJU is designated. The C2P has an SFJU mode that facilitates rapid assumption of the FJU function in the event the FJU becomes inactive or degraded on either link. It is highly desirable that the SFJU operate as a CIU, see note. This enables the FJU function to be shifted virtually instantaneously, with no perceptible loss of forwarded data. If the SFJU is not a CIU, it operates as a C2 JU, and monitors Link 11.

NOTE: A Concurrent Interface Unit (CIU) is a unit that participates on both Link 16 and Link 11 at the same time, but not as an FJU.

In “Full” CONCOPS, CIUs transmit all of their tactical data on both links, to the extent that the message standard of each link allows transmission. In limited variants of CONCOPS, CIUs use the two Links for different functions or participate concurrently in two separate Links, which are not interfaced. CIUs comply with all of the protocols and procedures for each Link. CIUs participate concurrently in the Link 11-gridlock process and the Link 16 Relative Navigation (JTIDS/MIDS RELNAV) and IU Registration processes. A CONCOPS capability is fully implemented in the C2P. However, CONCOPS shall not be used operationally if the applicable FJU is not capable of “CONCOPS forwarding” (see paragraph 4.3.2.).

b. The SFJU must ascertain the FJU initialization data specified in paragraph A2.2.7, and enter it in advance if so equipped, in order to expedite the transfer of the FJU function. The SFJU must be capable of performing all the forwarding functions that the FJU it is standby for may perform, such as MFJU/MLETNAU, CONCOPS forwarding, etc.

A2.2.7.3 Special Data Forwarding Procedures

a. An FJU does not forward data if a filter in effect on the link to which the data are to be forwarded prohibits forwarding. FJUs are capable of establishing forwarding filters independent of filters established by the FJU's host platform.

b. USN has the capability to forward a Command message ordering an engagement action addressed to an inactive IU on another link, as described in section 5. However, FJUs of other Services do not forward messages addressed to an inactive IU.

A2.2.8 Concurrent Operations (CONCOPS)

A2.2.8.1 Definition

a. Concurrent Operations (CONCOPS) is the general term applied to the situation in which any platform equipped with any combination of Link 11, Link 16, and Satellite-Link 16 (S Link 16) simultaneously participates actively on two or more activated links, but not as an FJU. A Concurrent Interface Unit (CIU) is a unit that actively transmits tactical data on any combination of Link 11, Link 16, and S-Link 16 concurrently in a Link 11/16 interface, but not forwarding data. In "Full" CONCOPS, CIUs transmit all of their tactical data on two or more links, to the extent that the message standard of each link allows transmission. In the Simultaneous Operations (SIMOPS) variant of CONCOPS, CIUs participate concurrently in two separate Links that are not interfaced. CIUs comply with all of the protocols and procedures for each Link. CIUs participate concurrently in the Link 11 gridlock, Link 16 Relative Navigation (RELNAV) and IU Registration processes.

A2.2.8.2 Prevention of Data Looping

a. Data looping occurs when one or more IUs receives the same information via more than one data path. This can cause serious problems for CDSs and operators. Without special technical programming provisions, CONCOPS would cause data looping. However, data looping is prevented in CONCOPS by implementation of the following rules in the C2P:

(1) FJUs do not forward data from CIUs, nor data addressed to a CIU.

(2) CIUs discard all forwarded data.

(3) CIUs process received data using a priority scheme. If data is received over more than one path, the higher priority data is retained over the lower priority data. The priority in descending order is as follows:

(a) Direct Link 16.

(b) Direct Link 11.

(c) Direct Satellite-Link 16.

(d) Indirect Link 16 (i.e., data received from a data forwarder).

(e) Indirect Link 11 (i.e., data received from a data forwarder).

(f) Indirect S-Link 16 (i.e., data received from a data forwarder).

(4) When a CIU goes inactive on either link, the FJU immediately commences forwarding data from and to the CIU, and the CIU commences receiving forwarded data.

b. With the above CONCOPS rules, a direct data path replaces the indirect forwarded data path that exists when a multi-link equipped platform uses only one of its links.

A2.2.8.3 CONCOPS and Data Forwarding

a. An FJU must be assigned whenever there are one or more JUs present that cannot also operate on Link 11, and one or more PUs present that also cannot operate on Link 16. CONCOPS can be used whether or not data forwarding is also used in an interface. However, CONCOPS cannot be used if an active FJU that would receive data from a CIU has not implemented the above CONCOPS forwarding rules. Therefore, it is essential that the use of CONCOPS be carefully coordinated. The ICO must ascertain whether assigned FJUs have implemented "CONCOPS forwarding." All USN and RN FJUs are capable of CONCOPS forwarding; other U.S. Joint Service FJUs do not have the capability.

b. CONCOPS-capable platforms shall obtain permission from the ICO before commencing CONCOPS. Such permission shall not be granted if the FJU has not implemented CONCOPS forwarding. The ICO should consider assigning an FJU and an SFJU capable of CONCOPS forwarding, in order to realize the benefits of CONCOPS described below.

A2.2.8.4 Operational Benefits of CONCOPS. CONCOPS offers significant operational advantages over single Link operations by multi-link equipped units. In estimated order of significance, these are:

a. CONCOPS greatly expedites the transfer of the FJU function when an FJU goes inactive on either Link, if a CIU is assigned as the SFJU. The CIU is already active on both Links, and need only activate its data forwarding function to assume FJU. In conjunction with an automated FJU transfer process (to be developed), this normally requires only a few seconds.

b. CONCOPS reduces the dependence on an FJU node. In fact, if an interface consists of only CIUs and PUs, or only CIUs and JUs, the FJU node can be eliminated altogether.

c. CONCOPS increases overall IU availability, thereby increasing interface integrity and interoperability. Since the FJU immediately commences forwarding for a CIU that goes inactive on one Link, the IU can continue full tactical data exchange uninterrupted. This avoids potentially long periods of loss of tactical data exchange that would occur if the unit operated on only one Link and became inactive on that Link.

d. CONCOPS increases the specificity of tactical data exchange, by avoiding certain data degradations and losses that occur in the forwarding process.

e. CONCOPS avoids certain other potential interlink problems in at least the following areas:

(1) Data Registration and Correlation: CONCOPS should assist in reducing dual designations.

(2) Reporting Responsibility: CONCOPS can avoid "R^2 fights" in some situations.

A2.2.8.5 CONCOPS Disadvantages. CONCOPS has two disadvantages that can be operationally significant, and that must be considered in interface planning. These are:

a. CONCOPS increases the Link 11 Net Cycle Time by approximately 1/3 second per CIU.

b. When a CIU makes an unscheduled departure from one link, it is temporarily unable to exchange any data with IUs operating only on that link

until the FJU commences forwarding its data. This loss will normally not exceed 90 seconds. During that time, voice means must be used by the CIU to exchange orders or other tactical data to or from IUs operating only on the link on which the CIU has become inactive.

A2.2.8.6 Track Number Considerations for CIUs. Due to the potential for creating duplicate track number situations, the following restrictions on TN usage by CIUs are necessary:

a. A CIU shall not be assigned to operate in a Link 11 TN pool.

b. A CIU operator shall not manually assign a TN outside of its allocated TN block.

c. A CIU that is concurrent on Link 11 and Link 16 and/or S-Link 16 shall be assigned track blocks below 07777, if feasible.

A2.2.8.7 Simultaneous Operations (SIMOPS). SIMOPS is a variant of CONCOPS. In SIMOPS, one and only one multi-link equipped Simultaneous Interface Unit (SIU) transmits all locally derived data on both Link 11 and Link 16, while all other IUs remain silent on both Links. SIMOPS should be used only when necessary due to EMCON considerations. For example, a single AEW or AWACS aircraft could be assigned to provide a tactical surveillance picture for the entire Battle Group, while the remainder of the BG remains passive to avoid detection. It is imperative that only the SIU transmits on either Link, and that only one SIU be assigned. The E2C is the only USN IU capable of acting as an SIU. The USAF E-3 AWACS can also act as a SIU.

Note: If a single ship operates in CONCOPS mode while all other IUs are silent, the result is the same as SIMOPS.

A2.2.8.8 Separate Link CONCOPS (SEPOPS). In SEPOPS, one or more multi-link equipped IU participates concurrently in separate Link 11 and Link 16 networks that are not interfaced by an FJU. In this situation, the PUs maintain a different tactical picture than the JUs, while the SEPOPS CIUs maintain a combined tactical picture. There are no special operational procedures required for SEPOPS. No USN IUs are capable of SEPOPS. It is used by USAF and NATO AWACS aircraft.

A2.2.8.9 Single Link CONCOPS. Single Link CONCOPS is the term used for the situation in which all IUs present operate in a single established Link, normally Link 11; while some multi-link equipped CIUs also participate in the other link, normally Link 16, established solely among themselves. Single Link

CONCOPS permits the establishment of a single Link 11 or Link 11/11B interface without an FJU, while allowing the multi-link equipped CIUs to realize some of the benefits of Link 16. It also permits the rapid establishment of a multi-link interface if one or more CIU goes inactive on Link 11, or if a JU joins the interface. If one of the CIUs has been designated as an SFJU, it can rapidly commence data forwarding, thereby permitting uninterrupted data exchange between all units.

A2.2.9 Paragraph 5.5 Air, Surface, Land, and Space Surveillance Operations. Variable Update Rate (VUR) and High Update Rate (HUR) Track Reporting Capability. (Applicable to USN Model 5 C2 JUs, and only when operating on Link 16). All real-time Air and Surface Tracks are periodically updated automatically on Link 16 at approximately 12-second intervals, and all Air NRTs and Surface Tracks are periodically updated automatically at approximately 48-second intervals. However, all USN C2 JUs have a unique operator-selectable capability to vary update rates, as described below. Several nations do not have this capability. VUR and HUR shall not be used if any C2 JU other than USN is an active participant; i.e., capable of assuming reporting responsibility for Air or Surface Tracks on the Surveillance NPG. However, it is permissible to use VUR and HUR if a C2 JU other than USN is capable of reporting only Subsurface and/or Land Tracks is an active participant.

A2.2.9.1 Variable Update Rates (VUR). When VUR is selected by a C2 JU, all real-time Air Tracks reported by the JU continue to be reported at approximately 12-second intervals, but all Surface Tracks and Air NRTs are only updated at approximately 96-second intervals.

a. The purpose of VUR is to increase Link 16 throughput. It shall only be used when directed by the FTC/TDC, who must obtain permission from or be directed by the ICO. Its use must be directed on a force-wide basis to all C2 JUs, not to selected JUs.

A2.2.9.2 High Update Rate (HUR). HUR is selectable only for individual real-time Air and Surface Tracks, and only when VUR is in effect. When a real-time Air Track is selected for HUR, it is reported following every sensor update, but not more often than every 2 seconds. When a real-time Surface Track is selected for HUR, it is reported approximately every 12 seconds.

a. The purpose of HUR is to increase the update rate of high interest targets, thus providing more current and accurate data to other JUs. It is particularly beneficial for tracks that are known to be targeted for remote targeting by another JU. NRTs cannot be selected for HUR.

A2.2.9.3 Effect of VUR/HUR on Link 11. VUR and HUR cannot be used on Link 11. Since PUs assume R^2 after 40 seconds without a track report, USN C2 JUs are programmed to continue to transmit dead-reckoned periodic track reports on Link 11 when a C2 JU has R^2 for a surface track when VUR is in effect, to prevent undesirable R^2 shifts. Tracks designated for HUR are forwarded to Link 11 at every FJU transmission opportunity, just as they normally would be without HUR. Therefore, VUR and HUR have no effect on Link 11 when there is an USN FJU. It is permissible to use VUR and HUR in an interface that includes PUs, RUs, or USN Model 4 C2 JUs, unless there is an FJU other than USN.

A2.2.10 Paragraph 5.7.10c USW Platform and System Status. This information is only received by other USW aircraft and aircraft carriers. Model 4 aircraft carriers report such information that is available in the CV USW Module (USWM) for S-3 aircraft under their operational control. However, this CV reporting capability is discontinued in Model 5.

A2.2.11 Paragraph 5.8.2.1 EW Source and Data Type. USN IUs shall not report "EW Tracks." If the EW system produces an EW Track, the operator shall manually convert it to either a fix, AOP, or passive vehicular track, whichever is deemed most appropriate by the operator, prior to releasing it to the interface. However, if EW Tracks are reported by C2 JUs of other Services and Nations, they are processed and displayed as received by USN C2 JUs.

A2.2.12 Paragraph 5.9 Intelligence Reporting. USN C2 IUs have two separate functions that establish how intelligence information is reported on the interface. For USN C2 IUs, these functions operate as described below. Use of these functions is at individual IU discretion, not requiring force coordination.

A2.2.12.1 Intelligence Initiation Mode. This function establishes whether intelligence information derived by ownship's intelligence sources is automatically or manually initiated on the interface, as follows:

a. Automatic. Any information transferred to the CDS by a shipboard intelligence source is automatically transmitted on the interface without intervention by a CDS operator. However, the decision to transfer the information to the CDS is made by an intelligence operator.

b. Manual. Information transferred to the CDS by a shipboard intelligence source is not transmitted on the interface until manually released by an appropriate CDS operator. The CDS operator should compare the intelligence information with other locally derived and remote information held

for the track, and ensure that conflicting, confusing or unreliable intelligence information is not transmitted.
He may also decide to change the locally held information on the track based on the intelligence information.

A2.2.12.2 Remote Information Reporting Mode. This function establishes whether own-ship intelligence reports will also include remote intelligence information that has been accepted, as follows:

a. Local Only. Ownship's intelligence reports include only locally derived intelligence information.

b. Remote Included. Remote information is included in ownship's reports if no locally derived intelligence information is available for a particular data element, or if remote intelligence information has been accepted by the CDS operator in preference to the locally derived intelligence information for a data element (see below).

A2.2.12.3 Intelligence Information Processing. Intelligence information received in the CDS, both from ownship and remote intelligence sources, is maintained and displayed separate from the surveillance information for the track. Since intelligence reporting is independent of track R^2, intelligence information can be received from multiple sources for the same track. However, only one set of intelligence information is maintained for each track. The following procedures are used to determine which intelligence information is retained when available from multiple sources:

a. When received remote intelligence information differs from information derived by ownship intelligence sources, the appropriate CDS operator is alerted and must decide which information to retain, on a case basis. This decision may require coordination with ownship's intelligence operators. If ownship's information is retained, an intelligence report containing that information is automatically retransmitted as a means of informing the other intelligence source of the decision.

A2.2.13 Paragraph 5.10.5.5 PU IFF Limitations. The procedures in this paragraph are fully applicable to all USN Model 5 C2 IUs and most USN Model 4 IUs. However, some USN Model 4 IUs are unable to fully comply with these procedures. Such IUs will be identified in the STIR as “IFF-limited” IUs. Further guidance will be provided in the STIR.

A2.2.14 Paragraph 5.10.6 Strength Changes (Link 16 Only). USN C2 JUs do not originate such reports, since they are of dubious utility and have no effect if

the R^2 IU is not a Model 5 C2 JU. However, if an USN Model 5 C2 JU with R^2 receives such a report, the operator is alerted and must take a manual action to accept or reject the change. Strength changes from other than the R^2 IU are automatically discarded by USN C2 JUs that do not have R^2.

A2.2.15 Paragraph 5.10.9.2.2 Link 16 Response. Link 11 DUR Limitations. For technical reasons, Link 11 only allows general DURs addressed to a specific C2 IU. Therefore, the following limitations exist in operations with PUs or Model 4 C2 JUs:

a. A collectively addressed DUR originated by a C2 JU is not forwarded to Link 11, nor received by Model 4 C2 JUs.

b. A track-specific DUR addressed to a PU, RU, or Model 4 C2 JU will result in no response, unless the TN is that of the PU, RU, or Model 4 C2 JU, in which case the FJU or C2P responds with Indirect IU PPLI information for that IU.

A2.2.16 Paragraph 5.11.1.5d. Command Initiation During EMCON or Radio Silent Operation. All of the Commands listed in subparagraphs 5.11.1.1 a through k are forwarded by USN FJUs to silent IUs.

A2.2.17 Paragraph 5.11.1.6 Monitoring of Commands by Supporting Commanders.

a. Some USN C2 IUs have an operator-selectable capability to receive and display certain Commands addressed to other IUs. The Commands are in subparagraphs 5.11.1.1a-k. This capability is for use by supporting commanders. When this capability is selected, the following information is displayed for each such Command issued within the interface:

(1) Command.

(2) Originator.

(3) Addressee.

(4) Target TN.

(5) Weapon Type ordered to be used.

(6) Friendly Weapon TN ordered to be used.

(7) Addressee response.

b. The above information is for information only to facilitate C2 by supporting commanders and particularly supporting the principle of Control by Negation. When the above capability is selected and commands are displayed that are not addressed to own IU, no acknowledgment or response is made by own IU.

c. To support the Command monitoring capability, USN FJUs forward all the above Commands, regardless of the addressee's link. However, it must be anticipated that other FJUs will not forward Commands to a link other than the addressee's, limiting supporting commanders' ability to monitor Commands.

A2.2.18 Paragraph 5.11.3.2 Engagement Status Definitions. Engagement Status information not used by the USN, but received by an USN IU, are automatically interpreted and processed as the most appropriate status used by the USN. The interpretations are listed below for information only in the event they are used on voice circuits in joint or allied operations.

Engagement Status	Interpreted As
Partially Effective	Engaging
Not Effective	Engaging
Engagement Interrupted	Engagement Broken
Investigating/Interrogating	Weapon Assigned
Shadowing	Weapon Assigned
Intervening	Weapon Assigned
Covering	Weapon Assigned

a. Link 16 also supports reporting of the status of EW “engagements,” i.e., jamming, chaff, and decoys. However, these reports are not originated or processed by USN IUs.

A2.2.19 Paragraph 7.3 Simulated Tracks. (USN Simulated Video Capability) This capability is unique to USN, however, it can be used in an interface with other IUs without causing any problems. All USN surface C2 IUs have the capability to generate simulated air, surface, and subsurface video on the interface. This places a simulated video return on the PPI displays of receiving IUs, which can then be used to initiate simulated tracks to stimulate full interface training. The following are the procedures for the use of the simulated video capability:

a. One USN surface C2 IU must be designated as the Force Training Transmission Unit (FTTU). Only the FTTU transmits simulated video.

b. Simulated video training scenarios are pre-scripted for generation by appropriate equipment in the FTTU. Scenarios can also be created or modified on-line.

c. The FTTU function includes the following tasks:

(1) Initiating the training exercise.

(2) Modifying initial simulated video target positions and parameters when a pre-problem script is used.

(3) Creating on-line targets.

(4) Designating targets requiring control, i.e., interceptors.

(5) Controlling movement of selected targets.

(6) Designating input stations for on-line steering commands.

(7) Controlling radar fade characteristics.

(8) Injecting parametric data, as desired.

(9) Deleting simulated targets.

(10) Temporarily halting the exercise to provide operator instruction.

(11) Aborting the exercise.

d. The simulated video capabilities of Model 4 and Model 5 ships, and Link 11 and Link 16, are virtually identical, with two significant exceptions:

(1) Model 5 ships can generate and process up to 1023 simulated video targets. However, only 127 can be transmitted on or forwarded to Link 11, or received or processed by any Model 4 ship, regardless of the link it is operating upon. Simulated Target Identifiers (STI) greater than 127 are not forwarded to Link 11. Therefore, in an interlink interface exercise in which the FTTU is a Model 5 C2 JU, simulated video scenarios should ensure that

simulated video targets intended for both links are assigned STIs in the range of 1-127.

(2) "Abort Training" can be ordered on Link 11 by a Model 4 or Model 5 ship, but it cannot be ordered on or forwarded to Link 16. "Abort Training" causes all simulated video targets to be automatically deleted in all participating IUs. Therefore, when the FTTU or other appropriate participant desires to abort training, he must parallel the order by voice to all C2 JUs participating in the training exercise. C2 JU operators can then enter this order into their CDS and cause all simulated video targets to be automatically deleted.

A2.2.20 Paragraph 6.1 Introduction. Service-Unique Air Control Considerations

A2.2.20.1 Navy Link 4C Procedures (Fighter-to-Fighter)

a. Up to four F-14 aircraft participate in a single Link 4C Fighter-to-Fighter net, consisting of one master aircraft, and up to three slave aircraft. The designation of particular aircraft to either designation on the net is prearranged or briefed by voice and is set into control panels as 70-series addresses, XX70 through XX73. The master aircraft must be present for the net to remain operational. Net slave members must remain within 256 miles of the most distant net participant. Once the master aircraft and at least one slave aircraft have selected their data link address numbers, information is transmitted and received by all net participants as listed below:

(1) Ownship Net Designation Letter (A, B, C, or D).

(2) Ownship Velocity, Altitude, Position (Lat/Long).

(3) Ownship Course, Fuel Quantity, Missile Load.

(4) Ownship Weapon System Status, Radar Channel.

(5) Target Range, Bearing, Altitude, Target ID Number.

(6) Target Course, Velocity, ID.

(7) Raid Size Estimate, Engaged Status, WILCO, CANTCO.

(8) Challenge Order, Bearing Only Angle, Threat Type.

b. Each participating aircraft transmits own-ship information constantly once the net is established. When targets are detected, each participant automatically reports up to four targets to all net aircraft. Any aircraft may order any other participant to challenge any target that has a Track ID being reported by any aircraft in the net.

A2.2.21 USN Satellite Link 11 Initialization Procedures

A2.2.21.1 Purpose. The following are the procedures for setting up a link using a satellite capable AN/WSC-3 via the digital port on the AN/USQ-125. This setup should not be confused with serial link. Refer to Figure A2-3 for a block diagram.

A2.2.21.2 Requirements for a Satellite Link:

a. AN/WSC-3 SATCOM transceiver.

b. A satellite channel with a bandwidth of 25kHz. Set the AN/WSC-3 Frequency Offset on 4. To check the offset, pull the WSC-3 out on it's slides and look down at the top of the WSC-3. The switch will be located towards the front on the left.

c. The USQ-125 should be wired into the DAMA rack (OK-454, OK-455). This enables the USQ-125 to use the Keyline Translator located behind the test panel inside the DAMA rack. If you are not using a DAMA patch panel to connect the USQ-125 to the WSC-3, you will need a Keyline translator to convert the 6-volt Keyline to a ground instead.

NOTE: Setting up the interface between the NTDS equipment, KG-40A, and the USQ-125 are the same as when setting up an audio link. The KG-40A must be loaded with the current keymat and the NTDS operational program must be loaded and running. The only difference being the setup of the USQ-125, which will be done as per the following procedure.

A2.2.21.3 AN/USQ-125 Setup

a. At the An/USQ-125 remote control, perform the following:

(1) Go To Page 1 (see figure A2-4).

(a) Select ADDRESS LIST (see figure A2-5).

(b) Select ADD, then select EXTENDED TIMEOUT (see figure A2-6) and enter the PU number for the station you will be doing the satellite link with. See note below.

NOTE: This setup is only necessary if the PU is going to be an active participant in the link. If the satellite PU is going to be an active participant, there is no need to place the PU in the address list. Doing this will only increase the Net Cycle Time unnecessarily since that particular PU will not be transmitting.

(c) Select RETURN.

(d) Select EXTENDED TIMEOUT (see figure A2-7) and enter between 80 and 100 frames of timeout.

(e) Select RETURN then select RETURN again. You should now be on Page 1.

(f) Select STATION ADDR (see figure A2-8) and enter your own station address if it has not already been done.

(g) Select RETURN.

(2) Go to Page 3 (see figure A2-9).

(a) Select LINK MODE.

(b) Select MIXED MODE (see note below).

(c) Select RETURN.

NOTE: If you are going to be operating as remote station you should select DIGITAL instead of MIXED MODE. In addition, receive only stations should choose from page 1 (see figure A2-4) selection EMCON (see figure A2-10). Then select RADIO SILENCE, the return.

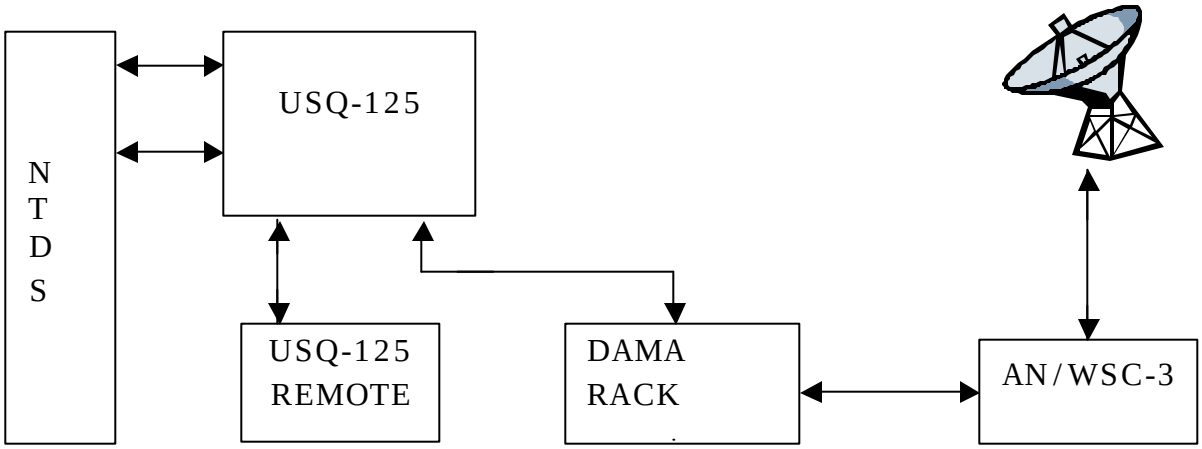

Figure A2-3. USN Satellite Link 11

A2.2.21.4 DAMA Rack Setup

a. At the DAMA rack, patch the USQ-125 to one of the designated AN/WSC-3s.

A2.2.21.5 AN/WSC-3 Setup

a. At the AN/WSC-3, check the following switch settings:

(1) LOS/SATCOM - SATCOM.

(2) TDMA/NONTDMA - TDMA.

(3) FREQUENCY OFFSET - 4.

(4) Dial in the correct uplink frequency.

(5) Ensure that the antenna is pointed at the correct satellite.

Page 1:

```
Multi-tone Link-11          [ ] Page 1          [ ] Start
[ ] Emcon: TX ENABLED       [ ] Sta Mode:    NCS
[ ] Net Mode: ROLL CALL     [ ] Recv Sb:     AUTO
[ ] Network Defaults        [ ] Test Mode:   OFF
[ ] Station Addr: 10        [ ] Addr List

10  22  48  36

STATUS                      SIG QUALITY
                            USB
                            LSB
```

Figure A2-4. Page 1: Multi-tone Link 11

PAGE 1: ADDRESS LIST

```
LINK-11 ADDRESS LIST, PAGE 1
[ ] ADD                     [ ] DELETE
[ ] INSERT                  [ ] CHANGE
[ ] EXTENDED TIMEOUT:       15 FRAMES

10  33  46  23*

[ ] RETURN
```

Figure A2-5. Page 1: Address List

PAGE 1: ADDRESS LIST
(ADD)

```
LINK-11 ADDRESS LIST, PAGE 1
ADD NORMAL ADDRESS:
[ ] NORMAL TIMEOUT   [ ] EXTENDED
TIMEOUT
[ ]0  [ ]1  [ ]2  [ ]3  [ ]4  [ ]5  [ ]6  [ ]7

10  22  48  36

[ ] RETURN
```

Figure A2-6. Page 1: Address List (Add)

PAGE 1: ADDRESS LIST
(EXTENDED TIMEOUT)

```
LINK-11 EXTENDED TIME OUT     [ ]
CANCEL

ENTER                         [ ]7   [ ]8   [ ]9
EXTENDED TIMEOUT:
   25 FRAMES                  [ ]4   [ ]5   [ ]6

                              [ ]1   [ ]2   [ ]3

                                     [ ]0

[ ] RETURN
```

Figure A2-7. Page 1: Address List (Extended Timeout)

PAGE 1:
OWN STATION ADDRESS

```
LINK-11 OWN STATION ADDRESS  [ ] CANCEL

ENTER ADDRESS:
[ ]0  [ ]1  [ ]2  [ ]3  [ ]4  [ ]5  [ ]6  [ ]7

[ ] RETURN
```

Figure A2-8. Page 1: Own Station Address

PAGE 3:

```
Multi-tone Link-11                [ ] Page 3        [ ] Start
[ ] Link Mode:    AUDIO           [ ] Mur Parameters
[ ] Waveform:     MULTI-TONE      [ ] Signal Presence
[ ] Split-Site:   OFF             [ ] Defaults
                                  [ ] Options

10  22  32  48

STATUS                            SIG QUALITY
                                  USB
                                  LSB
```

Figure A2-9. Page 3: Multi-tone Link 11

PAGE 1:EMCON

LINK-11 TRANSMIT MODE

[ ] TRANSMIT ENABLED
[ ] RADIO SILENCE

OUTPUT LEVEL: 0dBm
[ ] HIGHER
[ ] LOWER

[ ] RETURN

Figure A2-10. Page 1: EMCON

A2.3 US Air Force Procedures

None

A2.4 US Marine Corps Procedures

None

A2.5 General Service Procedures

A2.5.1 Key Loading Procedures for DTD and the Link 16 Terminal

A2.5.1.1 Table of Contents for Key Loading Procedures

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Set the DTD Protocol to Transfer Keys to a DS-101 Link 16 Terminal A2.5.1.5.4

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Set Station ID A2.5.1.5.6

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Set the DTD Protocol to Receive Paper Tape TEK from the KOI-18 .....A2.5.1.6.1

Set Default Key Tag Values to be Used When Loading Paper Tape TEK into the DTD A2.5.1.6.2

Load Red TEKs into the DTD from Paper Tape A2.5.1.6.3

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A2.5.1.2 Startup and Initialization Procedures for the AN/CYZ-10

A2.5.1.2.1 Power On Default Application Setup

NOTE: This step needs to be performed only once after the JFILL Application is installed. After that, JFILL will be automatically started upon powerup, and the RSL menu will not be displayed unless the Main Menu key is pressed from the JFILL JTIDS Main Menu.

To turn on the DTD press the ON/OFF button from the DTD keyboard one time.

From the DTD ROM Software Library (RSL) {MAIN} Menu select "Setup" or press 'S'.

```
Appl    Date    Time    Setup

Util    Bit             {MAIN}
```

Select "More" or press the 'M' key from the DTD keyboard to display the second screen of the Setup Menu. Pressing the [ABORT] key from the DTD keyboard will cause a return to the DTD RSL Menu.

```
Home_Addr    Serial#    Batt

More..       Keypad     {Setup}
```

Select "Program" or press 'P'.

```
Auto_Off     Def_cik    Program

Comm_Mode    Light      {More..}
```

Selecting "Program" from page two of the DTD Setup Menu results in the display of the prompt for specifying a default application. By specifying a default application, the DTD will bypass the main menu display after power on and execute the application. A supervisory CIK is required to select a default application. Without a supervisory CIK, the default application name can only be viewed.

If no default applications are found, this prompt is displayed.

```
No Applications Found

Press [CLR]
```

If a default application is found, it is displayed. Press "CLR"

```
Current Default: Jfill

Press [CLR]
```

A sample list of files available for selection as the default application is presented when a supervisory CIK is installed. Select “Jfill” or ‘J’.

Jfill Fill [DEL]
{PROG}

If the DTD ROM Software Library (RSL) {MAIN} Menu does not appear, press the “Main Menu” Key

Appl	Date	Time	Setup
Util	Bit		{MAIN}

A2.5.1.2.2 Initializing a CIK

NOTE: This step needs to be performed each time after the AN/CYZ-10 has been zeroized.

To turn on the DTD press the ON/OFF button from the DTD keyboard one time.

From the DTD ROM Software Library (RSL) {MAIN} Menu select “Util” or press ‘U’.

Appl	Date	Time	Setup
Util	Bit		{MAIN}

From the Utilities Menu select “cIk” or press ‘I’

Audit	Load	Erase	Format
cIk	Ckdat	Revno	{UTIL}

From the CIK Menu, Select “Itcik” or press ‘I’ to initialize the CIK.

Itcik Ldcik
{CIK}

The operator is prompted to enter a serial number in the range 0 to 16777215. Enter the Serial Number of the DTD and press “ENTR”

Enter CIK Serial Number

The operator is prompted to enter a CIK index slot in the range 1 to 8. Enter the slot index (usually 1) of the CIK and press “ENTR”

Enter CIK Index [1...8]

The DTD displays a message to let the operator know that processing is ongoing.

```
Please stand by
```

The initialize function requests that the [ENTR] key be pressed as a means of generating a stream of data to complete the initialization of the CIK. Begin pressing [ENTR] when prompted.

```
Tap  [ENTR]  repeatedly

until requested to stop.
```

Continue pressing the [ENTR] key until requested to stop. A minimum of 32 key presses are required.

```
Stop pressing  [ENTR]

Please stand by
```

After a short pause, a message is displayed indicating the status of the initialization. Press the "CLR" key. The CIK Menu will be redisplayed

```
Operation Successful

Press  [CLR]
```

Press the "Main Menu" or the "Abort" key to return to the DTD ROM Software Library (RSL) {MAIN} Menu

```
Itcik     Ldcik

{CIK}
```

```
Appl     Date     Time     Setup

Util     Bit              {MAIN}
```

A2.5.1.2.3 Setting Date and Time

NOTE: This step needs to be performed each time after the battery has been removed from the AN/CYZ-10 for longer than a couple of minutes, or if the DTD has been in storage and the battery has run down. Date and Time should be set to ZULU.

To turn on the DTD press the ON/OFF button from the DTD keyboard one time.

From the DTD ROM Software Library (RSL) {MAIN} Menu select "Date" or press 'D'.

```
Appl     Date     Time     Setup

Util     Bit              {MAIN}
```

The current setting of the date is displayed. Supervisory CIK operators have the option of providing a new setting. Depressing the [ABORT] key will exit

back to the DTD RSL Menu without changing the current date value. Depressing the [ENTR] key without entering a new date value will also return immediately to the DTD RSL Menu without changing the current date value.

The date must be entered as: mm-dd-yy, that is, the 2 digit month, followed by the 2 digit day, followed by the 2 digit year, followed by depressing the [ENTR] key. Dashes are displayed by the DTD to separate the date digits. Only the digits are entered as input by the user.

Enter the Current Date (Greenwich) and then press "ENTR". The DTD ROM Software Library (RSL) {MAIN} Menu will be redisplayed.

```
Date is Wed 11-02-1988

NEW mm-dd-yy:
```

From the DTD ROM Software Library (RSL) {MAIN} Menu select "Time" or press 'T'.

```
Appl    Date    Time    Setup

Util    Bit             {MAIN}
```

The current setting of the time is displayed on the first line of the display. Supervisory CIK operators have the option of setting a new time. Depressing the [ABORT] key will exit back to the DTD RSL Menu without changing the current time value. Depressing the [ENTR] key without entering a new time value will also return immediately to the DTD RSL Menu without changing the current time value.

The time must be entered as: hh:mm:ss; that is, the 2 digit hour, followed by the 2 digit minute, followed by the 2 digit second, followed by depressing the [ENTR] key. Colons are displayed by the DTD to separate the time digits. Only the digits are entered as input by the user. Entry of a new time value occurs on the second line of the display to the right of the "hh:mm:ss" prompt.

Enter the Current Time (Greenwich) and then press "ENTR". The DTD ROM Software Library (RSL) {MAIN} Menu will be redisplayed.

```
Time is 08:48:56

NEW hh:mm:ss:
```

```
Appl    Date    Time    Setup

Util    Bit             {MAIN}
```

A2.5.1.2.4 Initializing the JFILL Program

NOTE: The steps in this section need to be performed after the zeroization and reinitialization of the DTD, and if the Power On default Application Setup has not yet been completed.

From the DTD ROM Software Library (RSL) {MAIN} Menu select "Appl" or press 'A'.	**Appl** Date Time **Setup** Util Bit {MAIN}
Select "JFILL" or 'J' to load JTIDS specific application software. Other applications may be present on the DTD such as FILL or CSEP	FILL **JFILL** CSEP
The DTD displays that it is loading the application software.	Loading Application ...
The DTD displays that the JTIDS Rev 3.0x application software is loaded.	JTIDS Rev 3.0x
JTIDS Application software checks to ensure that a valid CIK is installed in the DTD.	Waiting for CIK status
The current date and time will be displayed	Current Date/Time is: 04-15-1995 13:15:00
A Supersession check will be started	Starting Key SUPERSESSION Check
The Supersession check will then be completed	Supersession check completed

The JTIDS Application Menu is Displayed after a valid CIK has been verified, and the supersession check has been completed. Select "JTIDS" or 'J' to execute the JTIDS thread

Jtids Fill

The JTIDS Main Menu will be displayed

A_xmit	Xmit	Sp_xmit	{J101
Recv	Util	Kls_reset	

A2.5.1.2.5 Pre-Setting the Default Startup Thread

NOTE: This step needs to be performed each time after the AN/CYZ-10 has been zeroized.

The DTD may be pre-set, using the 'Util' function to automatically start in the JTIDS thread, therefore allowing the DTD to boot up and present the JTIDS Main Menu by just pressing the ON/OFF key.

From the JTIDS DTD KMS Main Menu select Util, using the arrow keys or by pressing the 'U' key.

A_xmit	Xmit	Sp_xmit	{J101
Recv	**Util**	KLS_reset	

From the UTL menu press the ENTR key to select the Setup Options.

Setup	Init_sdu	{UTL
Delete	Load_stat	

From the setup menu, press the 'O' key to display more setup options.

Select setup option			{SET
Protocol	Tag	Match	**mOre**

From the additional setup options menu, press the 'T' key to display the Thread selection menu.

Set defaults:	{SET
Xmit **Thread**	

Select "Jtids" or press 'J' to set JTIDS as the default startup thread.

Select Startup Thread:		
Jtids	Fill	None

The JTIDS DTD KMS Main Menu is again displayed.

A_xmit	Xmit	Sp_xmit	{J101
Recv	Util	KLS_reset	

A2.5.1.2.6 Set the DTD Match Length Default Value

NOTE: This step needs to be performed each time after the AN/CYZ-10 has been zeroized.

Select "Util" or press 'U' enter the Utility Menu.

```
A_xmit   Xmit   Sp_xmit     {J101

Recv     Util   Kls_reset
```

Select "Setup".

```
Setup     Init_sdu          {UTL

Delete    Load_stat
```

Select "Match".

```
Select setup option         {SET

Protocol   Tag   Match   mOre
```

Enter a match length value. Press the ENTR key when finished.

```
Text-ID Match Length?

=>  3
```

The display will return to the JTIDS Main Menu.

```
A_xmit   Xmit   Sp_xmit     {J101

Recv     Util   Kls_reset
```

A2.5.1.3 Link 16 KEK Loading

A2.5.1.3.1 Set the DTD Protocol to Receive Paper Tape KEK from the KOI-18

The current protocol is displayed in the top right corner of the display. From the JTIDS Main Menu select "**U**tilities" to begin the sequence to change the protocol setting.

```
A_xmit   Xmit   Sp_xmit     {J101

Recv     Util   Kls_reset Xmit
```

Select "**S**etup" from the Utilities Menu, or press ENTR.

```
Setup     Init_sdu          {UTL

Delete     Load_stat
```

Select "**P**rotocol" from the Setup Menu, or press ENTR.

```
Select setup option        {SET

Protocol    Tag    Match
```

Select "**K**oi18" from the Protocol Selection Menu by pressing the 'K' key.

```
Select protocol:           {SET

Ds101  dS102  Rs232  Koi18
```

The protocol is now set to KOI-18 as shown in the top right corner of the display. Select "Recv" from the KOI18 Options Menu in preparation to receive a Red KEK from the KOI-18.

```
Xmit    Recv               {JK18

Utilities  Kls_reset
```

A2.5.1.3.2 Load Red KEK into the DTD from Paper Tape

Key Encryption Key (KEK) is used by the Link 16 SDU to decrypt Black Keys as they are loaded. Black Keys are encrypted traffic Keys (TEK). KEKs must be pre-positioned in the SDU each month. Normally, a KEK is loaded at the beginning of the month prior to its use. Initially, two KEKs, the current and next month, are loaded into the SDU.

Select "Recv" from the KOI-18 Options Menu in preparation to receive a Red KEK from the KOI-18.

```
Xmit    Recv               {JK18

Utilities  Kls_reset
```

The following steps in this section will need to be performed for as many KEKs as are to be loaded.

The operator is prompted to connect to the KOI-18. Press the [RCV] key to continue with the receive operation. Press the [ABORT] key to return to the KOI-18 Options Menu.

```
Connect to station and

Press  [RCV]/[ABORT]
```

The operator is prompted to pull the desired KEK tape through the KOI-18 that is connected to the DTD via Fill Cable.

```
Load in progress

⊕Pull tape...
```

The DTD has received the key data stream from the KOI-18. KEKs will not pass the required parity check and must be pulled through the KOI-18 a second time. The operator is prompted to press the [RCV] key to continue the KEK load.

```
Data rcvd.  Press [ABORT]

or [RCV] and reload key.
```

The operator is prompted to pull the KEK tape through the KOI-18 again.

```
Load in progress

⊕Pull tape...
```

The operator is asked if the key received is a KEK. To continue Select "Yes" if it is. Select "No" if it isn't.

```
Is Key a KEK?

Yes/No
```

In the case of "No" the DTD is informed that this key was a TEK and since the parity should have been good, this key must be bad. An error message would be displayed and the KOI-18 Options Menu would be displayed.

The JTIDS DTD KMS ignores any pre-set default Key Tag data when loading a KEK. The operator is prompted to enter a text ID. All alphanumeric characters are acceptable up to a limit of 16 characters.

Entering a descriptive ID such as "KEK APRIL"

```
Enter Text ID =>

????????????????
```

The operator is prompted to enter a short title for the KEK. All alphanumeric characters are acceptable up to a limit of 24 characters.

```
Enter Short Title =>

????????????????????????
```

The operator is prompted to enter the edition of the KEK. All alphanumeric characters are acceptable up to a limit of 6 characters.

```
Enter Edition

=>??????
```

The operator is prompted to enter the segment number of the KEK. All numeric characters are acceptable, up to a limit of 3 numbers are allowed, but the number must be less than 256.

```
Enter Segment Number

=>###
```

The operator is prompted to enter the register number of the KEK. All numeric characters are acceptable, up to a limit of 11 numbers are allowed, but the number must be less than 68719476736.

```
Enter Reg Number

=>###########
```

The operator is prompted to select the classification of the KEK. Select either "Unclass" (Unclassified), "Confid" (Confidential), "Sec" (Secret), or "Topsec" (Top Secret).

```
Select Classification

Unclass  Confid  Sec  Topsec
```

Following the reception of data from the KOI-18 the DTD is ready to receive more data. Press the [RCV] key to receive more data from the KOI-18. Press [ABORT] to return to the KOI-18 Options Menu.

```
Connect to station and

Press  [RCV]/[ABORT]
```

A2.5.1.3.3 Set the DTD Protocol to Transfer Keys to a DS-101 Link 16 Terminal

The current protocol is displayed in the top right corner of the display. From the JTIDS Main Menu select "**U**tilities" to begin the sequence to change the protocol setting.

```
Xmit    Recv          {JK18

Utilities
```

Select "**S**etup" from the Utilities Menu, or press ENTR.

```
Setup   Init_sdu      {UTL

Delete  Load_stat
```

Select "**P**rotocol" from the Setup Menu, or press ENTR.

```
Select setup option   {SET

Protocol  Tag  Match
```

Select "**D**s-101" from the Protocol Selection Menu by pressing the 'D' key or pressing ENTR.

```
Select protocol:      {SET

Ds101  dS102  Rs232  Koi18
```

The operator is prompted whether wakeup will be used. Wakeup is applicable for transmitting to a Link 16 DS-101 Crypto Device. Select "**Y**es" by pressing the 'Y' key or ENTR.

```
Use Ds101 wakeup?

Yes/No
```

The protocol is now set to DS-101 as shown in the top right corner of the display. The Main Menu displayed is for DS-101 with wakeup. A_xmit, Sp_xmit and Kls_reset are not displayed if wakeup is not enabled.

```
A_xmit  Xmit  Sp_xmit  {J101

Recv    Util  Kls_reset
```

A2.5.1.3.4 Transfer a KEK to a DS-101 Link 16 Terminal

With DS-101 with wakeup as the current protocol, select "Xmit" or press 'X' to manually select keys for transmission.

```
A_xmit  Xmit  Sp_xmit  {J101

Recv    Util  Kls_reset
```

The first key in the database will be displayed. Select the "Sel" option or press 'S' to select this KEK for transfer.

```
Sel  Edit  Find  Quit ↓ {XMT

KEK TEXT ID        0  U
```

An Asterisk will appear in the right hand column to indicate that the KEK has been selected. Pressing 'S' again will deselect it. To select other KEKs for transfer, use the PGUP and PGDN keys to scroll through the database and select each KEK that is to be transferred.

```
Sel   Edit   Find   Quit ↓ {XMT

KEK TEXT ID          0  U   *
```

After all KEKs that are to be transferred have been selected, select "Quit" or press 'Q' to exit the select menu and transfer the selected KEKs.

```
Sel   Edit   Find   Quit ↓ {XMT

KEK TEXT ID          0  U   *
```

The DTD will prompt to connect to device and to press the SEND key.

```
Connect to device;

Press [SEND] to initiate
```

The DS-101 wakeup occurs allowing the KGV-8B to accept a key load.

```
Activating Wakeup...

\
```

The station ID/fixed ID of the connected KGV-8B is displayed during the key transmission.

```
Transfer in progress to:

STATION ID          01
```

Results of the KEK transmission are briefly displayed for each KEK transferred.

```
Key Load Transferred
```

The JTIDS DTD KMS gives the operator the option to retransmit the KEK to another SDU, edit the KEK selected or to send a new key. Press ABORT to return to the JTIDS DTD KMS MAIN MENU.

```
Select

Retransmit    Modify    New
```

```
A_xmit   Xmit   Sp_xmit  {J101

Recv     Util   Kls_reset
```

A2.5.1.3.5 Zeroize the DTD

NOTE: The DTD should be zeroized if Black Key Data is to be loaded into it. This will prevent the Black Key Data and its associated KEK segment from residing on the same DTD. The zeroization will also return it to its unclassified CCI state.

Press the red “ZERO” key three (3) times	A_xmit Xmit Sp_xmit {J101 Recv Util Kls_reset
Zeroizing will format the C: drive and will cause COMSEC to clear all key data from the database	ZEROIZE IN PROGRESS...
After zeroization is complete, press the ON/OFF button	ZEROIZE COMPLETE PRESS [ON / OFF] NOW

Perform the startup procedures required to initialize the DTD for use in Link 16 key loading.

A2.5.1.4 Link 16 Black TEK Loading

A2.5.1.4.1 Load Black Key Data from a PC to the DTD

To turn on the DTD press the ON/OFF button from the DTD keyboard one time.

From the JTIDS Main Menu, select "Util" or press 'U'

```
A_xmit   Xmit   Sp_xmit   {J101

Recv     Util   KLS_reset
```

Select "Setup" from the Utilities Menu.

```
Setup    Init_sdu        {UTL

Delete   Load_stat
```

Select "Protocol" from the Setup Menu.

```
Select setup option        {SET

Protocol   Tag   Match   mOre
```

Select "Rs232" from the Protocol Selection Menu by using the arrow keys or pressing the 'R' key.

```
Select protocol:           {SET

Ds101   dS102   Rs232   Koi18
```

Select "PC" from the RS-232 Protocol Selection Menu by using the arrow keys or pressing the 'P' or 'ENTR' key.

```
Select RS-232 protocol:

PC      Stu
```

The Main Menu for RS-232 transfer is displayed. Select "Recv" or press 'R' to initiate the data transfer process.

```
Xmit     Recv            {J232

Utilities
```

Turn on the JTIDS PC and execute the JTIDS PC KMS

From the JTIDS PC KMS Main Menu, Select '1'

```
1. DTD Transfer Functions
2. Key Management Database
3. SDU Management Database
4. OPTASK Management Database
5. Quit
```

From the Transfer Menu, Select '2'

```
1. Develop Keyload (OPTASK)
2. Develop Keyload Multi-Day)
3. Develop SDU Initialize Data
4. Xmit Transfer File to DTD
5. Keyload Status Log Utility
6. Clear the Transfer file
7. Return to the Main Menu
```

From the Key Material Selection Screen, use the UP and DOWN Arrow keys to highlight the Short Title/Edition for the beginning of the Date Range to be selected and then press "ENTER"

```
AKME ####¦A¦031¦AKMT  ####...
AKME ####¦B¦031¦AKMT  ####...
AKME ####¦C¦031¦AKMT  ####  ...
AKME ####¦E¦031¦AKMT  ####...
```

From the Text ID Selection Screen, use the UP and DOWN Arrow Keys to highlight the SDU that is to be used as the Text ID for the Key Load, and press "ENTER"

```
Select SDU that keyload will be loaded into as
the Text ID:                          +------
          ------------+
     ¦ VAW116 602      ¦
     ¦ CGN-94          ¦
     +-----------------+
```

From the Date Range Selection screen, enter the range of dates for the selected key data load and then press "ENTER"

```
+-----------------------+
¦    Load Date Range    ¦
¦-----------------------¦
¦Enter date range of the¦
¦multi-day keyload for  ¦
¦      VAW116 602:      ¦
¦                       ¦
¦10/MAR/1995-08/APR/1995¦
+-----------------------+
```

From the SDU Location Selection Screen, use the LEFT and RIGHT Arrow keys to highlight the default SDU Location pair desired for the selected key data load and then press "ENTER"

Note: For U.S. Navy Link 16 this will normally be the 0/1 pair

```
+-----------------------+
¦    Load Date Range    ¦
¦-----------------------¦
¦Enter date range of the¦
¦multi-day keyload for  ¦
¦      VAW116 602:      ¦
¦                       ¦
¦10/MAR/1995-08/APR/1995¦
+-----------------------+
+-----------------------+
¦Select SDU Location    ¦
¦Pair:                  ¦
¦ 0/1  2/3   4/5   6/7  ¦
+-----------------------+
```

```
+-----------------------+
|    Load Date Range    |
|-----------------------|
|Enter date range of the|
|multi-day keyload for  |
|      VAW116 602:      |
|                       |
|10/MAR/1995-08/APR/1995|
+-----------------------+
+-----------------------+
|Select SDU Location    |
|Pair:                  |
| 0/1  2/3   4/5   6/7  |
+-----------------------+

 PROCESSING DATA PLEASE STAND
            BY
```

When the keyload has been added to the transfer file, press “RETURN” to continue

```
+-----------------------+
|    Load Date Range    |
|-----------------------|
|Enter date range of the|
|multi-day keyload for  |
|      VAW116 602:      |
|                       |
|10/MAR/1995-08/APR/1995|
+-----------------------++---
-------------------+
|22 keys for Edition A  |
| 8 keys for Edition B  |
+-----------------------+
```

Press any key to continue

```
          Items  added

030 items added to the transfer file.
Total items  in the file 00030.
   Press any key to continue.
```

From the Transfer Menu, Select ‘4’

```
1. Develop Keyload (OPTASK)
2. Develop Keyload Multi-Day)
3. Develop SDU Initialize Data
4. Xmit Transfer File to DTD
5. Keyload Status Log Utility
6. Clear the Transfer file
7. Return to the Main Menu
```

On the DTD Transfer Screen, select “RETURN” to transfer all items in the Transfer file to the DTD.

Note: Data Entry mode for Start or End Item may be entered by selecting either F2 or F4 respectively. This allows the user to modify the items to be transferred into the DTD.

```
Total number of items : 00030

Starting at item : 00001
End at item      : 00030

<CR>-Transfer    <F1>-Help
<F2>-Start       <F3>-End
<F4>-Display     <ESC>-Exit
```

Connect the DTD and the JTIDS PC via the special RS-232 cable.

```
Connect to DTD and press <CR>,

Press <ESC> to Abort
```

On the DTD, press the “ENTR” or the “RCV” key to continue with the receive operation.

```
Connect to station and

Press   [RCV]/[ABORT]
```

On the JTIDS PC Press the “RETURN” key to initiate the PC transfer of key data.

The DTD displays that it is attempting to connect to the JTIDS PC. If the operator presses the [ABORT] key a message that an abort is in progress is displayed and the RS232 Options Menu is displayed.

```
Attempting to connect
                        [ABORT]
```

The DTD displays that it is receiving data from the JTIDS PC.

```
Load in progress
```

As items are received from the JTIDS PC the DTD displays that they are received, starting from 1 up to the total number received.

```
Item 1 received
```

The DTD displays the total number of items received.

```
1 items received
```

Following the reception of data from the JTIDS PC the DTD is ready to receive more data. Press [ABORT] to return to the RS232 Options Menu.

```
Connect to station and

Press   [RCV]/[ABORT]
```

```
Xmit    Recv            {J232

Utilities
```

Following the transfer of key data from the PC to the DTD, a message notifying the user of the successful transfer will be displayed. This message is white background with blue letters.

In the event of an error, the message will have a red background with white letters.

In either case, Press "RETURN" to continue

Select '6' to Clear the Transfer File

1. Develop Keyload (OPTASK)
2. Develop Keyload Multi-Day)
3. Develop SDU Initialize Data
4. Xmit Transfer File to DTD
5. Keyload Status Log Utility
6. Clear the Transfer file
7. Return to the Main Menu

Press 'Y' to reset the Transfer File

Reset Transfer File

There are 00030 items
in the Transfer File.
Do you want to reset ? N

Select '7' to return to the Main Menu

1. Develop Keyload (OPTASK)
2. Develop Keyload Multi-Day)
3. Develop SDU Initialize Data
4. Xmit Transfer File to DTD
5. Keyload Status Log Utility
6. Clear the Transfer file
7. Return to the Main Menu

Select '5' to end the JTIDS PC KMS application

1. DTD Transfer Functions
2. Key Management Database
3. SDU Management Database
4. OPTASK Management Database
5. Quit

A2.5.1.4.2 Set the DTD Protocol to Transfer Keys to a DS-101 Link 16 Terminal

The current protocol is displayed in the top right corner of the display. From the JTIDS Main Menu select "**U**tilities" to begin the sequence to change the protocol setting.

```
Xmit    Recv          {R232

Utilities
```

Select "**S**etup" from the Utilities Menu, or press ENTR.

```
Setup   Init_sdu      {UTL

Delete  Load_stat
```

Select "**P**rotocol" from the Setup Menu, or press ENTR.

```
Select setup option      {SET

Protocol   Tag   Match
```

Select "**D**s-101" from the Protocol Selection Menu by pressing the 'D' key or pressing ENTR.

```
Select protocol:         {SET

Ds101  dS102  Rs232  Koi18
```

The operator is prompted whether wakeup will be used. Wakeup is applicable for transmitting to a KGV-8B. Select "**Y**es" by pressing the 'Y' key or ENTR.

```
Use Ds101 wakeup?

Yes/No
```

The protocol is now set to DS-101 as shown in the top right corner of the display. The Main Menu displayed is for DS-101 with wakeup. A_xmit, Sp_xmit and Kls_reset are not displayed if wakeup is not enabled.

```
A_xmit  Xmit  Sp_xmit  {J101

Recv    Util  Kls_reset
```

A2.5.1.4.3 Set the DTD Transmit Default Values

The JTIDS DTD KMS allows the operator to select a specific Key short title (or short titles) for loading into a Link 16 Terminal. This enables multiple short titles of Keys to be loaded into the DTD with the same Text ID. For example: AKAT/AKAE #### and AKAT/AKAE #### with Text ID; "VAW113".

The operator also has the option of selecting the memory locations for loading keys into the Link 16 SDU. This allows the operator to load keys into memory locations that are different than the location selected when the Key was first loaded into the DTD. An example of the necessity for using this option is when the Link 16 Network Load requires Keys be loaded into locations 6 and 7 instead of 0 and 1. Some Joint force/NATO networks will use locations 6 and

7. Most U.S. Navy networks use locations 0 and 1. In addition the JTIDS DTD KMS allows the operator to load the same Key into multiple locations (i.e., 0/1 and 6/7). Some special networks may require this capability.

The DTD will not allow loading of multiple Keys into the same memory location. If the operator selected or default short title memory locations are duplicated, the DTD KMS will require that the operator reselect the Keys for loading or change the locations.

Once the transmit defaults have been set the DTD will retain those defaults until they are change or the DTD is Zeroized.

Pre-set and store default short title and memory location data in the DTD:

Select "**U**til" or press 'U' from the JTIDS MAIN Menu.

```
A_xmit   Xmit   Sp_xmit     {J101

Recv     Util   Kls_reset
```

Select "**S**etup" or press 'S' from the Utilities Menu.

```
Setup    Init_sdu          {UTL

Delete   Load_stat
```

Select more setup options by pressing 'O'.

```
Select setup option        {SET

Protocol   Tag   Match   mOre
```

Select "Xmit" or press 'X' to set the Special Transmit defaults.

```
Set defaults:              {SET

Xmit   Thread
```

The Special Transmit defaults may be modified or cleared, if already pre-set. If the defaults are not pre-set or the operator wishes to add another short title to the default list select "Add".

```
Select Xmit Defaults:

Modify   Add   Clear
```

The DTD searches its Key storage data base for the lowest Short Title/Edition and displays a scrollable list for selection.

```
Locating Lowest Editions...

Pleas wait......
```

Use the P-Dn or P-Up keys to scroll the list of Short Titles, and press the ENTR to select the desired default Short Title.

```
Sel_des  Quit          ED:A

AKAE ####
```

The DTD displays the list of allowable memory location pairs. Select the desired pair by pressing a number or using the arrow keys. Press ENTR to select a pair.

```
Select default pairs:

0_1    2_3    4_5    6_7    Quit
```

More than one pair may be selected. Pressing the ENTR key when an already selected pair is highlighted de-selects that pair. Select 'Quit' to quit the process. If 'Quit' is selected without choosing a location pair, the DTD KMS will use only the short title selected and the location that was designated when that Key was loaded.

```
Select default pairs:

0_1*   2_3    4_5    6_7 *  Quit
```

```
Item added to defaults
```

The list of defaults may be modified if desired to add more short titles or additional location pairs. Press the 'ABORT' key to exit this menu. Press the 'MAIN MENU' key to go back to the JTIDS DTD KMS Main Menu.

```
Select Xmit Defaults:

Modify  Add   Clear
```

```
A_xmit  Xmit  Sp_xmit    {J101

Recv    Util  Kls_reset
```

A2.5.1.4.4 Set Station ID

NOTE: This procedure needs to be performed only if the Station ID of the SDU has not previously been set to the desired values. (Refer to SET STATION ID MANUALLY or SET STATION ID FROM A LIST found in the MISC Procedures Section). Once the SDU has been setup, this procedure can be skipped.

A2.5.1.4.5 Transfer Keys to a DS-101 Link 16 Terminal

In the Automatic Transmit operation, keys are automatically selected and loaded into the Link 16 Terminal. Keys are selected based on matching the Text ID to the Station ID/Fixed ID of the Link 16 Terminal and by selecting Segments of Key that match the default Short Title and the current and next day's date (using the DTD date/time). The Text ID match length value is used

to tell the JTIDS DTD how many significant characters to use for the exact matching. The composite display details the results of a successful key load of all eight keys into the Link 16 Terminal. There is no difference in procedures for loading BLACK or RED key into the SDU.

From the JTIDS Main Menu select "**A**uto_xmit" to begin the auto transfer by pressing the ENTR key.

```
A_xmit  Xmit  Sp_xmit    {J101

Recv    Util  Kls_reset
```

The DS-101 wakeup occurs allowing the Link 16 Terminal to accept a key load.

```
Activating Wakeup...

\
```

Keys whose Text Id matches the Station ID/Fixed ID of the connected Link 16 Terminal are being located. The JTIDS DTD KMS selects only the keys with the Short Title pre set in the transmit defaults. The DTD also will select the correct Segment number for the Keys based on the current date/time entered into the DTD. In addition the JTIDS DTD KMS will prepare the keys for loading into the memory locations pre set in the transmit defaults.

```
Locating matched keys

Please wait...
```

The DTD displays the Station ID and Fixed ID of the Link 16 Terminal that it is connected to. The Station ID was used to match the Text ID of keys.

```
Transfer in progress to:

STATION ID          01
```

Results of the key transmission are shown in a composite display for all transmitted keys. Also, the DTD display panel lights will blink once to signify a successful key load. If there are no failures, press ENTR to return to the Retransmit Menu.

```
SUCCESS:  0  1

FAILED :            <ENTR>
```

The Retransmit Menu allows a Re_auto selection as well as options for Retransmit, Modify, or New. Press the "Main Menu" or the "Abort" key to return to the JTIDS Main Menu

```
Select option:

Re_auto  re_Xmit  Modify  New
```

Notice that the retransmit menu contains the option "Re_Auto". The "Re_auto" selection is offered because an Auto Transmit was performed previously. The "Re_auto" selection is the same as going to the main menu and selecting "Auto_xmit" whereby another auto transmit will be performed on whichever KGV-8B is currently connected. Conversely, the "re_Xmit" selection offers the operator the ability to send the same set of keys that were previously sent to the same or different Link 16 Terminal. "Modify" and "New" allow the operator to modify the key list or create another key list for transmitting to the Link 16 Terminal.

A2.5.1.4.6 Common Error Messages

This error will occur when there are no keys with a Text ID that matches the SDU Station ID for the number of characters set in the match length..

This error will also occur when the transmit defaults are not properly set.

No Keys Selected

This error will occur when the transmit defaults are not properly set.

Duplicate SDU Locations Assigned

This error will occur when there is **NO** KEK loaded in the SDU.

EEPROM DECRYPT FAIL

This error will occur when the **WRONG** KEK is loaded in the SDU.

KEK/KEY DECRYPT FAIL

A2.5.1.5 Link 16 Paper Tape Key Loading

A2.5.1.5.1 Set the DTD Protocol to Receive Paper Tape TEK from the KOI-18

The current protocol is displayed in the top right corner of the display. From the JTIDS Main Menu select "**U**tilities" to begin the sequence to change the protocol setting.

```
A_xmit   Xmit   Sp_xmit     {J101

Recv     Util   Kls_reset Xmit
```

Select "**S**etup" from the Utilities Menu, or press ENTR.

```
Setup     Init_sdu          {UTL

Delete    Load_stat
```

Select "**P**rotocol" from the Setup Menu, or press ENTR.

```
Select setup option         {SET

Protocol    Tag     Match
```

Select "**K**oi18" from the Protocol Selection Menu by pressing the 'K' key.

```
Select protocol:            {SET

Ds101   dS102   Rs232   Koi18
```

The protocol is now set to KOI-18 as shown in the top right corner of the display.

```
Xmit     Recv               {JK18

Utilities  Kls_reset
```

A2.5.1.5.2 Set Default Key Tag Values to be Used When Loading Paper Tape TEK into the DTD

The JTIDS DTD can use operator defined default key tag values for Red keys received from the CFDs to reduce operator workload of entering key tag values for multiple keys with the same key tag values. The use of default key tag values can be applied to one or more of the key tag options or not used at all. If a key tag value is left blank, the DTD will prompt the operator to enter a value after each key is loaded into the DTD.

Select "**U**tilities" from the JTIDS Main Menu.

```
Xmit     Recv               {JK18

Utilities  Kls_reset
```

Select "**S**etup" from the Utilities Menu.

```
Setup    Init_sdu        {UTL

Delete   Load_stat
```

Select "**T**ag" from the Setup Menu.

```
Select setup option        {SET

Protocol  Tag  Match   mOre
```

Enter a 16 character (or less) default Text ID to use. All alphanumeric characters are valid. If no value is displayed when ENTR is pressed, the operator will be prompted to enter a Text ID for every subsequent key received. Press ENTR when finished. The LOCK LTR key may be toggled to permit entry of spaces and numbers.

```
Enter Text Id      =>

????????????????
```

Enter a 24 character (or less) default short title to use. All alphanumeric characters are valid. If no value is displayed when ENTR is pressed, the operator will be prompted to enter a short title for every subsequent key received. Press ENTR when finished. The LOCK LTR key may be toggled to permit entry of spaces and numbers.

```
Enter Short Title  =>

??????????????????????????
```

Enter a 6 character (or less) default edition to use. All alphanumeric characters are valid. If no value is displayed when the ENTR key is pressed, the operator will be prompted to enter an edition for every subsequent key received. Press ENTR when finished. The LOCK LTR key may be toggled to permit entry of spaces and numbers.

```
Enter Edition

=>??????
```

Enter a 3 number (or less) default segment number to use. All numeric characters are valid. If no value is displayed when ENTR is pressed, the operator will be prompted to enter a segment number for every subsequent key received. Press ENTR when finished. The JTIDS DTD KMS will automatically increment the Segment Number as each key is received.

```
Enter Segment Number

=>###
```

Enter default SDU location number to use. Only numbers 0-7 are valid. If no value is displayed when ENTR is pressed, the operator will be prompted to enter an SDU location number for every subsequent key received. Press ENTR when finished.

```
Enter SDU location

=>#
```

The DTD will toggle between the number entered and its SDU location pair mate as keys are received, for example; if 0 is entered then the DTD will toggle the SDU location value 0-1-0-1-0-1

Enter a 11 number (or less) default register number to use. All numeric characters are valid. If no value is displayed when ENTR is pressed, the operator will be prompted to enter a register number for every subsequent key received. Press ENTR when finished.

```
Enter Reg Number

=>###########
```

Classifications of Confid (Confidential), Sec (Secret), or Topsec (Top Secret) may be selected. Press ENTR when finished.

```
Select Classification

Unclass   Confid   Sec   Topsec
```

NOTE: It is not possible to enter a default classification of UNCLASS for incoming keys because to accidentally tag a key as UNCLASS would be a breach of security. Care should be taken when using default classifications.

The DTD is now ready to receive Keys from paper tape without the operator having to enter any Key Tag, Classification or SDU memory location data.

A2.5.1.5.3 Load Red TEK into the DTD from Paper Tape

Check that the protocol is set to KOI-18 as shown in the top right corner of the display. Select "Recv" from the JTIDS KMS Main Menu in preparation to receive a Red TEK from the KOI-18.

```
Xmit     Recv              {JK18

Utilities  Kls_reset
```

The operator is prompted to connect to the KOI-18. Press the [RCV] key to continue with the receive operation. Press the [ABORT] key to return to the JTIDS Main Menu.

```
Connect to station and

Press   [RCV]/[ABORT]
```

The operator is prompted to pull the desired TEK tape through the KOI-18 that is connected to the DTD via Fill Cable.

```
Load in progress

⊕Pull tape...
```

Following the reception of data from the KOI-18 the DTD is ready to receive more data. Press the [RCV] key to receive more data from the KOI-18. Press [ABORT] to return to the KOI18 Options Menu.

```
Connect to station and

Press   [RCV]/[ABORT]
```

The operator is prompted to pull the desired TEK tape through the KOI-18 that is connected to the DTD via Fill Cable.

```
Load in progress

⊕Pull tape...
```

The process is repeated until all Segments have been pulled through the KOI-18. As each Segment is loaded into the DTD the JTIDS DTD KMS increments the assigned Segment Number and toggles the SDU memory location as set by the default values. Press [ABORT] to return to the JTIDS Main Menu.

```
Connect to station and

Press   [RCV]/[ABORT]
```

If an error is made in loading, the operator must reset the default Segment/SDU memory location to new values prior to recommencing the Key load. The new values are determined by the next Segment to be loaded. For example: if Segment 20 jammed in the KOI-18 and Key loading had to restart, the default values for Segment Number would have to be changed to 20 and the SDU location value set to the appropriate location for crypto period designator for Segment 20. Key loading could then restart with Segment 20. Keys may be loaded into the DTD from paper tape for any DS-102 or DS-101 device using the above procedures. The entry of a value for SDU memory location is not required for Keys that will not be used for JTIDS.

A2.5.1.5.4 Set the DTD Protocol to Transfer Keys to a DS-101 Link 16 Terminal

The current protocol is displayed in the top right corner of the display. From the JTIDS Main Menu select "**U**tilities" to begin the sequence to change the protocol setting.

```
Xmit    Recv            {JK18

Utilities
```

Select "**S**etup" from the Utilities Menu, or press ENTR.

```
Setup   Init_sdu        {UTL

Delete  Load_stat
```

Select "**P**rotocol" from the Setup Menu, or press ENTR.

```
Select setup option     {SET

Protocol   Tag   Match
```

Select "**D**s-101" from the Protocol Selection Menu by pressing the 'D' key or pressing ENTR.

```
Select protocol:        {SET

Ds101  dS102  Rs232  Koi18
```

The operator is prompted whether wakeup will be used. Wakeup is applicable for transmitting to a DS-101 Link 16 Terminal. Select "**Y**es" by pressing the 'Y' key or ENTR.

```
Use Ds101 wakeup?

Yes/No
```

The protocol is now set to DS-101 as shown in the top right corner of the display. The Main Menu displayed is for DS-101 with wakeup. A_xmit, Sp_xmit and Kls_reset are not displayed if wakeup is not enabled.

```
A_xmit   Xmit   Sp_xmit  {J101

Recv     Util   Kls_reset
```

A2.5.1.5.5 Set the Transmit Default Values. The JTIDS DTD KMS allows the operator to select a specific Key short title (or short titles) for loading into a Link 16 Terminal. This enables multiple short titles of Keys to be loaded into the DTD with the same Text ID. For example: AKAT/AKAE #### and AKAT/AKAE #### with Text ID; "VAW113".

The operator also has the option of selecting the memory locations for loading keys into the Link 16 Terminal. This allows the operator to load keys into memory locations that are different than the location selected when the Key was first loaded into the DTD. An example of the necessity for using this option is when the JTIDS Network Load (JNL) requires Keys be loaded into locations 6 and 7 instead of 0 and 1. Some Joint force/NATO networks will use locations 6 and 7. Most U.S. Navy networks use locations 0 and 1. In addition the JTIDS DTD KMS allows the operator to load the same Key into multiple locations (i.e., 0/1 and 6/7). Some special networks may require this capability.

The DTD will not allow loading of multiple Keys into the same memory location. If the operator selected or default short title memory locations are duplicated, the DTD KMS will require that the operator reselect the Keys for loading or change the locations.

Once the transmit defaults have been set the DTD will retain those defaults until they are change or the DTD is Zeroized.

Pre-set and store default short title and memory location data in the DTD:

Select "**U**til" or press 'U' from the JTIDS MAIN Menu.

```
A_xmit   Xmit   Sp_xmit     {J101

Recv     Util   Kls_reset
```

Select "**S**etup" or press 'S' from the Utilities Menu.

```
Setup    Init_sdu          {UTL

Delete   Load_stat
```

Select more setup options by pressing 'O'.

```
Select setup option        {SET

Protocol  Tag  Match  mOre
```

Select "Xmit" or press 'X' to set the Special Transmit defaults.

```
Set defaults:              {SET

Xmit  Thread
```

The Special Transmit defaults may be modified or cleared, if already pre-set. If the defaults are not pre-set or the operator wishes to add another short title to the default list select "Add".

```
Select Xmit Defaults:

Modify  Add  Clear
```

The DTD searches its Key storage data base for the lowest Short Title/Edition and displays a scrollable list for selection.

```
Locating Lowest Editions...

Please wait......
```

Use the P-Dn or P-Up keys to scroll the list of Short Titles, and press the ENTR to select the desired default Short Title.

```
Sel_des  Quit          ED:A

AKAT ####
```

The DTD displays the list of allowable memory location pairs. Select the desired pair by pressing a number or using the arrow keys. Press ENTR to select a pair.

```
Select default pairs:

0_1   2_3   4_5   6_7   Quit
```

More than one pair may be selected. Pressing the ENTR key when an already selected pair is highlighted de-selects that pair. Select 'Quit' to quit the process. If 'Quit' is selected without choosing a location pair, the DTD KMS will use only the short title selected and the location that was designated when that Key was loaded.

```
Select default pairs:

0_1*   2_3   4_5   6_7 *   Quit
```

```
Item added to defaults
```

The list of defaults may be modified if desired to add more short titles or additional location pairs. Press the 'ABORT' key to exit this menu. Press the 'MAIN MENU' key to go back to the JTIDS DTD KMS Main Menu.

```
Select Xmit Defaults:

Modify  Add  Clear
```

```
A_xmit   Xmit   Sp_xmit     {J101

Recv     Util   Kls_reset
```

A2.5.1.5.6 Set Station ID

NOTE: This procedure needs to be performed only if the Station ID of the SDU has not previously been set to the desired values. (Refer to SET STATION ID MANUALLY or SET STATION ID FROM A LIST found in the MISC Procedures Section.). Once the SDU has been setup, this procedure can be skipped.

A2.5.1.5.7 Transfer Keys to a DS-101 Link 16 Terminal. In the Automatic Transmit operation, keys are automatically selected and loaded into the Link 16 Terminal. Keys are selected based on matching the Text ID to the Station ID/Fixed ID of the Link 16 Terminal and by selecting Segments of Key that match the default Short Title and the current and next day's date (using the DTD date/time). The Text ID match length value is used to tell the JTIDS DTD how many significant characters to use for the exact matching. The composite display details the results of a successful key load of all eight keys into the Link 16 Terminal. There is no difference in procedures for loading BLACK or RED key into the SDU.

From the JTIDS Main Menu select "**A**uto_xmit" to begin the auto transfer by pressing the ENTR key.

```
A_xmit   Xmit   Sp_xmit     {J101

Recv     Util   Kls_reset
```

The DS-101 wakeup occurs allowing the Link 16 Terminal to accept a key load.

```
Activating Wakeup...

\
```

Keys whose Text Id matches the Station ID/Fixed ID of the connected Link 16 Terminal are being located. The JTIDS DTD KMS selects only the keys with the Short Title pre set in the transmit defaults. The DTD also will select the correct Segment number for the Keys based on the current date/time entered into the DTD. In addition the JTIDS DTD KMS will prepare the keys for loading into the memory locations pre set in the transmit defaults.

```
Locating matched keys

Please wait...
```

The DTD displays the Station ID and Fixed ID of the DS-101 SDU that it is connected to. The Station ID was used to match the Text ID of keys.

```
Transfer in progress to:

STATION ID        01
```

Results of the key transmission are shown in a composite display for all transmitted keys. Also, the DTD display panel lights will blink once to signify a successful key load. If there are no failures, press ENTR to return to the Retransmit Menu.

```
SUCCESS: 0 1

FAILED :              <ENTR>
```

The Retransmit Menu allows a Re_auto selection as well as options for Retransmit, Modify, or New. Press the "Main Menu" or the "Abort" key to return to the JTIDS Main Menu

```
Select option:

Re_auto  re_Xmit  Modify   New
```

Notice that the retransmit menu contains the option "Re_Auto". The "Re_auto" selection is offered because an Auto Transmit was performed previously. The "Re_auto" selection is the same as going to the main menu and selecting "Auto_xmit", whereby another auto transmit will be performed on whichever Link 16 Terminal is currently connected. Conversely, the "re_Xmit" selection offers the operator the ability to send the same set of keys that were previously sent to the same or different Link 16 Terminal. "Modify" and "New" allow the operator to modify the key list or create another key list for transmitting to the Link 16 Terminal.

A2.5.1.5.8 Common Error Messages

This error will occur when there are no keys with a Text ID that matches the SDU Station ID for the number of characters set in the match length..

This error will also occur when the transmit defaults are not properly set.

```
No Keys Selected
```

This error will occur when the transmit defaults are not properly set.

```
Duplicate SDU Locations

Assigned
```

Current Crypto Period Designator (CCPD) Table Non-Leap Years							Current Crypto Period Designator (CCPD) Table Leap Years					
1991, 1994, 1997, 1999, 2002, 2005, 2007, 2010			1993, 1995, 1998, 2001, 2003, 2006, 2009				1992, 2000, 2008			1996, 2004		
Month	Day is... Odd	Day is... Even	Month	Day is... Odd	Day is... Even		Month	Day is... Odd	Day is... Even	Month	Day is... Odd	Day is... Even
JAN	1	0	JAN	0	1		JAN	0	1	JAN	1	0
FEB	0	1	FEB	1	0		FEB	1	0	FEB	0	1
MAR	0	1	MAR	1	0		MAR	0	1	MAR	1	0
APR	1	0	APR	0	1		APR	1	0	APR	0	1
MAY	1	0	MAY	0	1		MAY	1	0	MAY	0	1
JUN	0	1	JUN	1	0		JUN	0	1	JUN	1	0
JUL	0	1	JUL	1	0		JUL	0	1	JUL	1	0
AUG	1	0	AUG	0	1		AUG	1	0	AUG	0	1
SEP	0	1	SEP	1	0		SEP	0	1	SEP	1	0
OCT	0	1	OCT	1	0		OCT	0	1	OCT	1	0
NOV	1	0	NOV	0	1		NOV	1	0	NOV	0	1
DEC	1	0	DEC	0	1		DEC	1	0	DEC	0	1

A2.5.1.6 DS-102 Key Transfer

A2.5.1.6.1 Set the DTD Protocol to Receive Paper Tape TEK from the KOI-18

The current protocol is displayed in the top right corner of the display. From the JTIDS Main Menu select "**U**tilities" to begin the sequence to change the protocol setting.

```
A_xmit   Xmit   Sp_xmit     {J101

Recv     Util   Kls_reset Xmit
```

Select "**S**etup" from the Utilities Menu, or press ENTR.

```
Setup    Init_sdu          {UTL

Delete   Load_stat
```

Select "**P**rotocol" from the Setup Menu, or press ENTR.

```
Select setup option        {SET

Protocol   Tag   Match
```

Select "**K**oi18" from the Protocol Selection Menu by pressing the 'K' key.

```
Select protocol:           {SET

Ds101   dS102   Rs232   Koi18
```

The protocol is now set to KOI-18 as shown in the top right corner of the display.

```
Xmit     Recv              {JK18

Utilities  Kls_reset
```

A2.5.1.6.2 Set Default Key Tag Values to be Used When Loading Paper Tape TEK into the DTD.

The JTIDS DTD can use operator defined default key tag values for Red keys received from the CFDs to reduce operator workload of entering key tag values for multiple keys with the same key tag values. The use of default key tag values can be applied to one or more of the key tag options or not used at all. If a key tag value is left blank, the DTD will prompt the operator to enter a value after each key is loaded into the DTD.

Select "**U**tilities" from the JTIDS Main Menu.

```
Xmit     Recv              {JK18

Utilities  Kls_reset
```

Select "**S**etup" from the Utilities Menu.

```
Setup    Init_sdu        {UTL

Delete   Load_stat
```

Select "**T**ag" from the Setup Menu.

```
Select setup option        {SET

Protocol  Tag  Match   mOre
```

Enter a 16 character (or less) default Text ID to use. All alphanumeric characters are valid. If no value is displayed when ENTR is pressed, the operator will be prompted to enter a Text ID for every subsequent key received. Press ENTR when finished. The LOCK LTR key may be toggled to permit entry of spaces and numbers.

```
Enter Text Id      =>

????????????????
```

Enter a 24 character (or less) default short title to use. All alphanumeric characters are valid. If no value is displayed when ENTR is pressed, the operator will be prompted to enter a short title for every subsequent key received. Press ENTR when finished. The LOCK LTR key may be toggled to permit entry of spaces and numbers.

```
Enter Short Title  =>

????????????????????????
```

Enter a 6 character (or less) default edition to use. All alphanumeric characters are valid. If no value is displayed when the ENTR key is pressed, the operator will be prompted to enter an edition for every subsequent key received. Press ENTR when finished. The LOCK LTR key may be toggled to permit entry of spaces and numbers.

```
Enter Edition

=>??????
```

Enter a 3 number (or less) default segment number to use. All numeric characters are valid. If no value is displayed when ENTR is pressed, the operator will be prompted to enter a segment number for every subsequent key received. Press ENTR when finished. The JTIDS DTD KMS will automatically increment the Segment Number as each key is received.

```
Enter Segment Number

=>###
```

Enter default SDU location number to use. Only numbers 0-7 are valid. If no value is displayed when ENTR is pressed, the operator will be prompted to enter an SDU location number for every subsequent key received. Press ENTR when finished.

```
Enter SDU location

=>#
```

The DTD will toggle between the number entered and its SDU location pair mate as keys are received, for example; if 0 is entered then the DTD will toggle the SDU location value 0-1-0-1-0-1

Enter a 11 number (or less) default register number to use. All numeric characters are valid. If no value is displayed when ENTR is pressed, the operator will be prompted to enter a register number for every subsequent key received. Press ENTR when finished.

```
Enter Reg Number

=>###########
```

Classifications of Confid (Confidential), Sec (Secret), or Topsec (Top Secret) may be selected. Press ENTR when finished.

```
Select Classification

Unclass   Confid   Sec   Topsec
```

NOTE: It is not possible to enter a default classification of UNCLASS for incoming keys because to accidentally tag a key as UNCLASS would be a breach of security. Care should be taken when using default classifications.

The DTD is now ready to receive Keys from paper tape without the operator having to enter any Key Tag, Classification or SDU memory location data.

A2.5.1.6.3 Load Red TEK into the DTD from Paper Tape

Check that the protocol is set to KOI-18 as shown in the top right corner of the display. Select "Recv" from the JTIDS KMS Main Menu in preparation to receive a Red TEK from the KOI-18.

```
Xmit     Recv          {JK18

Utilities   Kls_reset
```

The operator is prompted to connect to the KOI-18. Press the [RCV] key to continue with the receive operation. Press the [ABORT] key to return to the JTIDS Main Menu.

```
Connect to station and

Press   [RCV]/[ABORT]
```

The operator is prompted to pull the desired TEK tape through the KOI-18 that is connected to the DTD via Fill Cable.

```
Load in progress

⊕Pull tape...
```

Following the reception of data from the KOI-18 the DTD is ready to receive more data. Press the [RCV] key to receive more data from the KOI-18. Press [ABORT] to return to the KOI18 Options Menu.

```
Connect to station and

Press   [RCV]/[ABORT]
```

The operator is prompted to pull the desired TEK tape through the KOI-18 that is connected to the DTD via Fill Cable.

```
Load in progress

⊕Pull tape...
```

The process is repeated until all Segments have been pulled through the KOI-18. As each Segment is loaded into the DTD the JTIDS DTD KMS increments the assigned Segment Number and toggles the SDU memory location as set by the default values. Press [ABORT] to return to the JTIDS Main Menu.

```
Connect to station and

Press   [RCV]/[ABORT]
```

If an error is made in loading, the operator must reset the default Segment/SDU memory location to new values prior to recommencing the Key load. The new values are determined by the next Segment to be loaded. For example: if Segment 20 jammed in the KOI-18 and Key loading had to restart, the default values for Segment Number would have to be changed to 20 and the SDU location value set to the appropriate location for crypto period designator for Segment 20. Key loading could then restart with Segment 20. Keys may be loaded into the DTD from paper tape for any DS-102 or DS-101 device using the above procedures. The entry of a value for SDU memory location is not required for Keys that will not be used for JTIDS.

A2.5.1.6.4 Set the DTD Protocol to Transfer Keys to a DS-102 Link 16 Terminal

The current protocol is displayed in the top right corner of the display. From the JTIDS Main Menu select "**U**tilities" to begin the sequence to change the protocol setting.

```
Xmit    Recv          {J101

Utilities
```

Select "**S**etup" from the Utilities Menu, or press ENTR.

```
Setup    Init_sdu
{UTL

Delete   Load_stat
```

Select "**P**rotocol" from the Setup Menu, or press ENTR.

```
Select setup option
{SET

Protocol   Tag   Match
```

Select "d**S**-102" from the Protocol Selection Menu by pressing the 'S' key.

```
Select protocol:          {SET

Ds101  dS102  Rs232  Koi18
```

The protocol is now set to DS-102 as shown in the top right corner of the display.

```
Xmit    Recv          {J102

Utilities  Kls_reset
```

A2.5.1.6.5 Transfer Keys to a DS-102 Link 16 Terminal

Select "Xmit" from the DS102 Options Menu.

```
Xmit    Recv        {J102

Utilities  Kls_reset
```

The Transmit Option Menu is displayed with the first key record of the key database shown.

```
Sel  Edit  Find  Quit ↓ {XMT

TEXT ID 1              0  U
```

Scroll if desired to see the next selected key using the Page keys (P UP or P DN).

```
Sel  Edit  Find  Quit ↓ {XMT

TEXT ID 2              0  U
```

Select "Sel" or press ENTR to select the key shown on the data line. All keys with the same text ID are selected.

```
Locating matched keys

Please wait...
```

An asterisk will appear showing the key(s) as selected. Note: Selecting Sel again will deselect individual keys.

```
Sel  Edit  Find  Quit ↓ {XMT

TEXT ID 2              0  U   *
```

Normally only two keys are transferred to the Link 16 Terminal during each load evolution. The JTIDS DTD KMS has selected all Segments of the keys with the matching Text ID. However, only two of the keys are needed. Rather than going through the process of deselecting those Segments that are not needed, merely abort the load process after the first two keys have been loaded.

Select "**Q**uit" or press 'Q' when finished selecting keys for transmit.

```
Sel  Edit  Find  Quit ↓ {XMT

TEXT ID 2              0 U   *
```

The DTD will prompt to connect to station and to press the CLR key. Connect the Fill cable from the DTD to the SDU at this time, then press CLR.

```
Connect to station;

Press [CLR]
```

On the Keyer Control Panel (KCP) select the desired memory location, then press the Initiate (Command) button to transfer the key.

```
Press initiate to xmit

\ TEXT ID 2
```

The DTD will briefly display that the transfer is in progress.

```
Transfer in progress...
```

On the KCP, change the desired memory location to the next location, then press the Initiate (Command) button to transfer the next key.

```
Press initiate to xmit

 \ TEXT ID 2
```

The DTD will briefly display that the transfer is in progress.

```
Transfer in progress...
```

Press the ABORT key to terminate the load process.

```
Press initiate to xmit

 \ TEXT ID 2
```

The DTD will display that the abort is in progress for approximately 30-60 seconds.

```
Abort  in  progress ...

Please wait
```

The total number of selected keys are counted and displayed.

```
5 keys transferred
```

Upon completion of the key transmission, the Retransmit Options Menu is displayed. Selecting “Retransmit” will perform the same transmit sequence as though the keys were just selected (useful to load another DS-102 device). “Modify” allows the operator to add or to delete from the select list in order to send additional keys or a subset of the previously transmitted keys. “New” is the same as beginning the entire Xmit

```
Select option:

Retransmit     Modify     New
```

sequence again without any keys yet selected. In either “New” or “Modify”, the operator is returned to the top of the database. Press the ABORT key to return to the JTIDS MAIN MENU.

```
Xmit     Recv          {J102

Utilities   Kls_reset
```

Current Crypto Period Designator (CCPD) Table Non-Leap Years							Current Crypto Period Designator (CCPD) Table Leap Years					
1991, 1994, 1997, 1999, 2002, 2005, 2007, 2010			1993, 1995, 1998, 2001, 2003, 2006, 2009				1992, 2000, 2008			1996, 2004		
Month	Day is... Odd	Even	Month	Day is... Odd	Even		Month	Day is... Odd	Even	Month	Day is... Odd	Even
JAN	1	0	JAN	0	1		JAN	0	1	JAN	1	0
FEB	0	1	FEB	1	0		FEB	1	0	FEB	0	1
MAR	0	1	MAR	1	0		MAR	0	1	MAR	1	0
APR	1	0	APR	0	1		APR	1	0	APR	0	1
MAY	1	0	MAY	0	1		MAY	1	0	MAY	0	1
JUN	0	1	JUN	1	0		JUN	0	1	JUN	1	0
JUL	0	1	JUL	1	0		JUL	0	1	JUL	1	0
AUG	1	0	AUG	0	1		AUG	1	0	AUG	0	1
SEP	0	1	SEP	1	0		SEP	0	1	SEP	1	0
OCT	0	1	OCT	1	0		OCT	0	1	OCT	1	0
NOV	1	0	NOV	0	1		NOV	1	0	NOV	0	1
DEC	1	0	DEC	0	1		DEC	1	0	DEC	0	1

A2.5.1.7 DTD to DTD Transfer. The JTIDS DTD can transmit and receive individual keys and commands or its entire database to and from another JTIDS DTD. The DS-101 protocol without wakeup and the Xmit selection on the RS-232 Options Menu are reserved for JTIDS DTD database transfer operations. The keys and commands can consist of Set Station ID command, Set Station Address command, Set Fixed ID command, Black keys, Red KEKs, and Red TEKs. Set Station ID, Set Station Address, and Set Fixed ID commands are transferred as part of the entire database transfer that is accessed via the "All" selection. The JTIDS DTD allows the operator to transmit a single key, transmit multiple keys, or transmit the entire key database.

To transfer data between JTIDS DTDs the protocols of both JTIDS DTDs must both be set to DS-101 without wakeup or RS-232 if using an intermediate connection device.

A2.5.1.7.1 Set the DTD Protocol to DS-101 Without Wakeup

The current protocol is displayed in the top right corner of the display. From the JTIDS Main Menu select "**U**tilities" to begin the sequence to change the protocol setting.

```
A_xmit   Xmit   Sp_xmit  {J101

Recv     Util   Kls_reset
```

Select "**S**etup" from the Utilities Menu, or press ENTR.

```
Setup    Init_sdu        {UTL

Delete   Load_stat
```

Select "**P**rotocol" from the Setup Menu, or press ENTR.

```
Select setup option      {SET

Protocol   Tag   Match
```

Select "**D**s-101" from the Protocol Selection Menu by pressing the 'D' key or pressing ENTR.

```
Select protocol:         {SET

Ds101   dS102   Rs232   Koi18
```

The operator is prompted whether wakeup will be used. Wakeup is not applicable for transferring data from one DTD to another Select "**N**o" by pressing the 'N' key.

```
Use Ds101 wakeup?

Yes/No
```

The protocol is now set to DS-101 as shown in the top right corner of the display. The Main Menu displayed is for DS-101 without wakeup. A_xmit, Sp_xmit and Kls_reset are displayed only if wakeup is enabled.

```
Xmit     Recv            {J101

Utilities
```

A2.5.1.7.2 Tranfer Keys Between DTDS

	Transmitting DTD	Receiving DTD
Select "Xmit" from the transmitting DTD. Select "Recv" from the receiving DTD.	Xmit Recv {J101 Utilities	Xmit Recv {J101 Utilities

	Transmitting DTD	Receiving DTD
To individually select items for transmission select "Select".	Choose transfer option: All Select	

When individually selecting keys the first key record of the key database is displayed.

To select the key select "Sel".	Sel Edit Find Quit ↓{XMT TEXT ID 0 U	

The operator can scroll to the next record by pressing the P DN key to view it or select "Find" to perform a search for a specific key record by text ID.

After the operator selects a key the DTD KMS searches for keys with matching Text Ids. The entire Text ID is used for the match. Any default match length is not used.	Locating matched keys Please wait ...	
An asterisk shows that this key has been selected. When finished selecting keys select "Quit".	Sel Edit Find Quit ↓{XMT TEXT ID 0 U *	

To deselect a key select "Sel" for a key with the * and the * will be removed.

To transfer the keys first press the RCV key on the receiving DTD. Then press the SEND key on the transmitting DTD.	Connect to station; Press [SEND]/[ABORT]	Connect to station and press [RCV]/[ABORT]
Both transmitting and receiving DTDs display that they are attempting to connect.	Attempting to connect... [ABORT]	Attempting to connect... [ABORT]

The transmitting DTD displays that the transfer is in progress.	Transfer in progress...	
The transmitting DTD shows the item being transferred. The receiving DTD shows that the load is in progress.	Transferring Item 1 [ABORT]	Load in progress
The transmitting DTD shows the total number of items transferred. The receiving DTD shows the item being received.	1 items transferred	item 1 received
The transmitting DTD shows the Retransmit Menu. The receiving DTD shows the total number of items received.	Select Retransmit Modify New	1 items received

The transmitting JTIDS DTD allows the operator to retransmit the previously selected key, modify the previously selected list of keys, or select a new set of key(s) for transmission.

	Transmitting DTD	Receiving DTD
The receiving DTD is now ready to receive more items.		Connect to station and press [RCV]/[ABORT]

A2.5.1.7.3 <u>Transfer the Entire DTD Database to Another DTD</u>. When transmitting the entire DTD database to another DTD the Link 16 Terminal Station ID/Fixed ID/Address commands located in the receiving JTIDS DTD database will be overwritten with the new ones received. However, any keys stored in the receiving DTD are not affected. Identical keys (Key Tag/Short Title) will be duplicated in the receiving DTD.

	Transmitting DTD	Receiving DTD
Select “Xmit” from the transmitting DTD. Select “Recv” from the receiving JTIDS DTD.	Xmit Recv {J101 Utilities	Xmit Recv {J101 Utilities
To transfer the entire database select “All”.	Choose transfer option: All Select	
To transfer the keys first press the RCV key on the receiving DTD. Then press the SEND key on the transmitting DTD.	Connect to station; Press [SEND]/[ABORT]	Connect to station and press [RCV]/[ABORT]
The transmitting DTD displays that it is gathering the data to be transferred. The amount of time this takes depends upon how many keys/commands are in the database.	Gathering data...	
Both transmitting and receiving DTDs display that they are attempting to connect.	Attempting to connect... [ABORT]	Attempting to connect [ABORT]
The transmitting DTD displays that the transfer is in progress. The receiving DTD displays that it is attempting to connect.	Transfer in progress	
The transmitting DTD shows which item is being transferred. The receiving DTD shows that the load is in progress.	Transferring Item 1 [ABORT]	Load in progress

	Transmitting DTD	Receiving DTD
The transmitting DTD continues to indicate which item is being transferred and the receiving DTD shows which item is being received.	Transferring Item 2 [ABORT]	item 1 received
	Transferring Item 3 [ABORT]	item 2 received
	Transferring Item 4 [ABORT]	item 3 received
If any Commands are transferred, the number of items skips to the next key being transferred.	Transferring Item 7 [ABORT]	item 4 received
The transmitting DTD shows the total number of items transmitted, including keys and Commands.	7 items transferred	
The transmitting DTD redisplays the Database Transfer Options Menu. The receiving DTD shows the total number of items received.	Choose transfer option: All Select	7 items received

NOTE: The number of transferred items and received items skipped from 4 to 7, because three commands were involved (Set Station ID, Set Station Address, and Set Fixed ID). Commands transferred are not individually displayed, but are counted as an item, so that the operator can tell that they were a part of the transaction in addition to keys.

The receiving DTD is ready to receive more data.		Connect to station and press [RCV] / [ABORT]

A2.5.1.8 MISC Procedures

A2.5.1.8.1 Supersession

Each day, when the JTIDS DTD KMS is run on the DTD, the software will automatically begin a check for superseded Keys and Key data. The KMS will display the stored Short Titles, one at a time, in alphabetical order, display the lowest Edition found and ask the user to confirm or enter the current Edition. When the Edition is confirmed or entered, the DTD KMS prompts the user to enter the current Segment, while displaying the current date as the default value. The user enters the current Segment and presses *ENTR*. The DTD KMS then checks its data base for Editions and Segments of the Short Title that are lower than the entered values. If any are found, the DTD KMS displays the Segment(s) found and asks the user to confirm destruction of each Segment. If an entire Edition is found that is lower than the current Edition, the DTD KMS will delete that Edition. The DTD KMS allows the user to skip supersession for a specific Short Title by pressing the *ABORT* key.

If supersession is skipped entirely, the DTD KMS will repeat the supersession check the next time the DTD KMS is run.

If any Keys or Key data is deleted during a supersession check, the DTD KMS will not repeat the check until the next day. The next day being when the DTD internal date changes. For example, if one or two Short Titles out of four stored in the DTD undergo supersession check and deletion the DTD KMS will not do a supersession check each time the DTD is turned on unless the date has changed (i.e., after 0000Z).

When the DTD KMS is run the current Date and Time is displayed. If this Date and/or Time does not correspond to the correct "ZULU" time, reset the DTD Date and Time from the ROM Software Library (RSL) menu. Press "ABORT", two or three times, to access the DTD RSL menu..

```
Current Date/Time is:

04-15-1995      01:15:00
```

```
Starting Key

 SUPERSESSION check...
```

The DTD will display the Short Title and lowest Edition (alphabetically) found. If the displayed Edition is the current Edition, press "ENTR" to continue. If the displayed Edition is not current, type in the current Edition and press "ENTR"

```
Sel Current ED: A@@@@@

AKME ####
```

The current DTD Date is displayed as the default Segment number. If this is correct, press "ENTR". If the current segment does not follow the date, enter the correct segment number for that Short Title/Edition, then press "ENTR".	Sel Current Seg: 15#
The DTD will search its data base for Keys with a lower Edition/Segment.	Checking for superseded keys... Please wait...
If there are any Keys with a lower Segment number than that entered, the DTD will display the Short Title, Edition and Segment number and prompt the user for confirmation to delete the Key.	Del A /Seg: 13 Yes No AKME ####
Press "ENTR" or 'Y' to delete the Segment. Pressing 'N' will skip to the next Segment found.	Marking deleted key...
Each superseded Segment found will be displayed for confirmation.	Del A /Seg: 14 Yes No AKME ####
When all superseded Keys for that Edition/Short Title have been marked. The DTD will delete references those Keys that were marked, from the data base.	Removing deleted keys Please wait...
Then the DTD KMS will erase the Keys from the DTD COMSEC storage area.	Deleting object Please wait...
The total number of Keys deleted from the selected Edition will be displayed.	2 keys removed.
The DTD will continue with the next Edition, then next Short Title, until all superseded Keys are processed.	...
	Supersession check complete.

When the suppercession check is complete, the DTD KMS will display the Main Menu.

```
A_xmit   Xmit   Sp_xmit   {J101

Recv   Util   Kls_reset
```

A2.5.1.8.2 Zeroize all RAM and EEPROM Locations

NOTE: The Link 16 SDU must be zeroized prior to removing it from the terminal for maintenance or transfer.

To turn on the DTD press the ON/OFF button from the DTD keyboard one time.

From the JTIDS Main Menu select "Utilities" or press 'U'.

```
A_xmit   Xmit   Sp_xmit   {J101

Recv   Util   Kls_reset
```

Select "Init_sdu" or press 'I'.

```
Setup     Init_sdu          {UTL

Delete     Load_stat
```

Select "Zero_sdu" or press 'Z'.

```
Zero_sdu     Stat_id

Fixed_id     Address     Trn_key
```

Select "Both" or press 'B'.

```
Select SDU zeroize area:

Ram     Eeprom     Both
```

The operator is prompted to confirm the zeroize operation. Select "Yes" or press 'Y' to zeroize both RAM and EEPROM locations.

```
Confirm Zeroize     No/Yes
```

Connect to the Link 16 Terminal. Press the "SEND" key when ready.

```
Connect to device;

Press  [SEND] to initiate
```

After the "SEND" key is pressed, the JTIDS DTD displays that it is activating wakeup.

```
Activating Wakeup...
```

The JTIDS DTD displays that the command is being transferred to the Link 16 Terminal (in this case to the station ID STATION ID 2 01).

```
Transfer in progress to:

STATION ID 2      01
```

The DTD displays that the command was transferred, both RAM and EEPROM locations are zeroized.

```
Command transferred
```

Upon completion of the zeroize operation the Initialize Menu is displayed. Press the "Main Menu" key once or the "Abort" key twice to return to the JTIDS Main Menu

```
Zero_sdu     Stat_id

Fixed_id     Address    Trn_key
```

```
A_xmit   Xmit   Sp_xmit   {J101

Recv   Util   Kls_reset
```

A2.5.1.8.3 Set Station ID Manually

NOTE: This procedure needs to be performed if the Station ID of the SDU has not previously been set to the desired values. Usually the Hull Number and Serial Number of the SDU or in the case of squadrons, the Squadron Number and Tail Number of the installation. Once the SDU has been setup, this procedure can be skipped.

The DTD can transmit the command to set the station ID of the Link 16 Terminal. A Set Station ID command received from the JTIDS PC or a manually entered station ID can be sent to the Link 16 Terminal by the DTD. Whenever there is communication between the DTD and the Link 16 Terminal, the protocol must be set to DS-101 with wakeup. However, in the Initialize SDU selections, the DTD knows which protocol is required and temporarily sets the protocol to DS-101 with wakeup.

From the JTIDS Main Menu select "Utilities" or press 'U'.

```
A_xmit   Xmit   Sp_xmit   {J101

Recv   Util   Kls_reset
```

Select “Init_sdu” or press ‘I’.

Setup **Init_sdu** {UTL
Delete Load_stat

Select “Stat_id” or press ‘S’.

Zero_sdu **Stat_id**
Fixed_id Address Trn_key

Enter an operator defined Station ID, (in this case TERMINAL 2). When ready press the “ENTR “ key.

Enter Station ID =>
TERMINAL 2????

The operator is prompted to load the station ID. Press the “SEND” key when ready.

Load ID : TERMINAL 2
Press [**SEND**]/[ABORT]

The JTIDS DTD displays that it is activating wakeup.

Activating Wakeup...
\

The JTIDS DTD displays that it is transferring the command to the Link 16 Terminal (in this case to the current station ID THORNTONTHORNT).

Transfer in progress to:
THORNTONTHORNT 01

The JTIDS DTD displays that the set station ID command was transferred to the Link 16 Terminal, thus the Link 16 Terminal has a new station ID of TERMINAL 2.

Command transferred

Upon completion of the set station ID command the Initialize Menu is displayed. Press the “Main Menu” key once or the “Abort” key twice to return to the JTIDS Main Menu

Zero_sdu Stat-id
Fixed-id Address Trn_key

A2.5.1.8.4 Set Station ID from a List

NOTE: This procedure may be performed if there is a requirement to load Station ID information from the PC into the AN/CYZ-10 and then the SDU. It should be noted, however, that the AN/CYZ-10 is able to store no more than 30 IDs at any given time.

To turn on the DTD press the ON/OFF button from the DTD keyboard one time.

From the JTIDS Main Menu, select "Util" or press 'U'

```
A_xmit   Xmit   Sp_xmit   {J101

Recv     Util   KLS_reset
```

Select "Setup" from the Utilities Menu.

```
Setup    Init_sdu        {UTL

Delete   Load_stat
```

Select "Protocol" from the Setup Menu.

```
Select setup option        {SET

Protocol   Tag   Match   mOre
```

Select "Rs232" from the Protocol Selection Menu by using the arrow keys or pressing the 'R' key.

```
Select protocol:           {SET

Ds101   dS102   Rs232   Koi18
```

Select "PC" from the RS-232 Protocol Selection Menu by using the arrow keys or pressing the 'P' or 'ENTR' key.

```
Select RS-232 protocol:

PC      Stu
```

The Main Menu for RS-232 transfer is displayed. Select "Recv" or press 'R' to initiate the data transfer process.

```
Xmit     Recv            {J232

Utilities
```

Turn on the JTIDS PC and execute the JTIDS PC KMS

From the JTIDS PC KMS Main Menu, Select '1'

```
1. DTD Transfer Functions
2. Key Management Database
3. SDU Management Database
4. OPTASK Management Database
5. Quit
```

From the Transfer Menu, Select '3'

```
1. Develop Keyload (OPTASK)
2. Develop Keyload Multi-Day)
3. Develop SDU Initialize Data
4. Xmit Transfer File to DTD
5. Keyload Status Log Utility
6. Clear the Transfer file
7. Return to the Main Menu
```

From the SDU Initialize Data Menu, Select '1'

```
1. Set Station ID Command
2. Set Station Address Command
3. Set Fixed ID Command
4. Clear the Transfer File
5. Return to Transfer Menu
```

From the ID Selection Screen, use the UP and DOWN Arrow Keys to highlight the ID that is to be used as the SDU Command, and press "ENTER"

```
Select the ID for this SDU Command:
 +-----------------+
 ¦ VAW116 602      ¦
 ¦ CGN-94          ¦
 +-----------------+
```

Press any key to continue

```
Items added

001 items added to the transfer file.
Total items in the file 00001.
   Press any key to continue.
```

The selection process as described in the previous three (3) steps may be repeated as often as necessary to include the required Ids in the Transfer File. It should be noted, however, that the AN/CYZ-10 is able to store no more than 30 Ids at any given time.

When all the desired Ids have been added to the Transfer File, Select '5'

```
1. Set Station ID Command
2. Set Station Address Command
3. Set Fixed ID Command
4. Clear the Transfer File
5. Return to Transfer Menu
```

From the Transfer Menu, Select '4'

```
1. Develop Keyload (OPTASK)
2. Develop Keyload Multi-Day)
3. Develop SDU Initialize Data
4. Xmit Transfer File to DTD
5. Keyload Status Log Utility
6. Clear the Transfer file
7. Return to the Main Menu
```

On the DTD Transfer Screen, select "RETURN" to transfer all items in the Transfer file to the DTD.

Note: Data Entry mode for Start or End Item may be entered by selecting either F2 or F4 respectively. This allows the user to modify the items to be transferred into the DTD.

```
Total number of items : 00030

Starting at item : 00001
End at item      : 00030


<CR>-Transfer    <F1>-Help
<F2>-Start       <F3>-End
<F4>-Display     <ESC>-Exit
```

Connect the DTD and the JTIDS PC via the special RS-232 cable.

Connect to DTD and press <CR>, Press <ESC> to Abort

On the DTD, press the “ENTR” or the “RCV” key to continue with the receive operation.

Connect to station and Press [RCV]/[ABORT]

On the JTIDS PC Press the “RETURN” key to initiate the PC transfer of key data.

The DTD displays that it is attempting to connect to the JTIDS PC. If the operator presses the [ABORT] key a message that an abort is in progress is displayed and the RS232 Options Menu is displayed.

Attempting to connect [ABORT]

The DTD displays that it is receiving data from the JTIDS PC.

Load in progress

As items are received from the JTIDS PC the DTD displays that they are received, starting from 1 up to the total number received.

Item 1 received

The DTD displays the total number of items received.

1 items received

Following the reception of data from the JTIDS PC the DTD is ready to receive more data. Press [ABORT] to return to the RS232 Options Menu.

Connect to station and Press [RCV]/[ABORT]

Xmit Recv {J232 Utilities

Following the transfer of data from the PC to the DTD, a message notifying the user of the successful transfer will be displayed. This message is white background with blue letters.

In the event of an error, the message will have a red background with white letters.

In either case, Press “RETURN” to continue

Select '6' to Clear the Transfer File

```
1. Develop Keyload (OPTASK)
2. Develop Keyload Multi-Day)
3. Develop SDU Initialize Data
4. Xmit Transfer File to DTD
5. Keyload Status Log Utility
6. Clear the Transfer file
7. Return to the Main Menu
```

Press 'Y' to reset the Transfer File

```
Reset Transfer File

There are 00030 items
in the Transfer File.
Do you want to reset?   N
```

Select '7' to return to the Main Menu

```
1. Develop Keyload (OPTASK)
2. Develop Keyload Multi-Day)
3. Develop SDU Initialize Data
4. Xmit Transfer File to DTD
5. Keyload Status Log Utility
6. Clear the Transfer file
7. Return to the Main Menu
```

Select '5' to end the JTIDS PC KMS application

```
1. DTD Transfer Functions
2. Key Management Database
3. SDU Management Database
4. OPTASK Management Database
5. Quit
```

The current protocol is displayed in the top right corner of the display. From the JTIDS Main Menu select "**U**tilities" to begin the sequence to change the protocol setting.

```
Xmit    Recv            {J232

Utilities
```

Select "**S**etup" from the Utilities Menu, or press ENTR.

```
Setup    Init_sdu        {UTL

Delete   Load_stat
```

Select "**P**rotocol" from the Setup Menu, or press ENTR.

```
Select setup option      {SET

Protocol    Tag    Match
```

Select "**D**s-101" from the Protocol Selection Menu by pressing the 'D' key or pressing ENTR.

```
Select protocol:         {SET

Ds101   dS102   Rs232   Koi18
```

The operator is prompted whether wakeup will be used. Wakeup is applicable for transmitting to a Link 16 Terminal. Select "**Y**es" by pressing the 'Y' key or ENTR.

```
Use Ds101 wakeup?

Yes/No
```

The protocol is now set to DS-101 as shown in the top right corner of the display. The Main Menu displayed is for DS-101 with wakeup. A_xmit, Sp_xmit and Kls_reset are not displayed if wakeup is not enabled.

```
A_xmit   Xmit   Sp_xmit  {J101

Recv     Util   Kls_reset
```

Select "**U**til" from the Main Menu

Select "**I**nit_sdu" or press 'I'.

```
Setup     Init_sdu          {UTL

Delete    Load_stat
```

Select "**S**tat_id" or press 'S'.

```
Zero_sdu     Stat_id

Fixed_id     Address     Trn_key
```

If a list of Station Ids has been loaded, the user will be prompted to select the Station ID desired for transmission. Use the PUP/PDN keys to display the desired Station ID and then select '**S**el' or press the ENTR Key.

```
Sel  Find  New  Del        {STA

VAW120 600
```

Connect the DTD to the SDU via the fill cable and select '**SEND**'

```
Load ID:VAW120 600

Press [SEND] / [ABORT]
```

After the "SEND" key is pressed, the JTIDS DTD displays that it is activating wakeup.

```
Activating Wakeup...
```

The JTIDS DTD displays that it is transferring the command to the Link 16 Terminal (in this case to the current station ID THORNTONTHORNT).

```
Transfer in progress to:

THORNTONTHORNT  01
```

The JTIDS DTD displays that the set station ID command was transferred to the Link 16 Terminal, thus the Link 16 Terminal has a new station ID of VAW120 600.

```
Command transferred
```

Press the MAIN MENU Key.

```
Zero_sdu     Stat_id

Fixed_id     Address     Trn_key
```

```
A_xmit  Xmit  Sp_xmit {J101

Recv    Util  Kls_reset
```

A2.5.1.8.5 Load Red Key from a KYX-15A and/or KYK-13 CFD. The JTIDS KMS can receive Red TEKs from the KYX-15A and/or KYK-13 Common Fill Device (CFD). The procedures for using either CFD are identical.

a. From the KOI-18 Options Menu, select **Utilities**.

```
Xmit  Recv    {JK18}
Utilities     Kls_reset
```

b. Select **Setup**.

```
Setup     Init_sdu {UTIL}
Delete  Load_stat
```

c. Select **Protocol**.

```
Select setup options {SET}
ProtocolTag  Match  mOre
```

d. Select **dS102**.

```
Select protocol          {SET}
Ds101  dS102  Rs232  Koi18
Timeout
```

e. The protocol is set. Select **Recv**.

```
Xmit  Recv    {J102}
Utilities     Kls_reset
```

f. Using a common fill cable, connect the KYK-13 or KYX-15A to the DTD and select key to be transferred (on the KYK-13, positions 1-6; on the KYX-15A, positions 1-15). Press **RCV**.

```
Connect to station and
Press [RCV]/ABORT]
```

g. The DTD will extract the KEYMAT from the KYK-13 or KYX-15A (parity light will flash). Following the KEYMAT transfer

transfer, the DTD will request specific key tag

```
Load in progress
```

```
Key received
Parity Passed
```

NOTE: Displays h through n may not appear, depending on the default key tag values.

h. Enter the specific Text-ID (e.g., KW-46, KG-84, KY-58). Press ENTR. Text-ID equates the KEYMAT to a specific equipment

equipment/system.

```
Enter Text ID =>
?????
```

i. Enter the appropriate short title, (e.g., AKAT12345, AKAT67809, etc.) and press **ENTR**.

```
Enter Short Title =>
?????
```

j. Enter the key segment edition (e.g., AA, BA, CC, etc.) and press **ENTR**.

```
Enter Edition=>
?????
```

k. Enter the appropriate key segment number (e.g., 1, 12, 15, etc.) and press **ENTR**.

```
Enter Segment Number=>
###
```

l. Enter the registration number (e.g., 123, 340, etc.) and press **ENTR**.

```
Enter Registration Number=>
###
```

m. Select the appropriate classification (i.e., Unclas, Confid, Sec, Topsec) and press **ENTR**.

```
Select Classification
Unclas Confid Sec Topsec
```

n. Enter the SDU location (e.g., 0-7) and press **ENTR**.

```
Enter SDU location=>#  (0-7)
```

o. Transfer complete. Press **RCV** to receive more data or **ABORT** to terminate.

```
Connect to station and
Press [RCV]/[ABORT]
```

A2.5.1.8.6 Using Default Key Tag Values

The JTIDS KMS has an option the operator can use to assign default key tag values for Red KEYMAT received from a CFD; thereby reducing operator workload when entering key tags for multiple keys with the same key tag values.

a. From the DS-102 Options Menu, select **Utilities**.

```
Xmit    Recv      {J102}
Utilities     Kls_reset
```

b. Select **Setup**.

```
Setup   Init_sdu    {UTL}
Delete  Load_stat
```

c. Select **Tag**.

```
Select setup option {SET}
Protocol Tag  Match mOre
```

d. Enter the specific Text-ID (e.g., KW-46, KG-84, KY-58). Press **ENTR**. Text-ID equates the KEYMAT to a specific equipment/system.

```
Enter   Text      ID=>
?????
```

e. Enter the appropriate short title, (e.g., AKAT12345, AKAT23456, etc.) and press **ENTR**.

```
Enter   Short     Title=>
?????
```

f. Enter the key segment edition (e.g., AA, BA, CC, etc.) and press **ENTR**.

```
Enter   Edition=>
?????
```

g. Enter the appropriate key segment number (e.g., 1, 12, 15, etc.) and press **ENTR**.

```
Enter   Segment Number=>
###
```

h. Enter the SDU location (e.g., 0-7) and press **ENTR**.

```
Enter     SDU
   location=>#        (0-7)
```

i. Select the appropriate classification (i.e., Unclas, Confid, Sec, Topsec) and press **ENTR**.

```
Select    Classification
Unclas Confid Sec  Topsec
```

j. Enter the registration number (e.g., 123, 340, etc.) and press **ENTR**.

```
Enter Registration Number=>
###
```

TAB 3

NATO TERM CROSS-REFERENCE GUIDE

A3.1 US - NATO Terms. Table A3-1 shows US terms used in this manual and the related NATO term that is present in ADatP-33. Each term is used in place of the other in the respective manuals.

Table A3-1 Equivalent National Terms and Abbreviations

US Terms	NATO Terms
Area Air Defense Commander (AADC)	Air Defense Commander (ADC)
Interface Control Officer (ICO)	Data Link Manager (DLM)
JTIDS Network Library (JNL)	appropriate Network Library (NL)
JTIDS/MIDS	MIDS
TACOPDAT	OPTASK AAW
Under Sea Warfare (USW)	Anti-Submarine Warfare (ASW)

A3.2 Paragraph 5.8 Electronic Warfare Operations

d. Operators involved in combined operations must note that the older EW terminology is still used within NATO and may also be used by other (non-NATO) allied forces. The equivalent terms for the basic types of EW are described in table A-3-2.

Table A3-2 Equivalent National EW Terms and Abbreviations

US Terms	NATO Terms
Electronic Attack (EA)	Electronic Countermeasures (ECM)
Electronic Protection (EP)	Electronic Protection Measures (EPM) or Electronic Counter-Countermeasures (ECCM)
Electronic Warfare Support (ES)	Electronic Support Measures or Electronic Warfare Support Measures (ESM)

APPENDIX B TO ENCLOSURE A

OPTASK LINK MESSAGE GUIDANCE

B1. Introduction. **This document does not contain OPTASK LINK message preparation instructions**. MIL-STD-6040 OPTASK LINK USER FORMAT shall be used (available at URL: http://www-usmtf.itsi.disa.mil). Baseline version to be used shall be determined by the operational commander. User formats are available through service distribution as:

a. DA PAM 25-7

b. OPNAV-P-942-1-86

c. AFPAM10-709, V 1CD

d. NAVMC 2800

(INTENTIONALLY BLANK)

APPENDIX C TO ENCLOSURE A

LINK 11 ESTABLISHMENT AND MAINTENANCE

C1. Link 11 System Description. Link 11 employs netted communication techniques and standard message formats for the exchange of tactical digital information. Data processing equipment located at each PU is linked to the other PUs via HF or UHF radio. The Link 11 Data Terminal Set (DTS) acts as a control interface between the TDS and the Link 11 radio equipment. The DTS performs the functions of address and control code recognition. Once initiated, Link 11 operation is automatic being controlled by the DTSs.

C1.1 Hardware Configuration. A typical Link 11 system is configured with a computer system, encryption device, DTS, and a radio set as shown in Figure C-1. Information transfer between TDS computers takes the form of discrete message types. This binary message data is exchanged between the computer system through the encryption device and the DTS. The DTS provides additional error detection and correction code information (Hamming codes) and control code information for use by the other DTSs. The DTS changes the binary information into audio tones used to modulate the radio transmitter.

DISPLAY/ INPUT CONSOLES (USERS)	TDS COMPUTER SYSTEM	ENCRYPTION DEVICE	DATA TERMINAL SET	RADIO HF/UHF

Figure C-1. Basic Link 11 System

C1.2 Modes of Operation. The DTS operates in a specific station mode along with a specific net mode. The station modes are NCS and Picket. Net modes are Roll Call, Net Sync, and Net Test. Some DTSs also have net modes of Broadcast and Short Broadcast. The following paragraphs briefly describe the various operating modes.

C1.2.1 Roll Call. This is the normal operating mode of Link 11 providing full utilization of area surveillance and tracking capabilities. In the roll call mode, one PU is designated to operate in station mode NCS and is referred to as the DNCS, while all other PUs are operating in station mode Picket. The DNCS DTS controls the sequence of PUs broadcasting over the common frequency by calling on itself and each picket station in turn. Picket stations assume control of the link only temporarily for transmission of their data when called on by the DNCS. Operation of the link roll call cycle is automatic once initiated. The time required for a cycle is variable and depends upon the number of PUs in

the link, the amount of data each transmits, and the Link 11 timing rate specified (fast or slow). The assignment of the DNCS merely determines which DTS polls the other DTSs. This hardware function is in no way related to military command or authority to control the operation of the link or force units. There are three sub-types of this method:

a. Full Roll Call. When all units are active on the net and every picket station responds to each call from the DNCS with the appropriate data.

b. Partial Roll Call. When some unites are switched to Radio Silence (Silent PU) and, although interrogated by the DNCS each cycle, do not respond. Should a unit observing Radio Silence in this way need to make a report on the link, then the unit will switch to become an Active PU and pass its data at the next cycle when interrogated. The unit can return to Radio Silence on completion of passing its information. The amount of data passed in this kind of report will depend on system design. Some units will have the capability to select individual or groups of tracks to report while others will transmit all the eligible information in their database. Some units will also be able to initiate command messages. Partial Roll Call also allows the DNCS to interrogate specific PUs with other units remaining either Silent (switched to Radio Silence) or Passive (switched to Picket but not interrogated).

c. Roll Call Broadcast. The DNCS transmits all its eligible data on the net, other PUs are either Silent or Passive. Silent PUs are interrogated sequentially but do not respond. A Silent PU having data to report does so as in paragraph C1.2.1.b above.

C1.2.2 Broadcast. In this mode of operation, the DNCS broadcasts repeated transmissions of its track data. PUs are not interrogated, and have no capability to report information on the link. If the tactical commander requires a broadcast mode of operation but wishes to retain the capability for some units other than the DNCS to make reports when necessary or to issue/reply to commands, then the broadcast variant of Roll Call as in paragraph C1.2.1.b is to be used.

C1.2.2.1 Silence. In this mode, all units are in Radio Silence. Should a unit need to initiate a report then the unit will do so by making a single transmission (Short Broadcast) to all units. The information passed during this transmission will depend on the unit's system design.

C1.2.3 Net Sync. Operation in the Net Sync mode is a prerequisite to subsequent operation of the DTS in the STORED timing mode. In this mode, the 2-tone AGC frames in the preamble signal are transmitted continuously by

one designated PU, normally the DNCS, for the purpose of establishing a universal timing reference in all PUs prior to operating in one of the modes described in paragraph C.1.2.1. When the PUs have reported synchronization achieved and switched to STORED timing, which should not normally exceed 2 minutes, they will switch to the selected timing mode. STORED timing has the advantage that frame alignment cannot be disturbed by Radio Frequency Interference (RFI) or adverse propagation conditions. However, it requires that:

a. The accuracy and stability requirements for frequency standards driving the DTSs must be satisfied, for which a frequency standard resetting (or frequency locking) operation may be needed.

b. If fast-moving units are participating on the link, excessively frequent updating of range switches may be needed in such units. Accordingly, operation of the DTSs should normally be conducted with CORRECTED timing, for which there is no prerequisite to operate in the Net Sync mode. However, the DNCS may commence transmissions in the Net Sync mode in order to establish that satisfactory signals may be received by PUs from the DNCS on the selected radio frequency, and that their DTSs will synchronize to these. The Net Sync mode is also available as a test mode.

C1.2.4 Net Test. Net Test is used to analyze the communication path between the DNCS and each picket. It may also be used to analyze equipment performance in terms of receive channel errors. The DNCS transmits a known test pattern that PUs receive and compare with the pattern that they independently generate. Reversion to the operational mode from the Net Test mode will be ordered by the DNCS.

C2. Link 11 Technical Planning. This section delineates the required Link 11 technical planning factors that must be considered in preparation for Joint and Combined Link 11 operations. Both technical and tactical considerations of Link 11 operations are essential elements of Link 11 planning. This section discusses only the technical considerations. Tactical considerations are covered in Chapter 4. This technical planning identifies and defines those items that are prerequisite to the establishment and operation of Link 11. These items must then be included in the OPTASK LINK or other appropriate planning directives. The following paragraphs identify those technical items that must be prearranged prior to establishment of Link 11 and provide an explanation of their effect on the interface and any considerations that should be made to accommodate special conditions. The following items must be available to all PUs prior to the initiation of Link 11 operation:

a. General

(1) PU Address (see paragraph 4.4.1).

(2) Terminal Address (see paragraph 4.4.1).

(3) TN Allocation (see paragraph 4.4.2).

(4) Data Link Reference Point.

(5) DLRP Transmission Unit, if SSN in link (see paragraph 5.7.11c).

(6) Frequency Assignments.

(7) Encryption.

(8) Link 11 Parameters (Data Rate, Time Base, Doppler).

(9) Link 11 Configuration (DNCS, GRU).

(10) Link 11 Waveform (CLEW or SLEW).

(11) Link 11 Mode of Operation.

(12) Transmission Arrangements.

(13) Filtering.

(14) Common Special Points.

b. Areas of Specific Interest. In addition to the above listed items, the Tactical Commander should be aware of system limitations and platform implementation differences. The following Link 11 specifics should be considered prior to the planning of the Link 11 net:

(1) Although most units are capable of operating with a TA different from the PU Address, some units are not. In NATO Link 11 operations, it is standard practice to assign the same number to both the TA and PU/RU Address. When the Tactical Commander elects to operate a Link 11 net with TAs different from PU Addresses, units without this capability will experience difficulty participating in the net (see paragraph 4.4.1.a for a list of those units that cannot operate with different TA and PU Addresses).

(2) Dependent on the information exchange requirements, the number and capabilities of the PUs, the Tactical Commander may elect to use multiple Link 11 nets (see Figure C-2). The Tactical Commander should issue specific procedures for the use of all nets and clearly discriminate between the different nets. If required, he should ensure that data from all Link 11 nets can be forwarded to Link 11B units.

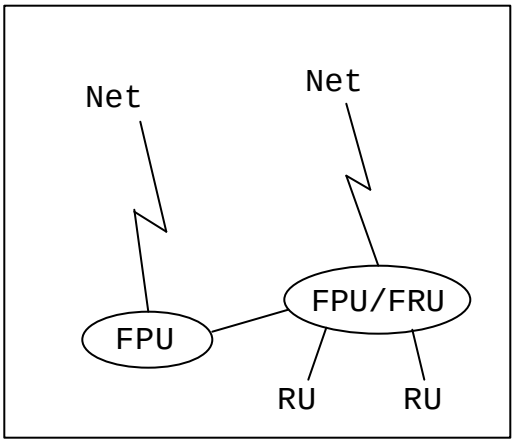

Figure C-2. Multiple Link 11 Nets

C2.1 DLRP. The DLRP is a fixed geographic point from which all positional information on the Link is derived and is used by each PU to reference the location of its SCC. The SCC is a location relative to the DLRP from which PUs report the positional data of their tracks in the Link 11 messages. Some PUs use their own unit position as SCC. Other PUs offset their position from SCC. All PUs must use the same DLRP to correctly locate track data. Selection of the DLRP is based primarily on a centralized location. The location of the DLRP relative to the PUs is not totally arbitrary. A PU cannot report its position if it is beyond 17 degrees in latitude or 17 degrees in longitude from the DLRP (34 degrees in longitude if DLRP latitude is 60 degrees North or South or greater). The DLRP should normally be assigned forward of the PIM to ensure PUs do not move out of the maximum range limitation.

C2.2 Frequency Selection. Link 11 communication can be accomplished with UHF or HF transmissions. The selection of frequencies is a communications planning function subject to the applicable constraints of frequency allocation. Frequency selection is determined by numerous variables including atmospheric conditions, geographic location, force composition and dispersal, time of day, and other frequency assignments. The frequency separation between the Link 11 frequency and the nearest other operating frequency must be at least 15 percent. If this criterion is not met, neither Link 11 nor the

communications requirement of the interfering channel will be satisfied. At least two frequencies, a primary and alternate(s), shall be chosen for Link 11 operations.

C2.2.1 HF Frequencies. Maximum communication distances are obtained when Link 11 is operating in the HF spectrum. The communication subsystems are designed to a maximum radius of 300 miles. The choice of operating frequency in the HF spectrum is the primary factor determining maximum communications distance. Lower frequencies are normally better at night while higher frequencies are better during the day. Link 11 operations normally use the HF ground wave propagation path.

C2.2.1.1 Sideband Selection. HF Link 11 data communication can be accomplished in either dual sideband or single sideband operation. The Link 11 HF operations are normally conducted in the dual sideband operation, with the DTS operating in the diversity mode. Single sideband operation is currently permitted for the upper sideband only. When specifying frequency, the sideband selection must also be specified.

C2.2.1.2 Window/Assigned Frequency Correlation. The assigned frequency and the (window) frequency dialed into the equipment are not necessarily the same when used for Link 11 operations. For standardization, the following procedures shall be used for determining the window/assigned frequency correlation.

a. Single Sideband. The assigned frequency and the (window) frequency are determined for single sideband transmissions as follows:

(1) The suppressed carrier for proper operation is obtained by subtracting 1.5 kHz from the assigned frequency and rounding off the resulting frequency (0.1 through 0.5 to the next lower whole kHz and 0.6 through 0.9 to the next higher whole kHz).

(2) The transmitter is tuned to the frequency obtained (window frequency) and upper sideband operation is utilized.

b. Dual Sideband.

(1) If the assigned frequency ends in a whole kHz, the window frequency is the assigned frequency.

(2) If the assigned frequency ends in 0.1 through 0.5 kHz, round off to the next lower kHz to obtain the window frequency.

(3) If the assigned frequency ends in 0.6 through 0.9 kHz, round up to the next higher kHz.

C2.2.2 HF/UHF Signal Exploitation/Jamming. Link 11 operating in the HF spectrum is significantly more vulnerable to signal exploitation/jamming by a hostile force operating beyond the local horizon than operating in the UHF spectrum. This is due to the fact that the ionosphere refracts HF signals (sky waves) and return to the earth's surface at distances ranging from several hundred miles to a thousand miles or more from the source. Use of charts to determine sky wave propagation for the various frequencies should be considered to minimize signal exploitation due to sky waves. Limited Range Intercept (LRI) techniques should be considered when practical.

C2.2.3 UHF Frequencies. A measure of protection from signal exploitation can be achieved by operating Link 11 in the UHF spectrum when force size and separation permit. Frequencies in the 225 to 400 MHz UHF band are utilized for Link 11 operations. Transmissions from surface PUs in the UHF spectrum under normal propagation conditions are limited to LOS ranges on the order of 20 to 30 miles at the surface. Actual transmission distances are a function of the height of the transmitting and receiving antennas and the existing propagation conditions. Maximum usable UHF data transmission is on the order of 200 miles for aircraft at altitudes of 20000 feet or above. The relatively short LOS range obtained at UHF does not allow its use in a dispersed force. Some aircraft have a continuous and/or Short Broadcast capability, which may be utilized at UHF to provide a tactical picture to surface and land units over a large area. During EMCON, units can operate in the Radio Silence (receive only) utilizing the tactical picture provided by the airborne PU.

C2.2.3.1 UHF Propagation Problems. An abnormal propagation condition, known as ducting, can occur that results in signals being transmitted near the earth's surface over distances greater than normal LOS. When this condition is present, UHF signals are propagated for considerable distances beyond the local horizon. These signals are not normally operationally significant, but can be used by a hostile force for signal exploitation.

C2.2.3.2 Link 11 Waveform. Link 11 was introduced as a single frequency link as described in Chapter 2 and the foregoing paragraphs. New designs in DTS equipment allow a single Link 11 to be operated on multiple frequencies simultaneously. This multiple frequency link technique is referred to as MFL, for multiple frequency links. The MFL DTS uses up to four RF channels to provide redundancy of the signal. This technique can enhance connectivity to a much higher value than a single frequency system. The MFL system can reassign an individual channel frequency without disrupting the other

channels, thereby eliminating downtime for frequency changes. In addition to the CLEW, the MFL DTS can also be configured with a channel for SLEW. SLEW and CLEW are not compatible waveforms. However, the MFL DTS uses adaptive channel techniques to maintain backward compatibility with the installed CLEW equipment on the host platform.

C2.2.3.3 Link 11 Single Tone. As noted above, SLEW and CLEW are incompatible waveforms. A PU operating on SLEW will not be able to exchange data with a CLEW PU unless the SLEW unit uses MFL. While the MFL DTS can configure with a SLEW capability, there is currently no way to forward data from SLEW to CLEW.

C2.2.3.4 The Use of UHF. The most likely uses of UHF Link 11 operation are:

a. Airborne PU broadcast of own sensor information with surface or ground forces operating under EMCON silent conditions.

b. Small close-force operations.

c. Operations when UHF airborne relay is available.

d. Operations where strict HF silence is necessary.

e. Operations with Theatre Missile Defense (TMD) systems.

C2.2.4 Multi-Media Link 11. Link 11 data can be transmitted using UHF or HF single frequency or “simulcast” UHF and HF transmitted simultaneously from a single DTS. Legacy DTSs use CLEW. More recent DTSs can employ either CLEW or SLEW. SLEW and CLEW are not compatible waveforms. Operationally, if any of the units to be included in the Link 11 network cannot be configured for SLEW, each DTS should be configured for CLEW.

C2.2.5 Additional DTS Capabilities (US Only). In addition to the CLEW and SLEW capable DTSs, some USN units are equipped with the Common Shipboard Data Terminal Set (CSDTS) that provides the following additional capabilities.

C2.2.5.1 Multiple Frequency Link 11. The CSDTS provides the capability to exchange data on single or multiple (two) Link 11 net(s) over multiple frequencies simultaneously. The CSDTS can use up to four RF frequencies within a single network to provide a redundancy of the signal or can be configured to support two networks using any combination of the four frequencies for connectivity and redundancy. This technique can enhance

connectivity and improve the quality of the received data provided to the host system. RF propagation characteristics may be such that a usable RF pathway between units is not attainable on a given single frequency. Units receiving redundant data on multiple RF frequencies sample data on each and select the best source to provide data to the host system. The MFL system can also reassign an individual channel frequency without disrupting the other frequencies, thereby eliminating downtime for frequency changes.

C2.2.5.2 Multiple Link 11 Networks. The CSDTS is capable of supporting data exchange between two (primary and secondary) Link 11 Networks. PUs on these networks may employ (but do not have to) a mix of CLEW and SLEW on each network. Another possible operational configuration might be a primary CLEW network and a secondary SLEW network. The CSDTS has the capability to serve as a gateway, re-transmitting data received on one network onto the other network. If a network contains a mixture of SLEW and CLEW units, a CSDTS equipped unit within that network should be used to re-transmit data between SLEW and CLEW units. To prevent data looping, only one such gateway should be provided. A CSDTS unit that re-transmits data between the primary and secondary networks is performing a “network gateway” function. Note that it is possible for a unit to simultaneously perform a network and waveform gateway function.

C2.2.6 Frequency Allocation. For guidance on frequency allocation, it is necessary to refer to the appropriate Tactical Commander's Frequency Allocation guide.

C2.2.7 Tactical Considerations for Frequency Selection. Frequency selection may be made due to tactical considerations. If all the units cannot have good communications, the selected frequency may be determined by either:

a. The largest number of units with adequate Link 11 communications.

b. Priority, based on tactical considerations, being given to selected pickets. The priority principle of frequency selection must be ordered by the Tactical Commander and priority units specified.

C2.2.8 Frequency Locking. The DTS radio oscillator frequencies and time bases are all derived from the frequency standard. This should be accurate and stable if satisfactory Link 11 operation is to be achieved. Some units may require carrying out a frequency lock before transmitting data. This should be carried out prior to operation. The accuracy of the frequency lock achieved can be checked in less than 10 minutes using the ADatP-11 described procedure.

C2.3 Link 11 Data Encryption. Normally, Link 11 and voice coordination circuits will be covered with suitable on-line encryption devices. For covered circuits, the mode of operation of crypto devices and applicable key lists must be specified. In addition to the general issues listed in Chapter 3, the Tactical Commander should also:

a. KG-40 equipment is intended for Link 11 fit and that reference may, therefore, be made to equipment settings when ordering the crypto mode.

b. Direct the crypto mode to be used (OPTASK LINK). The KG-40 provides cipher text modes designated A1, A2 and B; a 'plain text' KG-40 bypass mode is also available.

WARNING: Mode B shall not be used when Link 11 data is retransmitted on an uncovered link. In any case Modes A1 and A2 are the preferred modes for all Link 11 transmissions.

C2.3.1 Hamming Error Detection and Correction (EDAC). Hamming EDAC is a process by which additional bits are added to each information word in order to detect and correct errors. Errors may be caused by any phenomenon that affects the HF/UHF propagation medium to cause signal fading or interference. Each 24-bit information word that is received from the computer is processed by the DTS Hamming encoding circuitry. The Hamming encoding circuitry then adds 6 bits to the 24-bit word that results in the 30-bit word that is phase modulated and transmitted. When the DTS demodulates the 30-bit word, it is processed by the Hamming decoding circuitry. This detection process uses the six additional bits to determine if errors exist. The Hamming EDAC process is completely automatic with no operator involvement.

C2.3.2 Cryptographic Equipment

a. KG-22/40/40A has four modes of operation.

MODES	Criteria for Input Data Transfer/Use
(1) A1	Message Indicator (MI) must be error free.
(2) A2	MI must contain: No errors, one error - data corrected, or overall parity bit in error - data correct.
(3) B	MI not used in this mode/encrypted or decrypted regardless of errors
(4) Plain Text	MI not used in this mode/secure or clear.

b. KG-23 has three modes of operation.

MODES	Criteria for Input Data Transfer/Use
(1) A	MI must be error free.
(2) B	MI not used in this mode/encrypted or decrypted regardless of errors.
(3) C	MI not used in this mode/plain text (secure or clear).

c. Transmitting and receiving PUs must be in the same operating mode.

d. In modes A1 or A, if the MI is not error free, all following Link 11 messages are inhibited. In modes A2 or B, the MI is allowed to contain one error - (data corrected) or overall parity bit in error - (data correct).

e. Modes A2 or B shall be the standard operating mode.

C2.4 DTS Parameters. The Link 11/11B Manager shall establish and promulgate the standard equipment settings for the Link 11 data rate, synchronization time base, and Doppler correction activation in order to ensure correct data exchange.

C2.4.1 Data Rate. Link 11 can operate at either a fast data rate of 13 milliseconds (ms) per frame or a slow data rate of 22 ms per frame. All PUs must operate at the same data rate. Figure C-3 illustrates the effect of the number of PUs and link track load on the Net Cycle Time (NCT). An NCT of approximately 8 seconds is considered to be adequate for the exchange of real-time tactical information. The slow data rate also allows for two integration times, 9 ms and 18 ms, for the received data. Table C2-1 provides a comparison of the data rates and integration times. Initially a data rate of 13/9 should be specified because it provides a shorter NCT for the same track loads. Data rate of 22/9 should only be employed after it has been demonstrated that satisfactory operations cannot be achieved or maintained at 13/9. The 22/18 data rate may be used to counter ECM when other techniques fail. The 13/9 data rate equates to 2250 bps data transfer and 22 ms data rate equates to 1364 bps. The slow data rate can be used to overcome multiple data errors indicated by even parity status in all PUs due to poor data communications frequencies.

C2.4.2 Link Synchronization Time Base. DTSs have the capability for using two different time bases for synchronization of received data: Corrected (or external) and Internal (stored or continuous). For normal operation, the Corrected sync mode should be used. However, the Internal sync mode could be used by those PUs receiving long transmission cycles; i.e., data dumps between units, very poor propagation conditions, or during jamming. PUs do not have to be in the same sync mode for proper operation.

C2.4.3 Doppler Correction or Variable Control Oscillator (VCO) Mode. Doppler correction circuits are contained in all DTSs. Doppler correction is required to eliminate frequency errors generated by the relative velocity of PUs or by inaccurate frequency standards. Doppler correction circuits shall be energized during Link 11 operations.

C2.5 Link 11 Duties. Link 11 configuration planning consists of determining the assignment of the functions of the DNCS and GRU as well as assignment of the Link 11/11B Manager as prescribed in Chapter 3. The criteria for selection of the DNCS are provided below. Criteria for GRU assignment are provided in paragraph C3.2.15.1. The Link 11/11B Manager shall designate the DNCS and the GRU.

C2.5.1 Data Net Control Station. The DNCS can be assigned to only one PU at any one time. In the selection of the DNCS and any subsequent changes of DNCS, the effect on the quality of data link communication should be of primary concern. The operational command authority should not be considered for the selection of DNCS. Usually, a centrally located DNCS is considered to be the best choice due to the shortened RF propagation paths. However, most favorable communications may be found in any one of a variety of arrangements, and a centrally located DNCS should not be assumed to be optimum without further investigation. Other considerations are:

a. Units subject to frequent periods of radio silence due to ordnance handling restrictions.

b. Availability/status of Link 11 equipment.

c. Number of picket stations that a unit can interrogate.

d. Tactical situation.

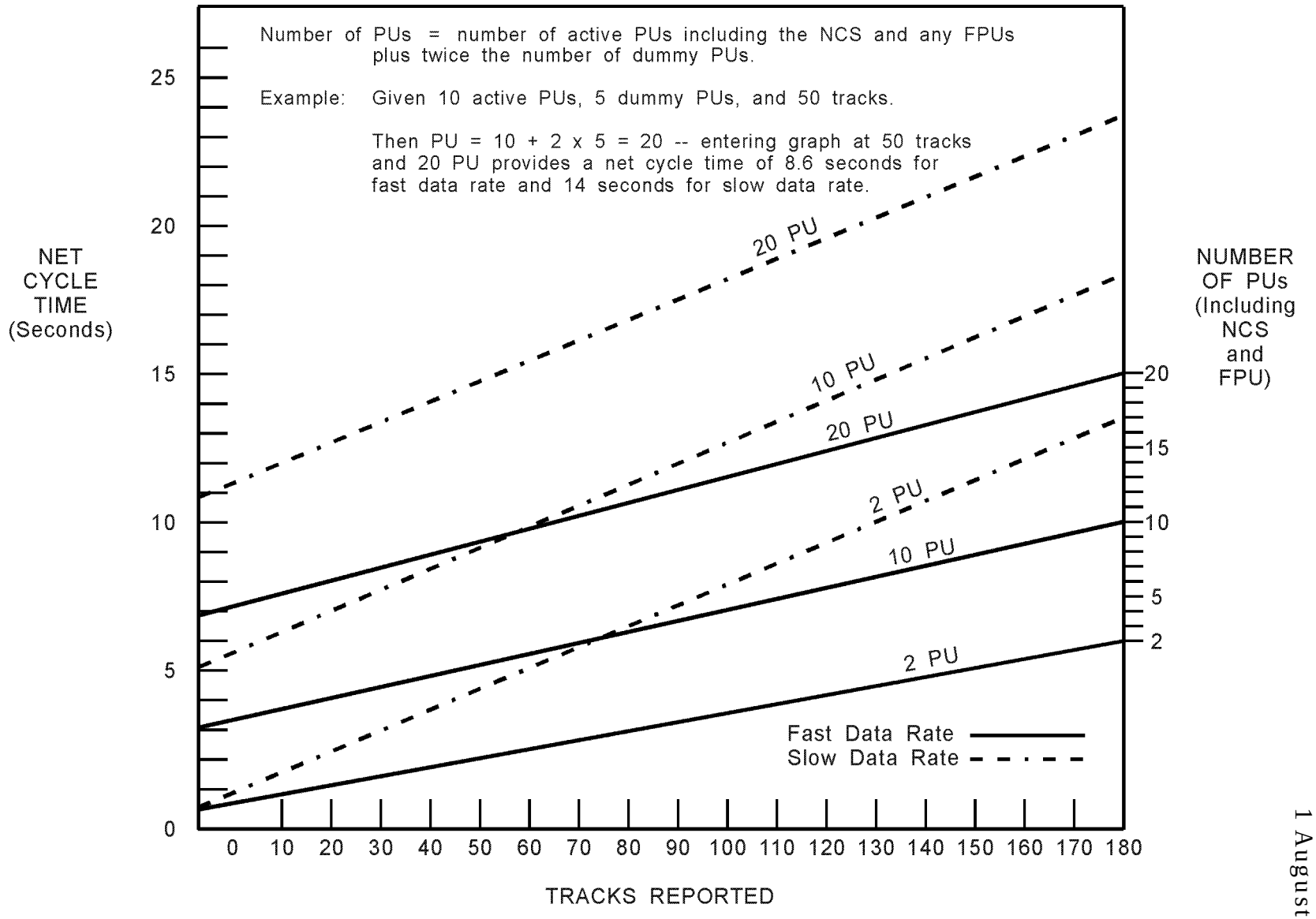

Figure C-3. Link 11 Net Cycle Time

Table C2-1. Comparison of Data Rates and Integration Times

DATA RATE	EQUIPMENT SETTING	ADVANTAGES	DISADVANTAGES
Fast	13/9 ms 2250 bps	Lowest NCT for a given number of PUs and tracks. Best possible real-time link conditions.	Net Sync problems may be more critical than with slow data rate. Requires the highest signal-to-noise ratio (SNR) to attain acceptable error rate. Equipment must be in optimum condition for reliable link.
Slow	22/18 ms 1364/18.18 bps	Has lowest SNR requirement for acceptable error rate; i.e., operates best under noisy conditions.	NCT may exceed maximum considered real-time data exchange within the link according to the number of PUs and link track load. Sync is more critical than the 22/9 setting.
	22/9 ms 1364/9.09 bps	Best net sync characteristics.	NCT is the same as for 22/18 setting and may exceed acceptable maximum for real-time data exchange. SNR required for acceptable error rate is greater than that required for 22/18 setting, but less than for 13/9 setting.

e. Radar Horizon (Some aircraft are ideal DNCSs, particularly in UHF environment).

C2.5.1.1 Standby DNCS (DNCSSBY). A DNCSSBY should be assigned in order to effect an orderly transfer of net control responsibilities so that an emergency shift of DNCS can be executed with a minimum delay. The same criteria as applied for the selection of the primary DNCS applies to the DNCSSBY. Paragraphs C3.2.5 and C3.2.6 provide the procedures for effecting DNCS transfers.

C2.5.1.2 Airborne DNCS Capabilities. Most aircraft (i.e. E-2C, S 3, P 3, E-3) have DNCS capabilities. These capabilities should be considered, depending upon the tactical situation. The use of airborne PUs to provide data in the Broadcast mode should also be considered.

C2.5.1.3 DNCS Responsibilities. The DNCS is responsible for ensuring that all PUs to be polled are entered in the DTS, that the Link 11 frequency is as directed by the Link 11/11B Manager, and that all PUs are informed of any changes.

C3. Link 11 Technical Operating Procedures

C3.1 General. Successful operation of Link 11 requires standardization of the actions that must be performed by operator personnel. The dispersal of Link 11 stations and the characteristics of automated data exchange necessitate that an orderly sequence of events be established for Link 11 initiation and operation. This section describes specific procedures and considerations required for pre-link preparation, link initiation, maintenance of an operational link and link departure. Procedures contained in this Appendix, in some cases, refer to actions or hardware settings unique to certain platforms. The reader should assume equivalent actions or settings applicable to other platforms.

C3.1.1 DNCS. During Link 11 operations, the unit designated as DNCS is responsible for controlling the Link 11 interrogations.

C3.1.2 PU Address/TA Entries. TAs are entered into the DNCS DTS to establish the interrogation sequence for roll call operation. Each picket station, in addition to the DNCS and DNCSSBY, should enter all TAs in their DTSs in the event they are designated as the DNCS. The PU Address assigned to a unit is normally the same address as the TA (see paragraph 4.4.1).

C3.1.3 DNCS DTS Address Sequence. There is no specific requirement for the sequence of TAs entered into the DNCS DTS. When using dummy TAs, they should normally be inserted between active PU TAs and not grouped at the end of the interrogation sequence. Appropriate operational commanders may also direct that those PUs with Command authority be interrogated more than once within a net cycle in order to decrease the Command initiation/response time.

C3.2 Specific Procedures. This section provides the specific procedures for the initiation and operation of Link 11. Detailed system procedures for the performance of functions such as DNCS and Picket are contained in applicable System Operator's Manuals (SOMs).

C3.2.1 Establishing Link 11

a. The step-by-step procedures in Table C3-1 permit Link 11 communications to be established with minimum coordination and effort. Satisfactory data communications are first established with as many PUs as possible while PUs operating in areas of poor radio wave propagation or experiencing equipment difficulties wait in radio silence. PUs that have communications difficulties should be assisted into the link once gridlock and

tactical picture have been established among the PUs experiencing no difficulties.

b. The time required to establish a new Link 11 net should be less than 20 minutes, if equipment checkout and set-up have been properly completed. The checkout and set-up of equipment should require 20 minutes or less. Responsibilities for establishing Link 11 rest with the FTC/TDC, Link 11/11B Manager, DNCS, and the individual PU coordinators.

c. The DNCS must coordinate all DNCS actions with the Link 11/11B Manager before execution, unless otherwise directed. The DNCS is responsible for monitoring and analyzing the DTS indications and informing the Link 11/11B Manager of problems being experienced.

C3.2.2 Entering an Established Link 11. When entering an established Link 11, care should be exercised to prevent disruption of the link communication cycle. Adherence to the procedure shown in Tables C3-2 and C3-3 provides an orderly and expeditious entrance into Link 11 without causing interference among other stations. Entry should be accomplished within 5 to 10 minutes once equipment operational performance is verified by performing the equipment checkout and set-up procedure. The exact time required to enter the link is dependent upon such variable factors as eliminating dual track designations and performing manual gridlock.

C3.2.2.1 Surface/Land PUs Entering an Established Link 11. The specific procedures for entering an established Link 11 net are shown in Table C3-2 for surface and land PUs.

C3.2.2.2 Airborne PUs Entering an Established Link 11. Table C3-3 provides the procedures for Airborne PUs to enter an established Link 11.

C3.2.3 Normal Link 11 Exit Procedures. This Link 11 exit procedure provides a set method for a picket station to leave an operating link. A station may leave Link 11 only as a picket station. The DNCS must transfer the responsibilities of the net control to another unit before initiating this link exit procedure. The link exit procedure must be initiated before a unit leaves the operational range of Link 11. The unit leaving the link must ensure that it does not disrupt the tactical picture for the remaining PUs on the link. Specific procedures for Link 11 exit are shown in Table C3-4.

Table C3-1. Procedures for Establishing Link 11 Net

Step	Condition	Action	Time
1	Equipment checkout and set-up.	All Units: Validate and/or perform the set-up of the Link 11 equipment.	Completed no later than 20 minutes prior link initiation.
2	Stand by for Link 11 initiation.	DNCS: Advise all units on DCN to stand by for link initiation.	20 minutes prior to link initiation.
3	Tune Link 11 radio.	All Units: Tune Link 11 radios for primary frequency.	Prior to or immediately after step 2.
4	Net sync preparation. (Only required prior to operating in stored mode)	DNCS: Set DTS net mode = NET SYNC Pickets: (Surface/Land units) Set DTS net mode = NET SYNC	After completion of step 3.
5	Net sync transmission (Only required prior to operating in stored mode)	DNCS: 1. Report initiation of net sync on the DCN. 2. Transmit Net Sync for 2 minutes. 3. Monitor transmitter power. 4. Monitor sync indications of sidetone. 5. Acknowledge picket reports. Pickets: 1. Monitor Net Sync indications. 2. Set reference generator. 3. Report to DNCS on the DCN the status of Net Sync, when requested.	After completion of step 4.
6	Net test preparation.	DNCS: 1. Report on the DCN test initiation. 2. Set DTS net mode = NET TEST. Pickets: Set DTS net mode = NET TEST.	After completion of step 5.
7	Net test initiation.	DNCS: 1. Initiate Net Test for 1 minute. 2. Monitor own transmission of Net Test. 3. Request results from pickets on the DCN. Pickets: 1. Monitor Net Test indications. 2. Report to DNCS on the DCN the results of Net Test, when requested. NOTE: If several units experience problems, the problem may be within DNCS, and the DNCSSBY should be directed to initiate net sync, then net test. If only a single unit reports problems, the unit should verify its DTS operation in accordance with the maintenance procedures.	30 seconds after step 6.

Table C3-1. Procedures for Establishing Link 11 Net (continued)

Step	Condition	Action	Time
8	Roll call selection.	DNCS: Set DTS to net mode = ROLL CALL. Pickets: Set DTS to net mode = ROLL CALL.	After all units report step 7.
9	Start transmit (without data).	DNCS: 1. Initiate Roll Call transmit for each unit individually. 2. Verify receipt of each picket's signal and activate next picket. Pickets: Verify receipt of control codes from DNCS and other pickets as they are interrogated and respond. DNCS: Request receive status of picket station on DCN. Pickets: Report receive status of control to DNCS.	After step 8. After all pickets entered in link.
10	Enter parameters into computer system.	DNCS: Disable all units, including own unit from DTS interrogations. All units: Enter or verify entry of required parameters, DLRP, own unit address (both TA and PU address), TN allocations. Enable Link 11 functions if necessary. NOTE: Those units with automatic tracking and/or reporting capabilities ensure that entries or selections have been made to ensure Link 11 reports are not automatically initiated.	After step 9.
11	DNCS initiate transmissions.	DNCS: Enable own unit TA, reinitiate transmissions. Verify transmit power. Pickets: Monitor the DTS audio and receive indications. If the DTS audio monitor has clear audio, the radio is working and the communication path is most likely good. If the DTS gives a receive indication, the detection section is working. Reception of remote tracks from the DNCS indicates the complete receive path is working. Note TQ of the tracks being reporting by DNCS.	
12	Receive DNCS data/manual gridlock.	Picket: 1. Monitor RQ of DNCS, if capable. 2. Monitor reported TQ of tracks received from DNCS. 3. If DNCS is the GRU, and the TQ of the received tracks is 5 or better, perform manual gridlock procedures. If DNCS is not the GRU, do not perform manual gridlock until the GRU becomes an active picket, see step 15.	Upon receipt of DNCS data.
13	DNCS determine receive status of picket station.	DNCS: 1. Request each picket report the TQ of DNCS reported tracks and if able, the RQ of the DNCS on the DCN.	2-5 minutes after initiation of step 12.

Table C3-1. Procedures for Establishing Link 11 Net (continued)

Step	Condition	Action	Time
14	DNCS enables address of pickets.	DNCS: 1. GRU other than own unit enable interrogation of GRU, otherwise enable 1st picket in DTS sequence. 2. Do not enable the TA of those PUs reporting that the TQ of DNCS reported tracks is less than 5. 3. If a PU answers to less than 75% of the call-up messages, disable the TA of that PU and enable next picket in sequence. 4. After verification a picket is transmitting correctly, enable another picket until all pickets have been enabled once. All: After GRU is enabled, complete Step 13 gridlock procedures. FTC/TDC: As the pickets become active, coordinate with the DNCS and pickets on the TSN for any data conflicts or differences	After step 13.
15	GRU initiate auto gridlock procedures if capable.	FTC/TDC: Request GRU initiate automatic gridlock procedures. GRU: Initiate auto gridlock procedures. Pickets: If capable, perform automatic gridlock procedures. The link is established at this time even though some PUs might not be active. NOTE: Not all GRUs are capable of Auto Gridlock.	After all units enabled one time.
16	DNCS enter remaining pickets.	DNCS: Enable each remaining picket one at a time and assist them in resolving communications and tracking difficulties. NOTE: Manual gridlock will be used when entering these stations. Pickets that have communications so poor as to disrupt the data link will not be enabled except by order of the FTC/TDC. A picket forced to remain in Radio Silence because of propagation, atmospherics, or interference is to contact the FTC/TDC and inform him of any tracks that are deemed to be of tactical importance by that picket. The FTC/TDC may then wish to enable the picket's address to acquire the desired tracks.	After completion of step 15.

Table C3-2. Surface and Land PU Procedures for Entering an Established Link 11 Net

Step	Condition	Action
1	Equipment checkout	Verify performance of equipment checkout and set-up.
2	Establish voice communication	Units: Inform FTC/TDC on TSN and Link 11/11B Manager on DCN of intent to join link. Use appropriate authentication procedures.
3	DTS/data program entries.	DNCS and DNCSSBY: Enter new TA in DTS, but do not enable TA. NOTE: All DNCS capable PUs should enter the new TA into their DTS, in case own unit is designated as DNCS on an emergency basis. All units: Enter new PU Address into program, if required. Entering PU: 1. Set DTS to Radio Silence. 2. Enter required data into program.
4	Monitor received data.	Entering PU: 1. Monitor received track data reports. 2. Perform manual gridlock. 3. Report to FTC/TDC if unable to receive track reports. Attempt to determine problem and reinitiate Step 3. 4. Resolve conflicts/differences and correlate remote track data with local tracks. FTC/TDC: Assist new PU in resolving conflicts/differences.
5	Permission to enter Link 11.	Entering PU: Report to Link 11/11B Manager on the DCN that PU is ready to enter and request permission to enter Link 11. Link 11/11B Manager: Give permission to enter link. DNCS: Enable new TA in DTS.
6	Link 11 entry.	Entering PU: 1. Change from Radio Silence to Roll Call mode. 2. Initiate Data Update Request (DUR) to each IU to obtain reference points, EW data, intelligence, and weapons status if program does not automatically initiate DUR. DNCS: Request interrogation status from new PU. FTC/TDC: Monitor track reporting to ensure new PU not disrupting established link.

Table C3-3. Procedures for Airborne PUs Entering an Established Link 11 Net

Step	Condition	Action
1	Equipment checkout/ set-up.	Verify performance of equipment and ensure correct settings and frequency as stated in latest OPTASK LINK or voice communication.
2	Monitor received data.	1. Enable roll call, radio silence. 2. Monitor received track reports for a period of not less than 5 minutes. 3. Monitor RQ values for received PUs to ensure satisfactory data being received. 4. Resolve dual designations and duplicate TNs.
3	Established voice communications/ permission to enter Link 11	1. If voice communications available, report to Link 11/11B Manager of readiness to enter link (request PU to be entered). 2. Enable transmit. 3. Monitor DTS for interrogation of own PU. If DTS not interrogated, verify via voice communications that DNCS has TA entered.

Table C3-4. Procedures for Normal Link 11 Exit

Step	Condition	Action
1	Request to initiate Link 11 exit procedures	Exiting PU: Request permission from Link 11/11B Manager on DCN to execute Link 11 exit procedures. Link 11/11B Manager: When permission granted, inform the FTC/TDC and all other IUs on the DCN that specified PU is exiting the interface. FTC/TDC: If exiting PU has been responsible for originating any common points, assign another IU to report the point.
2	Request permission to leave Link 11	Exiting PU: Request permission from Link 11/11B Manager on DCN to leave Link 11. Link 11/11B Manager: Grant permission to exit Link 11. Exiting PU: After Link 11/11B Manager grants permission, report to DNCS on DCN that PU is leaving Link 11.
3	Link 11 exit complete	DNCS: Disable TA of exiting PU (see Note 1). Exiting PU: 1. Place DTS in receive only - remain in link standby condition until Link 11 information is no longer required by unit. 2. Perform required maintenance operating procedure to ensure Link 11 equipment is available for Link 11 operations.
NOTE 1: If the exiting PU is a forwarding unit and will continue to perform the forwarding function after the PU exits Link 11, do not disable the TA of the exiting PU. The PU's DTS is to remain operational and continue to be polled in order to allow the unit to forward data between the links involved.		

C3.2.4 Emergency Link 11 Exit Procedures. Emergency exit is used when equipment malfunctions or operational considerations prevent satisfactory Link 11 data communications. This includes TDS program losses, DTS problems, or radio failure. This procedure discusses only the emergency procedures. A prime consideration of Link 11 exit is for the FTC/TDC to ensure that those tracks previously being reported by the departing PU are reported by other IUs. Specific procedures for emergency exit of Link 11 are shown in Table C3-5.

Table C3-5. Procedures for Emergency Exit of Link 11

Step	Condition	Action
1	Report emergency Link 11 exit.	Exiting PU: 1. If DNCS, conduct emergency DNCS shift with DNCSSBY (DNCS shift not required for program loss only). 2. Notify FTC/TDC on the TSN. 3. Notify DNCS and Link 11/11B Manager on the DCN.
2	Link 11 exit.	Exiting PU: 1. Place DTS in receive mode to ensure no disruption of interface. 2. Report to Link 11/11B Manager estimated time to re-enter Link 11. FTC/TDC: Ensure tracks previously reported by departing PU are currently being reported by another IU. DNCS: Disable or leave enabled the TA of PU, as determined by estimated time to re-enter, criticality of NCT, and whether exiting PU is also FJU (see Note 1 of Table C3-4). If PU is still being interrogated 1/2 second is added to NCT. Exiting PU: Rejoin Link 11 using the established Link 11 entry procedure.

C3.2.5 Normal DNCS Change. The orderly change of Link 11 DNCS can normally be accomplished with a minimum of disruption to the interface. When shifting the DNCS, primary concern is the effect on the quality of data link communications. The PU designated as the DNCSSBY must monitor the link transmissions closely to ensure their equipment is ready to assume DNCS functions. The Link 11/11B Manager directs the change of DNCS. Any PU recognizing a need to shift DNCS should advise the Link 11/11B Manager. The time required to change DNCS is normally within a single net cycle. The change in the DNCS is accomplished on the DCN. Once a change of DNCS has been accomplished, the Link 11/11B Manager must ensure a DNCSSBY is designated in order that a DNCS change can be effected again if required. Specific procedures for the normal change of DNCS are provided in Table C3-6.

C3.2.6 Emergency DNCS Change. There are two conditions that can necessitate an emergency shift of DNCS. The DNCS can recognize a problem in own system and request the DNCSSBY to assume net control. In the other case, the DNCS does not recognize a problem or has experienced a loss of communications, and the DNCSSBY must take actions to assume DNCS. Table C3-7 provides the procedures for effecting an emergency DNCS change. When the DNCS goes down, it is desirable that the DNCSSBY take immediate actions to ensure that any interruption to data exchange is minimized. If a DNCS experiences a TDS program loss, there is no requirement for the PU to conduct an emergency shift of DNCS, if the DTS NCS function is independent of the TDS program function. In this case, consideration should be given to

effecting a normal DNCS change and perform an emergency Link 11 exit for the old DNCS. The DNCSSBY must exercise caution before it shifts to the DNCS mode of operation, so that both the original and DNCSSBY do not inadvertently attempt control of Roll Call at the same time.

C3.2.6.1 DNCS Net Entry. When the DNCS experiences a TDS program loss and retains the DNCS function, Link 11 operation and re-entry shall be as follows:

a. Disable transmission of own data at the DTS.

WARNING: Do not place DTS in Radio Silence; doing so stops the roll call sequence.

b. After TDS program is restored, monitor Link 11 to correlate remote tracks with local video and conduct gridlock.

c. Obtain Link 11/11B Manager permission to enter Link 11.

d. Enable transmission of own data at DTS.

C3.2.7 Changing Frequency. Changing the Link 11 frequency is at times unavoidable because of weather, atmospherics, and interference. When a change is required, it must be made as rapidly as possible. This procedure establishes guidelines to ensure minimum time is required for the actual frequency change. Planning and coordination is required for a smooth change in frequency. The DNCS must perform checks to ensure that the new frequency provides the best possible communication among all the link participants. The Link 11/11B Manager orders changes in the Link 11 operating frequency as required or directed. A PU may inform the Link 11/11B Manager of its quality of communication at any time. But the PU must recognize that the Link 11/11B Manager is responsible for Link 11 communications among all the stations and that the DNCS has the best capability of evaluating each picket's communications. The DNCS must have the permission of the Link 11/11B Manager before starting the frequency change procedure. The Link 11/11B Manager is responsible for selecting the frequency and initiating the frequency change. (If the DNCS does not have secondary radio equipment available, consideration should be given to shifting the DNCS functions to a PU with secondary equipment so that the change in frequency can be done expeditiously.)

Table C3-6. Normal DNCS Change Procedures

Step	Condition	Action
1	Initiate change of DNCS	Link 11/11B Manager: Inform all PUs of DNCS change on DCN. Direct old and new DNCS to effect change on the DCN.
2	DNCS update	New DNCS: 1. Update TAs in DTS to ensure all existing and intended PUs are entered. 2. Remain in picket mode. 3. Enable all required TAs. 4. Inform existing DNCS when ready to assume DNCS duties on DCN. Old DNCS: 1. Monitor DTS, for program cycle. After own PU transmits, place DTS in picket mode. 2. Inform new DNCS that station is now in picket mode. New DNCS: Place DTS in DNCS mode.
3	DNCS Transfer complete	New DNCS: 1. Monitor the call-up of each picket and determine the quality of communications between itself and each picket. Resolve any communications difficulties brought about by changing net control. (If a particular picket is reporting difficulty in communicating with the new DNCS, contact the old DNCS and determine communications difficulties were experienced between old DNCS and the picket reporting communications difficulties.) 2. Report to Link 11/11B Manager the DNCS change has been accomplished.
4	DNCS monitor	All PUs: If time base/sync is in stored/internal, ensure range entry updated based upon new DNCS location .

Table C3-7. Emergency DNCS Change Procedures

Step	Condition	Action
1a	Old DNCS initiate change	Old DNCS: 1. Notify DNCSSBY and Link 11/11B Manager on the DCN of DNCS casualty and request DNCSSBY take immediate control. 2. Ensure DTS is not in the DNCS mode of operation. 3. Inform FTC/TDC on TSN. 4. Conduct Link 11 entry procedures when ready to join the link. DNCSSBY: 1. Upon receipt of original DNCS request, immediately shift DTS to DNCS mode of operation. 2. Ensure TAs in DTS are enabled. 3. Inform Link 11/11B Manager of roll call interrogation status. Link 11/11B Manager: Inform all units of DNCS change.
1b	DNCSSBY initiate change	DNCSSBY: 1. Upon observing a loss of DNCS interrogations or other PU's responses, contact the original DNCS on DCN to determine status. 2. If unable to establish voice communication with the DNCS on any circuit, contact other PUs on DCN to determine if they are still receiving DNCS interrogations and responses. If all PUs contacted report loss of DNCS interrogations, assume responsibilities of DNCS and initiate roll call operation.
2	Change complete	New DNCS: Notify Link 11/11B Manager of the status of link, after initial interrogation of all PUs.
3	DNCS monitor Link 11	New DNCS: Monitor DTS for responses, request status of each of picket of DTS response on DCN. All pickets: 1. If stored/internal, reset range based upon new DNCS. 2. Monitor DTS status, report to new DNCS on DCN. If difficulties are encountered, shift to Radio Silent mode and use Link 11 entry procedures. Link 11/11B Manager: Obtain status of old DNCS, specify an alternate DNCS. Inform all PUs of new DNCSSBY.

C3.2.7.1 Subsurface PU Considerations

a. Submarines are not always in contact on the assigned voice frequencies, and special consideration may be required to ensure planned frequency changes are promulgated to these units. The Link 11/11B Manager should consider a pre-briefed set of conditions for the submarine to recognize an impending frequency shift.

b. If the DLRP must be shifted and the submarine cannot be contacted by other means, the DLRP can be updated by directing the designated DLRP Transmission Unit to enable DLRP transmission, if not already enabled (see paragraph 5.7.11c).

C3.2.7.2 Airborne PU Considerations. Airborne PUs are not always in constant radio contact on the DCN and special consideration may be required in order to ensure planned frequency changes are promulgated to these units. The Link 11/11B Manager should consider a pre-briefed set of conditions for the airborne PUs to recognize that a frequency shift will occur to an alternate frequency. Then, whenever an airborne PU ceases to receive interrogations, it can re-enter Link 11 using the Airborne PU Link 11 entry procedures on the alternate frequency.

C3.2.7.3 Frequency Change Procedures

a. During a frequency shift, Link 11 should not be deactivated. If a PU cannot accomplish the frequency shift within 60 seconds, it should go to Radio Silence and rejoin the link after the frequency shift. This is because PUs are declared inactive if no data is received from them for 60 seconds.

b. Training within and among units is a major factor in the time required to shift frequencies. PUs are encouraged to practice frequency change procedures whenever operational considerations warrant. Table C3-8 provides the procedures to be followed for a normal frequency change, and Table C3-9 provides the procedures to be followed for an emergency frequency change; e.g., jamming encountered.

C3.2.8 Changing DLRP

a. A change in the DLRP may become necessary due to a shift in the geographic area of interest or as a matter of operational policy. DLRP changes are normally accomplished during low levels of link and operational activities. Although it is not necessary to deactivate Link 11 to accomplish this procedure, some units may have to exit and re-enter the net. Changing during

operation may cause some disruption to the exchange of data. There is short period (10 to 30 seconds) during which some tracks may be displayed in erroneous locations. Once the new DLRP has been correctly entered, all tracks will appear in their correct locations.

b. DLRP changes are normally accomplished at designated times as specified in the OPTASK LINK. If DLRP changes occur otherwise, the FTC/TDC should control the change. PUs must ensure the DLRP change is accomplished and monitor the resulting track reports. Table C3-10 provides the procedures to be used for a directed DLRP change.

c. After a DLRP change, the GRU should zero gridlock pads and request all PUs initiate manual gridlock. The FTC/TDC should ensure gridlock is accomplished prior to normal operations.

C3.2.9 Change of the Link 11 Crypto Keylists. The changing of crypto keylists occurs at a predefined time and shall be promulgated by the Link 11/11B Manager. Any deviations from this time must be authorized by the ICO and disseminated to all PUs via the OPTASK LINK or other appropriate means. The crypto restart period is a critical time period in Link 11 operation, because all PUs will be out of the link during the restart period. If the crypto period is extended, the restart should occur under the direction of the Link 11/11B Manager. Each PU must accomplish the restart expeditiously. PUs not having a preset key available for installation should declare themselves inactive and rejoin the link using the procedure for entering an established Link 11. Table C3-11 provides the procedures to be followed during the crypto restart.

Table C3-8. Normal Frequency Change Procedures

Step	Condition	Action
1	Monitor alternate frequencies	Link 11/11B Manager: Request on the DCN that all capable PUs monitor the alternate frequencies and report status. All PUs: 1. Monitor alternate with a secondary receiver (do not frequency interrupt Link 11 operations). 2. Report to Link 11/11B Manager on the DCN the status of specified alternate frequencies (noise and/or adjacent transmissions).
2	Select Frequency	FTC/TDC: If tactical situations require that selected PUs, e.g., the FJU(s), be given prime consideration as to the quality of the communications, provide Link 11/11B Manager with priority conditions of PUs. Link 11/11B Manager: As a result of reports, select frequency that would allow most PUs or priority PUs to have good Link 11 communications.
3	Prepare for frequency change	Link 11/11B Manager: Advise FTC/TDC on the TSN what frequency has been selected and request permission to change frequency. FTC/TDC: give permission to Link 11/11B Manager on the TSN net to change frequency, if tactical situation permits. Link 11/11B Manager: 1. Inform all PUs on the DCN of the selected frequency, and estimated time of shift. 2. Request all PUs report when ready. All PUs: Check out and set up alternate radio equipment (if available) and report to Link 11/11B Manager on the DCN when ready. If alternate radio equipment is not available or the shift cannot be accomplished within 60 seconds, advise Link 11/11B Manager and consider self to be an inactive PU after frequency shift.
4	Change Frequency	Link 11/11B Manager: After all PUs report ready for change, provide all PUs with a countdown on the DCN. DNCS: 1. When execute is given, shift to new frequency and continue Roll Call mode. 2. Monitor DTS for correct operation. 3. Prepare to allow other PUs to join Link 11. 4. Inform Link 11/11B Manager on the DCN of completion of frequency change. Pickets: 1. Upon receipt of countdown, shift to new frequency when execute given. Those pickets not able to accomplish step 3 place DTS in Radio Silent mode and prepare to re-enter link using Link 11 entry procedures. 2. Monitor DTS for responses to interrogation and track reports for correct display. 3. If difficulties are experienced, immediately inform Link 11/11B Manager on DCN. Link 11/11B Manager: Assist PUs having problems. If disruption occurs, disable PU's Address until problem identified and corrected.
NOTE: If operational conditions warrant (i.e., frequency change during a no operation condition), the Link 11/11B Manager may request that net sync be initiated immediately after the change in frequency. This should only be accomplished with the concurrence of the FTC/TDC prior to the frequency shift. Refer to ADatP-11 (Chapter 3 paragraph 313).		

Table C3-9. Emergency Frequency Change Procedures

Step	Condition	Action
1	Emergency Shift	DNCS: When jamming or disruptive conditions exist, immediately inform FTC/TDC and Link 11/11B Manager and request an emergency shift to alternate frequency. FTC/TDC: Depending on the tactical situation, grant permission or give other alternatives.
2	Shift frequency	Link 11/11B Manager: Inform all PUs on the DCN to switch to alternate frequency immediately. DNCS: 1. Switch own radio to new frequency. 2. Monitor receipt of responses to interrogations. 3. Inform Link 11/11B Manager on DCN of results of frequency change. Pickets: 1. Immediately switch to new frequency. 2. Monitor receipt of interrogations. If problems occur, place DTS in Radio Silent mode in order to not disrupt the existing link and report status to Link 11/11B Manager on the DCN.
3	Airborne PU	DNCS: Monitor Airborne PUs for response frequency change to interrogations. If no response, inform IUs in contact with Airborne PUs to have Airborne PUs effect change and rejoin link. Airborne PU: Upon loss of interrogations, check frequency for interrogation tones. Switch to alternate frequencies in attempt to find new frequency. An emergency shift will normally be to one of the two designated alternate frequencies. If time elapsed is greater than 60 seconds, place DTS in receive mode until net re-established.

Table C3-10. Directed DLRP Change

Step	Condition	Action
1	Initiate DLRP change	FTC/TDC: Initiate simultaneous DLRP change on the TSN. ALL PUs: Upon direction from the FTC/TDC, enter new DLRP. Observe shifting of remote track data and PU locations. If displays do not return to normal within 10-30 seconds, verify entry of DLRP and advise FTC/TDC if problem persists.
2	Initiate Gridlock	FTC/TDC: Instruct GRU to conduct auto gridlock procedures. If tracks not available to provide good gridlock conditions, ensure gridlock is accomplished prior to normal link operations.

Table C3-11. Crypto Restart Procedures

Step	Condition	Action
1	Restart	All PUs: 1. At specified time install preset keylist into crypto equipment. 2. If alarms cannot be cleared, multiple data error received or track data not received, inform Link 11/11B Manager on the DCN.
2	Monitor	FTC/TDC: Monitor track reports to ensure tactical picture does not degrade during crypto restart period. Coordinate with Link 11/11B Manager and DNCS to resolve any link problems. DNCS: 1. Monitor response to interrogation from each PU. If excessive errors occur, coordinate with PU on DCN. 2. Report to Link 11/11B Manager on the DCN the status of the link. 3. Allow inactive PUs to rejoin the link.
NOTE: If DTSs display no code error but track data is still not presented, the crypto may be bad.		

C3.2.10 Change in Link 11 Mode. Permission to change Link 11 modes must be obtained from the FTC/TDC.

C3.2.11 Change of CLEW Net Speed

a. The net speed to be used will be given by OPTASK LINK or detailed in an OPORD. There are three net speeds available when using CLEW:

(1) 13/9-2250. This is the high data rate and is normally selected. It is equivalent to 75 data frames per second.

(2) 22/18-1364/18.8. This is used in conditions of poor signal to noise ratio (often occurs when units are operating at extreme range) and is equivalent to 45 data frames per second.

(3) 22/9-1364/9.09. This is used when considerable multi-path propagation conditions are experienced and is equivalent to 45 data frames per second.

b. When a change to net speed is required, units will:

(1) Check radio tuning.

(2) Verify frequency lock with DNCS. (See paragraph C2.2.7)

(3) Perform dynamic net sync.

c. On successful completion, the net is used at the new speed.

C.3.2.12 Link 11 Monitoring

a. The primary responsibility for monitoring an operational Link 11 rests with the FTC/TDC and Link 11/11B Manager. They are responsible for detecting Link 11 communications problems as well as tracking problems. Tracking and communications problems are very closely related. Therefore, the FTC/TDC and Link 11/11B Manager must work together to solve link problems. Poor TQ is a possible indicator of a communications problem. Each PU is responsible for monitoring its own DTS indications and informing the Link 11/11B Manager of any problems.

b. The communications performance of the Link 11 net can be determined by using either or both of the following functions:

(1) Analyzing the RQ reported by each unit for each other unit within the network and the RQ calculated by own unit for each unit in the network. This capability is not implemented equally amongst all units.

(2) Analyzing the network operations with a dedicated or integral test system. Units may be equipped with such equipment (e.g., LMS 11) or units may have a DTS that includes such functionality (e.g., AN/USQ 125). The operator should consult the appropriate SOMs for operation and use of this equipment.

C3.2.12.1 Link 11 Communications Quality

a. The normal roll call method of Link 11 communication control includes an DNCS that calls each PU, waits for the PU's data transmission and stop code, and then calls the next PU. In an ideal RF transmission environment, the PUs receive every call from the DNCS and respond with a data transmission and stop code. All PUs receive the end of transmission indicators and respond appropriately.

b. Operational hardware might not be properly maintained, set up, or aligned. Propagation conditions may be less than optimum. Noise and co-channel interference from other communication systems are often present. All these conditions combine to limit Link 11 communications quality. A degraded RF transmission environment often results in PUs missing their calls from the DNCS. In addition, poor communications quality results in missed stop codes and may result in more than one unit transmitting simultaneously.

Degraded communication results in data loss, confusion, poor reception quality, and increased NCT.

C3.2.12.2 Link 11 Reception Quality. Each PU calculates RQ for every other PU in the link. RQ is reported on Link 11 and displayed to the operator as a number 0 through 7. The RQ value represents the quality of Link 11 communications from each PU to own unit, with 0 indicating no communications and 7 indicating perfect communications.

C3.2.12.3 Utilization of RQ Data. RQ data enables an operator to analyze the communications performance of the whole link, or the communications performance of own PU. The degree of implementation of this feature by the analyzing PU determines the amount of data available for near-real-time analysis at the PU. PUs fully implementing this feature have access to the NCT, as calculated by every PU, and the RQ values for every communications path in the link. PUs incorporating the minimum requirements only have access to the NCT calculated by own PU and to the RQ values for the communications paths relative to own PU.

C3.2.12.4 Capabilities and Limitations. Using the Link 11 RQ data, operators can analyze the data in order to:

a. Determine the overall performance of Link 11 communications.

b. Segregate communications problems to specific communications paths.

c. Identify individual problem DTSs or PUs.

d. Isolate individual DTS/PU problems to the transmit or receive function.

e. Establish the magnitude and variability of NCT.

C3.2.12.4.1 Analyzing Link 11 RQ Data. Procedures for analyzing Link 11 RQ data are provided in section C4. An analysis of Link 11 RQ data cannot identify specific problems within a PU that may be contributing to substandard performance. Once a problem has been isolated to a PU's receive or transmit function by the use of RQ data analysis, conventional troubleshooting techniques and the procedures outlined in section C4 must be employed to further isolate and subsequently correct the problem.

C3.2.12.5 Assignment of Unacceptable RQ. It is not possible to assign definitive numerical RQ and NCT values that represent normal or acceptable operations. These values are dependent upon the tactical situation. An RQ value of seven, the optimum RQ value, indicates all data transmitted by the PU for which RQ is being calculated have been received at own unit without detectable loss of data or parity errors. The Link 11/11B Manager should closely monitor any PU being reported with an RQ value less than five.

C3.2.13 Equipment Checkout and Setup Procedure. This procedure assists operators in checkout and set-up of the Link 11 equipment. The procedure provides for checkout and set-up of DTS and radio. After verification the DTS and radio will function together, and after connection to the remainder of the system, a system verification test is performed. The test results should be recorded on a Link 11 equipment status sheet and retained from one checkout to another. This allows the operator to quickly identify a problem. Equipment checkout and set-up procedures consist of the following sequence:

a. DTS checkout.

b. Link 11 radio checkout.

c. Data systems test (POFA).

d. Data systems set-up.

C3.2.13.1 DTS Checkout. The DTS requires a complete checkout prior to attempting to enter an existing Link 11. The DTS must pass the self-test, Net Test, tone attenuation tests for the fast data rate, and Single Station Programmed Operational Functional Analysis(POFA). Failure to pass the self-test for the slow data rate should be reported as a degraded operation, but not listed as down for repair. Failure to pass the Doppler test is considered a degraded status if there are airborne PUs in the link. Table C3-12 provides the detailed procedures to be used for DTS checkout.

C3.2.13.2 Link 11 Radio Checkout. A checkout and set-up of the radio must be completed before attempting to enter an operating link. The radio must be checked out for frequency lock, tone output, and receiver sensitivity while operating on a dummy load. Use local established procedures for checkout of the radio equipment.

C3.2.13.3 Link 11 Programmed Operational Functional Analysis (POFA). The purpose of the Link 11 POFA is to provide tests of the rapid evaluation of Link 11 performance and to provide tests for single station evaluation of

communications between the DTS, the communications central of Link 11, and the computer (Radio/crypto/DTS connected, crypto keys verified, correct switch settings on DTS (both remote and local), and multi-station POFA). POFA procedures provide the operator with all the information necessary to prepare the equipment, perform the test, and evaluate the performance of Link 11. The operator, however, must become familiar with the information contained in all sections of the procedures before attempting to run the program.

Table C3-12. DTS Checkout

Step	Condition	Action
1	Preliminary equipment	1. Complete initial setting equipment set up and perform on self test own unit DTS. 2. Perform self test in both the fast and slow data rate.
2	Tone attenuation	Perform tone attenuation test and record results of test. Equipment not meeting minimum requirements should be considered inoperative.
3	Doppler Test	Perform Doppler test. If channel errors occur, the Doppler section of the DTS is faulty and should be reported. The Doppler function only affects the reception of data and may be listed as degraded status when airborne PUs are in the link.

C3.2.13.3.1 Multi-station Testing. The multi-station test verifies all features of actual Link 11 operation. Equipment pre-operating and operating procedures are identical to normal operation. Multi-station testing consists of exchanging known data over Link 11, evaluating the data received, and transmitting the evaluation reports with the data to other PUs. Evaluation reports are available for printing at each PU. The full report consists of Link 11 performance as evaluated by own computer plus the evaluation reports received from the other PUs included in that particular test run. Thus, all PUs acquire a rapid evaluation of the network performance and identification of any PU experiencing difficulties due to radio interference, weak radio signals, or equipment problems. Five to ten minutes of multi-station testing (approximately 2 minutes per PU) are sufficient for a comprehensive evaluation of Link 11 performance.

NOTE: Not all Link 11 units are capable of performing multi-station POFA testing.

C3.2.13.3.1.1 Multi-station POFA Test Content. A message is prepared and transmitted by each PU for each transmission consisting of report data and fixed pattern data. Each message is evaluated for errors at each receiving PU. The status report words are evaluated by checking the Hamming condition,

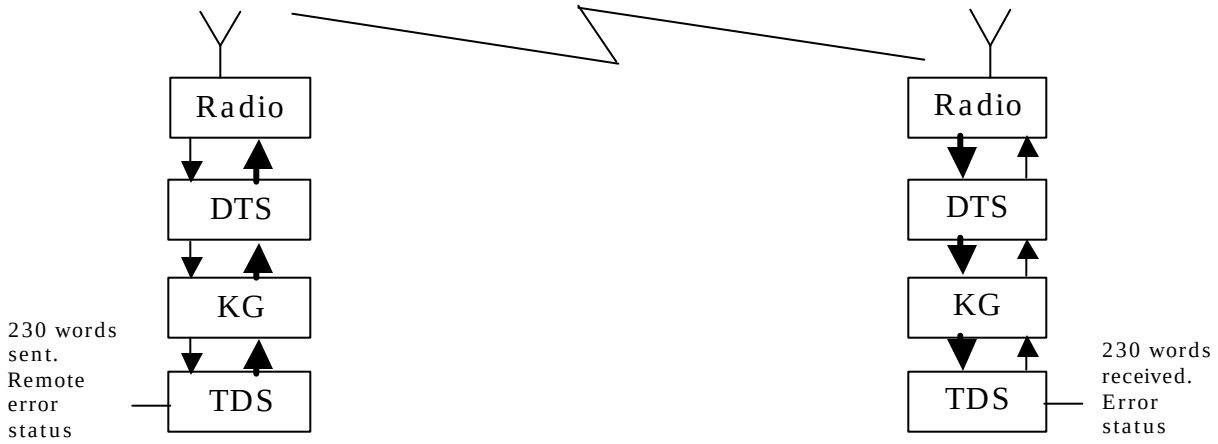

Figure C-4. Data Flow for the Multi-Station POFA

and the fixed pattern data words are evaluated by a bit-by-bit comparison. The results of the evaluations are in the report. (see Figure C-4)

C3.2.13.3.1.2 Multi-station POFA Requirements. This test requires that the PUs have an operating voice communications circuit and that each has the Link 11 POFA program loaded with the multi-station test called up. During the test, one PU is designated as the DNCS and the other PUs as the picket stations. The maximum number of PUs that can participate in a multi-station test, including own PU, is seven.

C3.2.13.3.1.3 Conducting a Multi-Station POFA. The scripted procedure to be followed as well as how to interpret the results are given in the classified supplement.

C3.2.13.3.2 Single Station POFA. The single station tests verify approximately 80 percent of Link 11 equipment of a single PU. The computer-to-DTS interface, however, can be completely verified. The Link 11 equipment that is not thoroughly checked with these test includes the radio transmitter and receiver levels and the Automatic Gain Control (AGC) circuit. The sync and Doppler correction circuitry of Link 11 cannot be verified.

C3.2.13.3.2.1 Single Station POFA Description. Data is transferred from the computer to the DTS for coding. The coded data is then sent to the communications central for transmission. Communications central output is connected to a dummy load. The coded side tone information received by the communication central is transferred to the DTS for conversion to digital data and then transferred to the computer for comparison with the data originally

sent (see figure C-5). This test checks the Link 11 system under optimum conditions. The DTS is prepared for Roll Call operations, the normal operational mode. When using the program as a normal maintenance aid or for an equipment confidence check, a 5 to 10 minute test should be sufficient to obtain the status of the Link 11 equipment. After the test period, the initially selected I/O console output will occur.

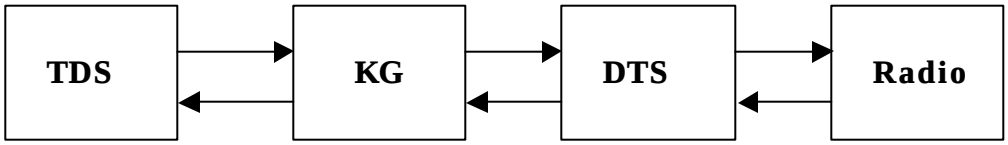

Figure C-5. Sequence of Procedures for Equipment Checkout and Set-up

C3.2.13.3.2.2 Single Station POFA Test Content. A message of fixed pattern data is used for all single station testing. A bit-by-bit analysis of this data is accomplished after the data is returned to the computer. When using the KG-22 secure equipment, a special single station test must be selected that utilizes a one-word output buffer. The same fixed pattern data, however, is verified after the message is received.

C3.2.13.3.3 Buffer of Data Words. For the Single Station POFA and Multi-Station POFA, the data words used by all platforms must be the same. The buffer contains 100 data words (24-bit words). Its contents are described in the classified supplement.

C3.2.13.4 Equipment Set-up. After equipment checkout has been completed, the system must be set up with the proper switch settings and prearranged data items. Complete detailed lists of the initial switch settings for each DTS are contained in the applicable operators or technical manuals. Abbreviated switch setting lists are also included. These settings will be the initial settings for either establishing or joining Link 11.

C3.2.14 Jamming Countermeasures

a. The term “jamming,” as used in this paragraph, refers to any form of RFI that causes a degradation or disruption in the transmission of data. Link 11 is susceptible to jamming. PUs must recognize that the link is being jammed, identify the type of interfering signal, and then employ countermeasures to reduce the impact on force operations. There are primarily four types of jamming that can affect Link 11 operations: data tone, Doppler tone, wideband noise, and playback.

b. If operations permit, a potentially effective way of defeating a hostile jammer is to transmit on the primary and secondary frequencies simultaneously and receive on only one of the frequencies. This has the advantage of requiring the jammer to broadcast on both frequencies to be effective in jamming Link 11. Another countermeasure is to increase the power output of the transmitter. This requires the jammer to increase power proportionately in order to be effective. Increasing the power output has the disadvantage of potential interference on other communication circuits. These and other countermeasures should be applied only if EMCON restrictions permit.

C3.2.15 Link 11 Gridlock

a. Gridlock is the Link 11 procedure for eliminating induced track position errors caused by navigation error and radar misalignment between two PUs. Navy mobile systems have the capability to conduct Link 11 gridlock procedures using a PU, RU, or C2 JU as GRU with a TN in the range 001 through 175_8. Gridlocked PUs transmit their track position data adjusted to GRU. Requiring PUs to gridlock to a single GRU results in PUs simultaneously gridlocking to each other. Gridlock is accomplished with the use of “gridlock pads” that are applied to incoming and outgoing PU position reports. Thus if a PU does not have itself positioned accurately, it can still correlate tracks within the interface.

b. The GRU maintains its geographic position as accurately as possible. Its gridlock pads should be cleared (zero) because it is reference for the force. However, the GRU's pads are not zero if its navigation position has been updated subsequent to gridlocking. The pads are also not zero if a surface GRU has gridlocked to a land-based IU. Gridlocking to a land based IU increases the probability that the latitude and longitude readouts of tracks and IUs are correct.

C3.2.15.1 Selection of a GRU. A Link 11 GRU must be designated. However, the Link 11 GRU need not be a PU; it may be a C2 JU or RU whose data are being forwarded to Link 11. The GRU should be located near the center of the interface and should hold local video on tracks that are mutually held by all PUs. The GRU must have an accurate navigation system in order to contribute an accurate tactical picture to other units. Force dispersion or operating conditions may preclude any one IU from satisfying the GRU requirements for entire Link 11. In the event that no one IU satisfies the GRU requirements, multiple GRUs may be assigned as required to ensure gridlock is achieved force wide. In this case, each GRU must gridlock to a common GRU in order to

achieve the best gridlock. Selection of GRU is dependent on the tactical situation, but a recommended priority order of GRU selection is as follows:

a. In a multi-link interface, it is highly desirable that a C2 JU be designated as the Link 11 GRU (see paragraph 4.3.4).

b. An E-2C or E-3 aircraft is normally a good choice for GRU due to its wide area surveillance coverage.

c. Land IUs should be used when available. Although they do not have the capability to initialize the auto gridlock function, their position is fixed and it provides an accurate navigation location.

C3.2.15.2 Methods of Gridlock. Two methods of gridlock are available, manual and automatic. Both methods require common sensor contacts. Specific platform actions necessary to perform manual or automatic gridlock vary by unit and are specified in SOMs. It should be noted that gridlocking does not affect a PU's navigational data. (If the GRU updates navigation data, it must then zero gridlock pads.)

C3.2.15.2.1 Manual Gridlock

a. Manual gridlock shall be used by any PU that notes it is out of gridlock and when entering an existing Link 11. Manual gridlock should normally be accomplished with a remote track received from the GRU or the GRU itself. An airborne PU can be used as a designated reference track if coordinated with the FTC/TDC to allow a dual designation with the reported airborne PU.

b. Manual gridlock consists of the designation of a remote track symbol to be used as a reference track, the designation of local video associated with the remote symbol, and the performance of appropriate manual gridlock operator functions. This procedure results in calculation of gridlock pads and appropriate adjustment to the display symbology.

c. Manual gridlock is performed by an operator hooking a remote track, positioning the ball tab, light pen or other markers over a corresponding local video, and initiating the manual gridlock function. This causes the computer to calculate X and Y components of the distance between the hooked track and ball tab and causes this inverse distance to be added from any existing gridlock pad. The track symbol falls upon the locally held video. All remote reports from all IUs are offset by the same value. Therefore, if a PU gridlocks to an IU that is not in gridlock with all other IUs, the remote tracks received from all

other IUs will not be in gridlock. The importance of all PUs gridlocking to a single GRU or a GRU reported track cannot be overemphasized.

C3.2.15.2.2 Automatic Gridlock

a. Automatic gridlock is used to bring more than one PU into gridlock at the same time. This method should be used in establishing Link 11 once data communications are established. Automatic gridlock should be performed periodically to maintain an accurate gridlock. This procedure requires at least 5 minutes to complete; therefore, the FTC/TDC must order this procedure only when absolutely necessary or during periods when the tactical situation will allow.

b. PUs not capable of automatic gridlock shall perform manual gridlock with the GRU immediately following all other PUs' termination and verification of automatic gridlock.

c. The automatic gridlock function causes all tracks being tracked locally by the GRU with TQ of 3 and above to be broadcast on Link 11 regardless of R^2. Other PUs hook the GRU symbol and initiate the automatic gridlock procedure. The difference of position of all tracks held mutually by a PU and the GRU are averaged and the result is applied to the gridlock pads. In addition to the X and Y pads associated with manual gridlock, automatic gridlock applies an azimuth pad in the event a radar azimuth error exists. After 5 minutes the automatic gridlock calculation ceases and the GRU should manually stop the gridlock function. This stops the transmission of low TQ tracks by the GRU.

d. The disadvantage to automatic gridlocking is that it includes tracks in the calculation that may be invalid, low TQ, or reported tracks not on video. In manual gridlocking, a known valid track can be used.

e. Automatic gridlock is initiated by orders from the FTC/TDC. The FTC/TDC directs all PUs to stand by for automatic gridlock. The GRU performs the procedure. Upon receipt of standby for automatic gridlock, each PU should ensure own unit is tracking all tracks for which local video is held. Table C3-13 provides the procedures for automatic gridlock. P-3C and S-3B aircraft cannot participate in automatic gridlock.

C3.2.15.3 Modified Automatic Gridlock with a Pseudo Gridlock Reference Station. Although land-based IUs of other Services do not have the capability to perform automatic gridlock, it is possible and frequently preferable to conduct a modified form of automatic gridlock using such a land-based IU.

This is done by USN PUs individually and independently of each other. The FTC/TDC should establish standard policy for such gridlocks when operating with land based IUs, which may require all PUs to request permission to perform auto gridlock with a pseudo GRU or allow IUs to perform auto gridlock with a designated pseudo GRU as required to maintain gridlock. The FTC/TDC must also be kept advised if land-based IUs insert a site registration or SCC position correction and may direct that this land-based IU not be used. The procedure is the same as described in Tables C3-13 and C3-14 except that the pseudo GRU takes no action and the gridlocking PU ensures that at least one mutual track is held with the pseudo GRU with a remote TQ of 3 or greater. The procedure is also applicable using a surface IU as the pseudo GRU, but is not as desirable as using a land-based IU.

C3.2.15.4 Gridlock Procedure with Both Land-Based and Surface GRUs. Another method of gridlocking when operating with land-based PUs combines individual gridlock with a land-based PU and gridlock among surface PUs. This is accomplished as follows:

a. There must be mutual tracks. The pseudo GRU must have R^2 for some mutual tracks with a TQ of 3 or greater.

b. Initially, an afloat GRU performs gridlock (automatic or manual) on mutually held tracks reported by a land-based pseudo GRU. On completion, the afloat GRU allows calculated gridlock pads to remain and initiates gridlock with afloat PUs without a program entry designating own unit as GRU, because such program designation will clear computed pads. (This method may be desirable if the afloat GRU does not want own unit navigation data changed.)

c. Alternatively, after gridlocking with a land-based pseudo GRU, the afloat GRU can reposition own unit by pads that will result in a clearing of pads and then initiate the gridlock process with other surface IUs with own unit designated as GRU. (This method may be desirable if GRU wants its navigation data modified by the values of gridlock pads.)

Table C3-13. Automatic Gridlock Procedure

Step	Condition	Action
1	Stand by	FTC/TDC: Inform all PUs to stand by for auto gridlock on the TSN, specify GRU. GRU: (1) Ensure own-ship tracking all tracks for which local video is held. (2) Take close control of own-ship symbol.
2	Initiate	GRU: Initiate auto gridlock function. This results in all tracks with a TQ of 3 or greater that are held by GRU to be output on the link, regardless of reporting responsibility. PUs: Hook GRU and make entry to initiate auto gridlock procedures at own unit. This action initiates automatic calculation of the difference of position of all tracks held mutually by the PU and the GRU. The differences are averaged and the result is applied to the gridlock pads. In addition to the latitude and longitude pads associated with manual gridlock, the automatic gridlock applies an azimuth pad in the event a radar azimuth error exists. After 5 minutes, the automatic gridlock calculations cease.
3	Terminate	GRU: (1) Terminate auto gridlock function at own unit. (2) Inform FTC/TDC that auto gridlock is terminated. NOTE: Auto gridlock function by the GRU is not automatically terminated by the program after 5 minutes. This may result in continuous R^2 shifts of the GRU tracks if the function is not terminated at the GRU. FTC/TDC: (1) Verify results of auto gridlock. (2) Direct PUs not capable of auto gridlock to conduct manual gridlock procedures. (3) Direct E-2C to initiate unique auto gridlock procedures.

C3.2.16 Adjustment of Navigation Position. In each system design there is a relationship between the alignment of the geographical position of the DLRP and that of the unit and the tracks that unit is reporting. This may be handled differently in individual systems. In some systems, updating of the unit's navigational position or the DLRP may cause the positions of reported tracks to jump and result in breaks in gridlock and subsequent track decorrelations. It is normally more important to retain gridlock than to insist on updating the system geographical position, and units should carry out such changes as long as they do not affect gridlock. This is clearly particularly important for the GRU. FTC/TDC or FTC-A is to ensure that units that cause registration problems are de-activated on the link and can only re-enter the net once their alignment has been performed.

Table C3-14. Surface PU Automatic Gridlock Procedure

Step	Condition	Action
1	GRU initiate Auto gridlock	GRU: (1) Ensure track symbols are on video returns. (2) Take close control of own-ship symbol. (3) Enter automatic gridlock function using appropriate System Operator's Manual (SOM). NOTE: This sets own-ship gridlock pads to zero and causes all tracks with TQ of 3 or greater to be reported on the interface each time the GRU is interrogated. (4) Inform all PUs on TSN that automatic gridlock is initiated.
2	Units initiate	PUs: (1) Hook IU designated as GRU. (2) Enter automatic gridlock function using appropriate SOM for system. NOTE: Mutual tracks being used for gridlock calculations are accompanied with a pointer symbol on the PPI. Calculations on received tracks from the GRU are performed for 5 minutes, then terminated automatically.
3	Verify gridlock	PUs: (1) Verify results of gridlock at own unit. (2) Report results of gridlock to FTC/TDC on the TSN. FTC/TDC: Verify gridlock results. If gridlock is not successful, request automatic gridlock be reinitiated by all PUs. If gridlock is successful, order GRU to terminate automatic gridlock function of own unit.

C4. Link 11 Problem Identification and Resolution

C4.1 General

a. This section contains information concerning Link 11 problems, including methodology for identification, isolation, and resolution of problems. It also provides maintenance procedures to isolate and correct problems. A primary cause of poor Link 11 operations is the failure to rapidly identify link problems and resolve them. A problem at the DNCS may appear as a problem on other units (i.e., frequency propagation or self-jamming can result in partial link failures, or DTS hardware problems may effect some units and not others.)

b. This section presents two of the three methods of identifying Link 11 problems:

(1) Analyzing Link 11 RQ data.

(2) Monitoring DTS indicators.

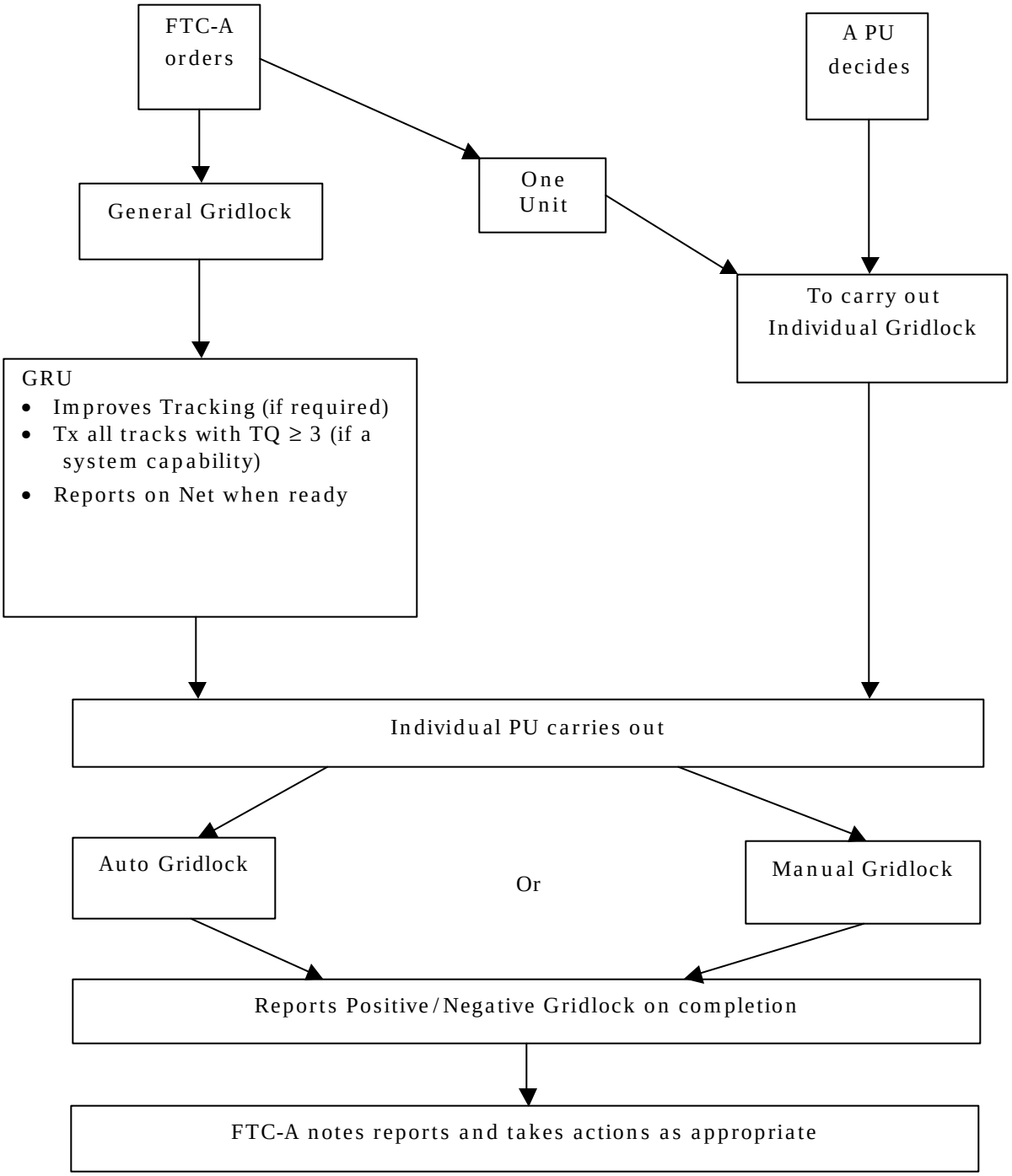

Figure C-6. Summary of Gridlock Procedure

(3) Using built-in or integral test equipment functionality (e.g., LMS-11). The procedures involved in the use of this equipment vary with the capabilities of the systems fitted. The operator should consult the appropriate SOMs to determine the proper use of the equipment.

NOTE: It also provides alternatives for resolution of the problems identified and discusses the use of Net Test and the POFA for either verification of equipment operation or problem identification. Due to the multiplicity of equipment and platforms, problem identification is limited to functions (i.e., Receive, Transmit, Sync, DTS Addressing, Frequency Propagation) and not to specific equipment.

c. When a problem is identified at a single PU, that PU should be removed from the link to ensure its data does not disrupt the remainder of the link. When a problem is identified that effects the total link (i.e., frequency problem, jamming), the problem must be resolved and actions taken to maintain an effective Link. The Link 11/11B Manager has the responsibility for monitoring and analyzing Link 11 communications. In addition, each PU has the responsibility to continually monitor its own DTS and communications equipment and the received and calculated Link 11 RQ data as exchanged on Link 11.

C4.2 Link 11 Monitoring and Analysis. Procedures for use of the Link 11 RQ data monitoring are presented herein. Additional monitoring and analysis procedure are presented to assist the operator in diagnosing link communications problems for those platforms that do not have access to complete Link 11 RQ data, and to aid all PUs in diagnosing equipment problems.

C4.2.1 Link 11 RQ Performance Parameters. Some PUs are capable of calculating, transmitting, receiving, and displaying information regarding the quality of Link 11 communications. The Link 11 Monitor message is used to report locally calculated values of link performance parameters. The Timing message provides a transmit counter that is used as one input in calculating link RQ. The Link 11 communications performance parameters, reported in the Link 11 Monitor message, are NCT and RQ.

C4.2.1.1 Net Cycle Time. NCT is calculated by each PU and is reported every net cycle. The value of NCT reported and displayed to the operator represents the average value of the last eight net cycles. NCT is the time required for one net cycle as measured from the receipt of a prepare-to-transmit interrupt by the TDS program to the receipt of the next prepare-to-transmit interrupt. NCT is a function of the number of PUs in the link, the amount of data being

transmitted, and the quality of the communication paths between the DNCS and the PUs. Control of one or more of the following contributing factors that tend to increase NCT beyond acceptable limits for real-time tactical data transfer should be exercised.

a. Number of PUs. NCT increases with the number of PUs independent of the individual track load of each PU. Each PU transmits certain basic data when interrogated to maintain link integrity. The time consumed in exchanging the above information increases as each additional PU is added to the link.

b. Tactical Data Load. The time required to transmit tactical data, including system tracks, system status data, and tactical management data contributes to the NCT.

c. Communications Quality. The normal Roll Call method of Link 11 communication control includes a DNCS that calls each picket station and waits for the PU's data transmission. If a PU does not answer the first call, DNCS calls that PU a second time prior to calling the next PU. In an ideal RF transmission environment, PUs receive every call from the DNCS and respond with a data transmission. However, some PUs' hardware might not be properly maintained, set up, or aligned; propagation conditions may be less than optimum; noise and co-channel interference from other communication systems are often present. All these conditions combine to limit Link 11 communications quality. A degraded RF transmission environment often results in PUs missing their calls from the DNCS. Degraded communication results in data loss, confusion, poor reception quality, duplicate track numbers, dual designations, and increased NCT.

C4.2.1.2 Reception Quality. RQ is displayed as a numerical value of 0 through 7. It represents the quality of link communications from each PU in the link upon reception of each data report from the PU. The RQ displayed to the operator and reported in the Link 11 Monitor message is the average RQ for the measurement period. For this purpose, the measurement period is equivalent to reception of eight separate transmissions from the PU for which RQ is computed. RQ values are calculated for one-way (transmit to receive) communications paths in Link 11 and are a function of both the quality and completeness of the received data as determined by the operational program of the receiving PU. RQ may be less than optimum for a transmit to receive path because:

a. Data received from the transmitting PU contained parity errors.

b. Complete data transmissions from the transmitting PU were discarded because a valid SCC was not received from the PU at the beginning of the transmission.

c. Data received from the transmitting PU contained 11 sequential frames with bad parity in a single Link 11 data report. When this occurs all receive processing ceases until receipt by the TDS program of the next valid external interrupt from the DTS.

d. Data transmissions are lost due to missed start codes.

C4.2.2 Procedures for Use of Link 11 RQ Data. As described in paragraph C3.2.12.3, the Link 11 monitor capabilities of platforms vary, depending on the degree of implementation of the Link 11 RQ data monitor feature. The following procedures are fully applicable to platforms that fully implement the feature and to a lesser extent in other platforms.

C4.2.2.1 Analysis of Link RQ Data

C4.2.2.1.1 Introduction. Each PU is responsible for analyzing its own Link 11 communications performance. The primary responsibility for analyzing the communications performance of the whole link rests with the Link 11/11B Manager. The Link 11/11B Manager should coordinate with the FTC/TDC to resolve problems that involve propagation and tracking difficulties. Tables C4-1 and C4-2 contain the characteristic NCT and RQ value patterns expected when specific conditions exist in the Link 11 communications environment. Possible corrective actions are included for each problem area. Table C4-1 lists probable indications for various Link 11 or PU communications conditions. Table C4-2 lists indications, probable causes, and corrective actions for typical communication problems.

C4.2.2.1.2 Assumptions and Generalizations. Analysis of communications performance using Link 11 RQ data is based on the below assumptions and generalizations. The notation, PU_i, is used to denote a specific PU that may be assigned any TN.

a. If PU_i receives acceptable data from the majority of PUs, the receive function at PU_i is assumed to be good.

b. If PU_i transmits data that is received satisfactorily by the majority of PUs, the transmit function at PU_i is assumed to be good.

c. If PU_i does not receive acceptable data from a PU with a proven good transmit function (as in subparagraph b. above), the receive function at PU_i is suspect.

d. If a PU_i transmits data that is not received satisfactorily by a PU with a proven good receive function (as in subparagraph a. above), the transmit function PU_i is suspect.

e. If PU_i does not receive acceptable data from the majority of PUs with proven good transmit function (as in subparagraph b. above), the receive function at PU_i is assumed to be bad.

f. If PU_i transmits data that is not received satisfactorily by the majority of PUs with a proven good receive function (as in subparagraph a. above), the transmit function at PU_i is assumed to be bad.

g. If a majority of PUs are not receiving acceptable data from most other PUs, an abnormal communications environment is assumed to be the cause.

h. If a PU or group of PUs in a geographical or operational environment significantly different from the majority of PUs experience problems with either the transmit function or the receive function, the unique environmental factors are suspect.

i. If the NCT value calculated by a PU is significantly larger than the link average NCT value, the receive function at that PU is suspect.

j. If the NCT value calculated by the DNCS is long, the link is assumed to be approaching or beyond the acceptable limits of real-time data transfer required for tactical use.

k. Monitoring of NCT assumes that every unit is only addressed once in each net cycle. If any unit is addressed more often than once per net cycle, then the NCT reported by that unit will be shorter than that reported by other units. The difference in NCT will depend on how many times the unit is addressed in relation to the other units. Additionally, if a unit is addressed more than once per net cycle, it may report different NCTs depending on the number of units between its calls.

Table C4-1. Link 11 Monitor Data Indications of Communications Status

Link or Station Communications Status	Link Monitor Data Probable Indications
1. GOOD receive function at PU_i.	RQ values calculated by PU_i for the majority of PUs are > 5 and NCT value calculated by PU_i is approximately the same as other PUs reported NCT.
2. GOOD transmit function at PU_i.	RQ values calculated by the majority of PUs for PU_i are > 5.
3. BAD receive function at PU_i.	RQ values calculated by PU_i for the majority of PUs are < 6 and/or NCT value calculated by PU_i is long (approximately twice as long as other PUs reported NCT).
4. BAD transmit function at PU_i.	RQ values calculated by the majority of PUs for PU_i are < 6.
5. GOOD link communications status (effective data transfer in near-real-time).	Majority of RQ values calculated by PUs are > 5 and majority of NCTs calculated by PUs are approximately the same.
6. BAD link communications status (excessive time required to update and to communicate initial data. Excessive parity errors and lost data missed interrogations).	Majority of RQ values calculated by PUs and/or majority of NCT values calculated by PUs are < 6.

Table C4-2. Analysis of Link Monitor Data

Conditions	Probable Cause	Corrective Action
1. All RQ values calculated by PU_i are < 5 and/or NCT value calculated by PU_i is long.	Defective receive function at PU_i.	Troubleshoot and correct problem in receive function at PU_i.
2. RQ values calculated by all PUs for PU_i are < 5.	Defective transmit function at PU_i.	Troubleshoot and correct problem in the transmit function at PU_i.
3. RQ values calculated by PU_i and RQ values calculated by all net PUs for PU_i are < 5 and NCT value calculated by PU_i is long.	Defective DTS at PU_i involving both the receive and transmit functions. and/or Long transmission paths due to geographical position of PU_i relative to other link stations.	PU_i troubleshoot and correct problem in DTS. Link 11/11B Manager should consider: a. If operating link in UHF spectrum, moving link operation to the HF spectrum. b. Changing DNCS to obtain better geographic coverage.
4. PUs on periphery of link geographical configuration are experiencing low RQ values on both transmit and receive paths for most PUs.	Long transmission paths due to operational unit geographic positioning. If operating at UHF, transmission distances exceed line-of-sight. Excessive signal attenuation with distance due to abnormal propagation conditions.	FTC/TDC should request that PUs on periphery be assigned unique TN block to ensure duplicate track numbers are not originated because of missed initial track reports. Link 11/11B Manager should consider changing frequency from UHF to HF, thereby increasing effective transmission range for surface PUs. Link 11/11B Manager should consider changing from HF to UHF or UHF to HF.

Table C4-2. Analysis of Link Monitor Data (Continued)

Conditions	Probable Cause	Corrective Action
5. Majority of PUs are experiencing low RQ values for both transmit and receive. Average NCT value calculated by PUs is long.	Abnormal propagation conditions.	FTC/TDC should consider changing from HF to UHF or UHF to HF.
	RF interference.	Link 11/11B Manager should: a. Attempt to identify interfering signal and relocate or silence it if feasible. b. Relocate link frequency to a clear channel.
	Jamming	Link 11/11B Manager should: a. Consider changing link frequency within operating spectrum (HF or UHF). b. Consider changing link operation from HF to UHF or UHF to HF.
6. Average NCT value calculated by PUs is long, causing loss of real-time tactical data transfer	Large number of PUs operating in the link.	FTC/TDC and Link 11/11B Manager coordinate to deselect low priority PUs from interrogations, thereby placing them in Radio Silence mode.
	Excessive tactical data load.	FTC/TDC consider: a. Ordering activation of selected data filters. b. Ordering low priority tracks to be dropped. c. Establishing a second independent Link 11.
	Abnormal communications environment causing missed interrogations.	Link 11/11B Manager consider: a. Changing frequency within current band if interfering signal is present that cannot be eliminated. b. Changing frequency HF to UHF or UHF to HF.
	DNCS has bad receive or transmit function, resulting in missed interrogations by other PUs.	Link 11/11B Manager change DNCS.

C4.2.3 Post Operations Analysis. Analysis conducted after completion of operations will benefit from the availability of data derived from Data Extraction (DX). The DX functions for TDSs may provide for the extraction of Link 11 messages transmitted and received by own unit as well as all Link 11 DTS interrupts processed by the Link 11 program module. Link 11 communications analysis in the post operations timeframe is concerned with a chronological reconstruction of link communications performance. NCT and RQ values can be plotted as a function of IU TN and time. Attempts should be made to isolate PUs with abnormal performance. The following factors common to groups of PUs should be considered:

a. Common DTS equipment.

b. Common program class.

c. Distance from the DNCS.

d. Platform-unique software.

e. Platform-unique hardware.

C4.3 Responsibilities for Link 11 Problem Determination. The DNCS has the responsibility for assisting the Link 11/11B Manager in monitoring and analyzing Link 11. DNCS is the only PU in the link with the capability to accurately determine the quality of the communications with each PU. The address control indicators of the DTS, which are active only at the DNCS, provide a unique analysis capability. The ability to determine which picket is transmitting during a certain time period allows the DNCS to evaluate the quality of that picket's communications. The DNCS is capable of determining the number of code errors received from a specific picket. With sufficient practice an operator may also determine the sync signal and receive data quality from any of the pickets. An important link diagnostic capability of the DNCS is the ability to determine the percent of the time that the picket answers the call up messages. This unique analysis capability places still further responsibility on the DNCS. It requires the DNCS personnel to know, at all times, that the station equipment is fully operational. A DNCS shall not at any time to try to analyze the quality of the Link 11 when its own equipment is in a degraded mode operational status. The DNCS shall monitor the link performance by following the Link 11 analysis procedure detailed in Figure C-7.

C4.3.1 Link 11 Analysis Procedure

C4.3.1.1 Step-by-Step Procedure

a. This seven-step procedure is used to determine the quality of communications from each PU. The analysis procedure evaluates the performance of Link 11. This analysis procedure is based on all Link 11 equipment operating satisfactorily and is accomplished by developing a seven digit number as determined by the result of each step of the procedure and comparing the number with the causes and possible solutions described below.

b. The Link 11 analysis chart in Figure C-7 displays a pictorial view of the procedure steps. The number is developed by entering 0,1,2,3 as appropriate in the designated block of the DNCS analysis table (see figure C-8). There may be more than one probable cause and possible solution. This procedure reduces the possible solutions to the point that the correct one may readily be found by trial and error. With a little experience, the operator will be able to proceed directly to the correct solution.

c. The starting point of this procedure is the determination of the RQ values of the PU to be evaluated and the PU's reported RQ value of own unit. An RQ value of 6 or 7 is an indication that link communications with that PU are good and no further checking is required.

(1) Step one of the procedure determines the percentage of call-up message answered by each IU. This is a direct measure of the radio circuit quality. If by monitoring the station call indicator of the DTS for several cycles, it is determined that the PU is responding to at least 9 out of 10 calls, enter a 1 in block one. If the picket responds to less than 9 out of 10 calls, enter a zero in block one.

(2) Step two determines if the control codes and data frames have errors. This information is derived from observing the RECEIVE BAD DATA and CODE ERROR or CHANNELS ERROR indicators located on the DTS immediately after the interrogation of the PU. Step two is also used to determine if code errors from the PU are random in nature or adhere to a fixed pattern. This is determined by observing, if capable, the channel error indicators of the DTS or its remote control unit. If there are no received code errors, enter a zero in block one. If the received code errors appear in a fixed pattern, enter 1 in block two. If the received code errors appear random, enter a 2 in block two. The presence of a specific pattern of code errors indicates that modulated interference is present or an equipment failure has occurred. Equipment failure recognition will be considered in another section. Because

link analysis with defective equipment is very difficult, the link analysis must be performed assuming all equipment works.

(3) Step three determines if the sync signal is being received from the PU. The sync tone during the transmission of the preamble is 6 dB higher than a data tone. If the sync signal cannot be detected from the PU being analyzed, the receive HF signal is very weak. Equipment problems may also be involved. If a sync signal is being received as indicated on DTS, enter a 1 in block three. If a sync signal is not being received, enter a 2 in block three.

(4) Step four determines the range to the PU being analyzed with respect to the range to other PUs with good Link 11 communications. This information is obtained using the display consoles. At this time it is also advisable to check the local weather conditions around the PU whose communication path is being studied. If the distance to the PU in question is greater (30 miles or more) than the distance to the furthest PU with good communications, enter a 1 in block four. If the distance to the PU under investigation is less than the most distant picket with good communications, enter a 2 in block four. If the radar indicates locally heavy weather in the area of the PU's reported position, enter 3 in block four. (This is not shown in Figure C-7 due to low probability of occurrence.)

(5) Step five monitors the data channel audio to determine if interference is present and its seriousness. This is accomplished at either the DTS or its remote control (e.g., for USQ-29/36/74/76) or in coordination with Radio Central (e.g., for USQ-59/63). Weak local interference may mark the signal from a PU operating close to the system range limits. If modulated interfering signals are heard whose signal strength is equivalent to or greater than that of the PU, enter a 1 in block five. If only background noise is present, enter a 2 in block five. Additional aid may be obtained in evaluating the level of interference with the use of a signal analyzer or other test equipment to monitor the data tones.

(6) Step six is coordinated analysis with the PU having communications problems. This step determines if interference that cannot be detected at the DNCS is present at the PU. The PU monitors Link 11 on request and reports any interference conditions. The PU also supplies weather, equipment status, and any other information requested by the DNCS. If the PU reports interference, enter 1 in block six. If the PU reports clear, place a 2 in block six.

(7) Step seven, the final step, is to repeat the procedure for any other PUs with less than 90 percent received call-up replies. If the analysis of

the remaining PUs reporting Link 11 communication difficulties is complete, place the number of PUs with similar analysis in the number block reserved for step seven. If analysis is not complete, start with step one for the next PU to be analyzed.

C4.3.1.2 Link 11 Analysis Procedure Evaluation. This paragraph contains selected numerical patterns that can be used to compare against those obtained in the seven-step procedure. It also provides the possible conditions, if any, that caused problems and recommended resolutions of the problems for the selected numerical patterns. All the numerical patterns possible are not discussed, as they are too specific for general link analysis.

a. 1000000: This is a computer program problem. The DTS has good communications with the picket.

(1) The DNCS should verify that the PU Address was entered into the computer via the communications keyset, if required. This may be done by deleting the PU Address for the program and re-entering it. Check that the link is enabled.

(2) Request all PUs ensure their program does not have a radio silence function entered or IU filter active. Check that Link 11 is enabled and that own PU Address and DLRP are entered.

b. 011111X, 011112X, 011121X, 021111X, 021112X, 021121X: These numbers are indicative of conditions caused by modulated RFI. The numbers located in blocks five and six indicate the location of the interference. If block five value is 1, the interference is near the DNCS. If block six value is 2, the interference is near the PU. If both block five and six values are 1, interference is present at both stations. The PU with weak communications is at a greater range than other PUs with good communications. The following actions are recommended for use under the conditions represented by the above numbers.

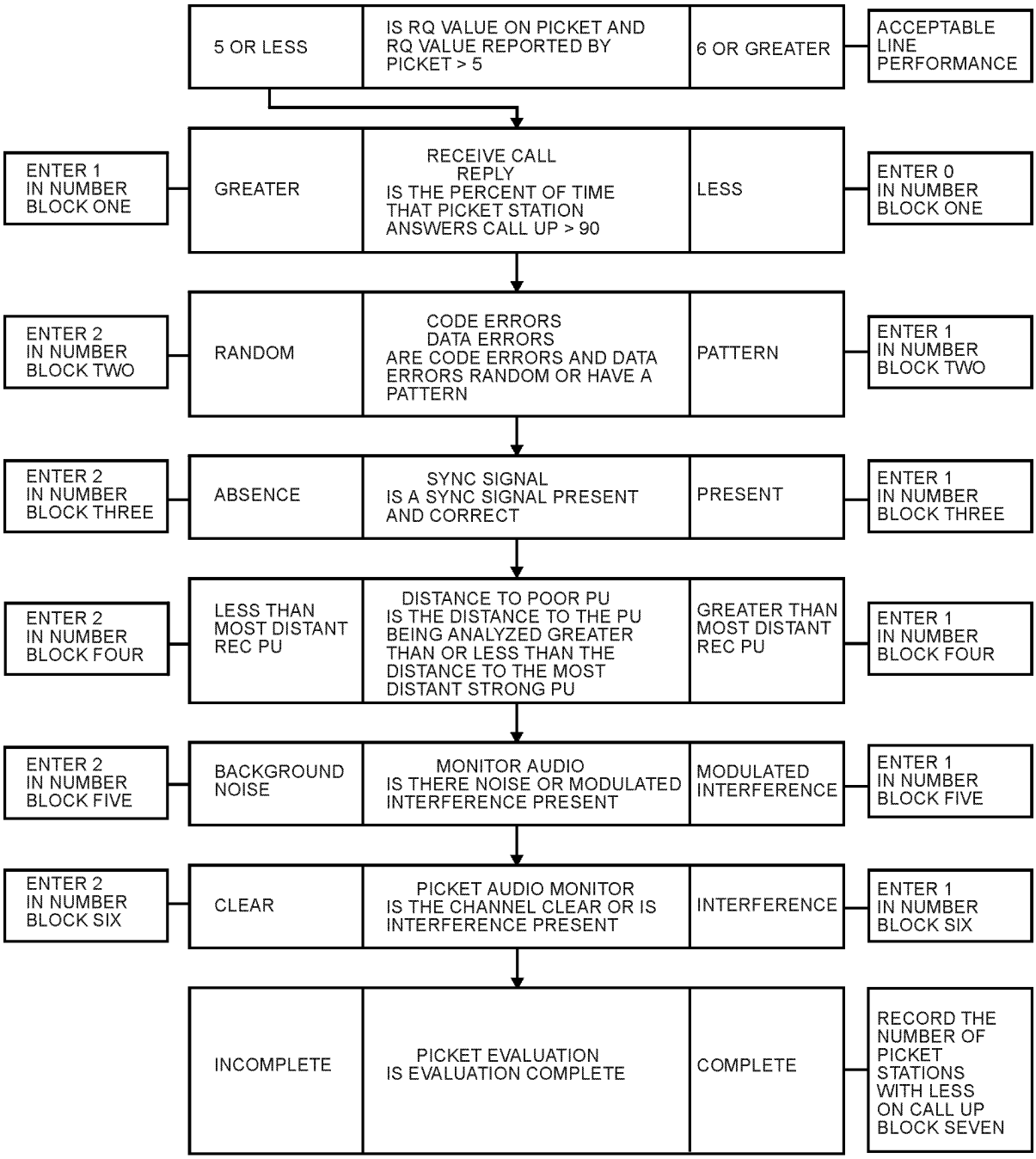

Figure C-7. Link 11 Analysis Procedure Chart

Type of Check	% Call Up	Code Error	Sync	Range	Audio Tones	Picket	Number of Pickets	
BLOCK	1	2	3	4	5	6	7	COMMENTS
PU ___								
PU ___								
PU ___								
PU ___								
PU ___								

Figure C-8. DNCS Analysis Table

(1) Locate interference if at own unit and remove it. The PU should do the same if the interference is being generated by own unit.

(2) If X is greater than 30 percent of the total PUs, frequency change procedure should be initiated.

(3) If X is less than 30 percent of the total PUs and if the PUs are in the same direction, change the location of the DNCS to decrease the distance between the DNCS and those PUs.

c. 021122X, 022122X: This indicates generally poor atmospheric conditions, or the PUs are on the fringes of the operating limits. The atmospheric conditions may change in a matter of hours, but tactical conditions will generally require that corrective action be taken.

(1) The DNCS and PU should use maximum power output. The atmospheric condition that decreases the effective range may also cause antenna inter-modulation. If Link 11 seems to interfere with all the ship's HF

communications following a power increase, lower the power, and perform step b.

(2) The DNCS when directed by the Link 11/11B Manager should start the change of frequency procedure. Use this only if more than 30 percent of the PUs are involved or communications with that PU are ordered.

(3) The location of the DNCS should be changed to reduce the distance from DNCS to the PUs having difficulty. This action should not be used when more than 30 percent of the PUs are involved.

d. 0X2XXXX: Any number with 2 in block three indicates the failure to receive a sync signal from that PU. Most likely the PU is also not receiving a sync signal from the DNCS. The PU should be instructed to change receive timing to stored (normal at the DNCS). The station must maintain a correct range setting. This syncs the PU's receiver to the DNCS's transmitter. This improves the communications between DNCS and the PU, but the PU might not receive all the other PUs' transmissions.

e. 0XX2XXX: Any PU or PUs whose analysis results with a 2 in block four are experiencing skip or ducting. This is a condition in which the radio signal skips over the receiving station. With a surface wave system, such as used on Link 11, this is quite rare. If more than one PU is involved, they should be approximately the same distance from the DNCS.

(1) The Link 11/11B Manager should take steps to lower the radio frequency. The procedure for change of frequency should be used.

(2) Location of DNCS should be changed to either increase or decrease the distance to the PU.

C4.3.2 <u>DNCS Equipment Monitor and Fault Location Procedure</u>. The DNCS equipment monitor and fault location procedure provides the equipment operator guidelines to follow in determining the satisfactory performance of the Link 11 equipment. This procedure is not designed to replace regularly scheduled maintenance, but provides equipment operators the knowledge that the Link 11 equipment is operating correctly. Knowledge of satisfactory equipment performance permits more meaningful decision regarding link communications. The procedure consists of eight checks (see Figure C-9). Each check contains the purpose of the check and directs either an action or the next step to be performed. The equipment monitoring checks are provided in paragraph C4.3.2.1. The actions required as a result in paragraph C4.3.2.2. If the operator completes all checks without being directed to an action block,

the equipment is considered to be operating. If the indications show an equipment failure, the malfunction must be located and corrected. The DNCS operator must know very quickly following an equipment failure which equipment is down and be prepared to change DNCS, if warranted. The Link 11/11B Manager is responsible for monitoring the operation of the Link 11 equipment. The Link 11/11B Manager informs the FTC/TDC that a PU is not functioning properly. The TDS is informed of any change in PU status, which may degrade the tactical picture or require a link configuration change.

C4.3.2.1 Equipment Monitoring Checks. The following eight checks provide for a determination as to the status of the DNCS equipment.

a. Check 1. Verify address control-indicator sequence to each enabled address. This is to determine if the DTS address sequencing equipment is functioning. If the station call indication of the first enabled address comes on and then either goes out or stays on, the equipment has called one picket station. The station call indication of the second enabled address should then be illuminated and either go out or remain on, depending on whether the picket answers. The third, fourth, fifth, sixth, and all the other addresses that are enabled should follow the same pattern. Not all station call indicators will extinguish. If many PUs do not answer, press equipment reset, wait 10 seconds and press TRANSMIT START. Equipment reset clears all station call indicators and when TRANSMIT START is pressed, you will see the sequence. If the sequence is correct, perform check two; if not, complete action 1.

b. Check 2. Monitor the transmit indicator. The indicator should light at least once for each enabled address. The indicator may light twice on some addresses. These addresses do not answer the first call-up message. The DNCS DTS calls a given address. If the address does not reply, the DNCS calls this address again. These are the two transmissions indicated. The DNCS does not call a third time, but rather moves on and calls the next PU whose address is enabled. If the transmit indicator lights, perform check 3; if not, complete action 2.

c. Check 3. Monitor the transmit error indicator. The transmit error indicator should not be lit during any transmission. This is an indication of either a radio or DTS problem. If the transmit error light does not illuminate, perform check 4; if not, compete action 3 that will further isolate the problem.

d. Check 4. Monitor the sync error indicator during transmit. A sync error indicator is not available on all DTSs. The sync error indicator should not be lit during either transmit or receive cycles. If the indicator does not light or lights only upon receipt from one or two PUs, perform check 5 for own

system and have other PUs monitor sync signals of PUs for which bad sync was received if the sync error indicator during transmit or for a majority of receive cycles, complete action 4.

e. Check 5. Monitor receive indicator when the receive indicator is lit, it indicates that a start code was received from another PU (this verifies DTS detection and code recognition). The receive indicator should light after each transmit cycle by own unit, except for missed interrogations by the PU. If the receive indicator lights after the transmit indicator 90 percent of the time, perform check 6, if not, complete action 5.

f. Check 6. Monitor receive errors. Most DTSs can indicate code errors and receive errors independently. This verifies both the code recognition and receive circuits of the DTS. If the error light does not light, perform check 7, if not, complete action 6, which will further identify the problem.

g. Check 7. Monitor local/remote tracks. Request operators verify local and remote tracks are being updated and RQ of PUs are greater than 5. This verifies the program receive function and DTS to computer interface through the crypto device. If tracks are being updated, perform check 8; if not, complete action 7.

h. Check 8. PU monitor DNCS reported tracks. Request a PU to monitor for receipt of any DNCS reported tracks. If PU reports receipt of tracks, checks are complete and system is operating normal; if not, perform action 8.

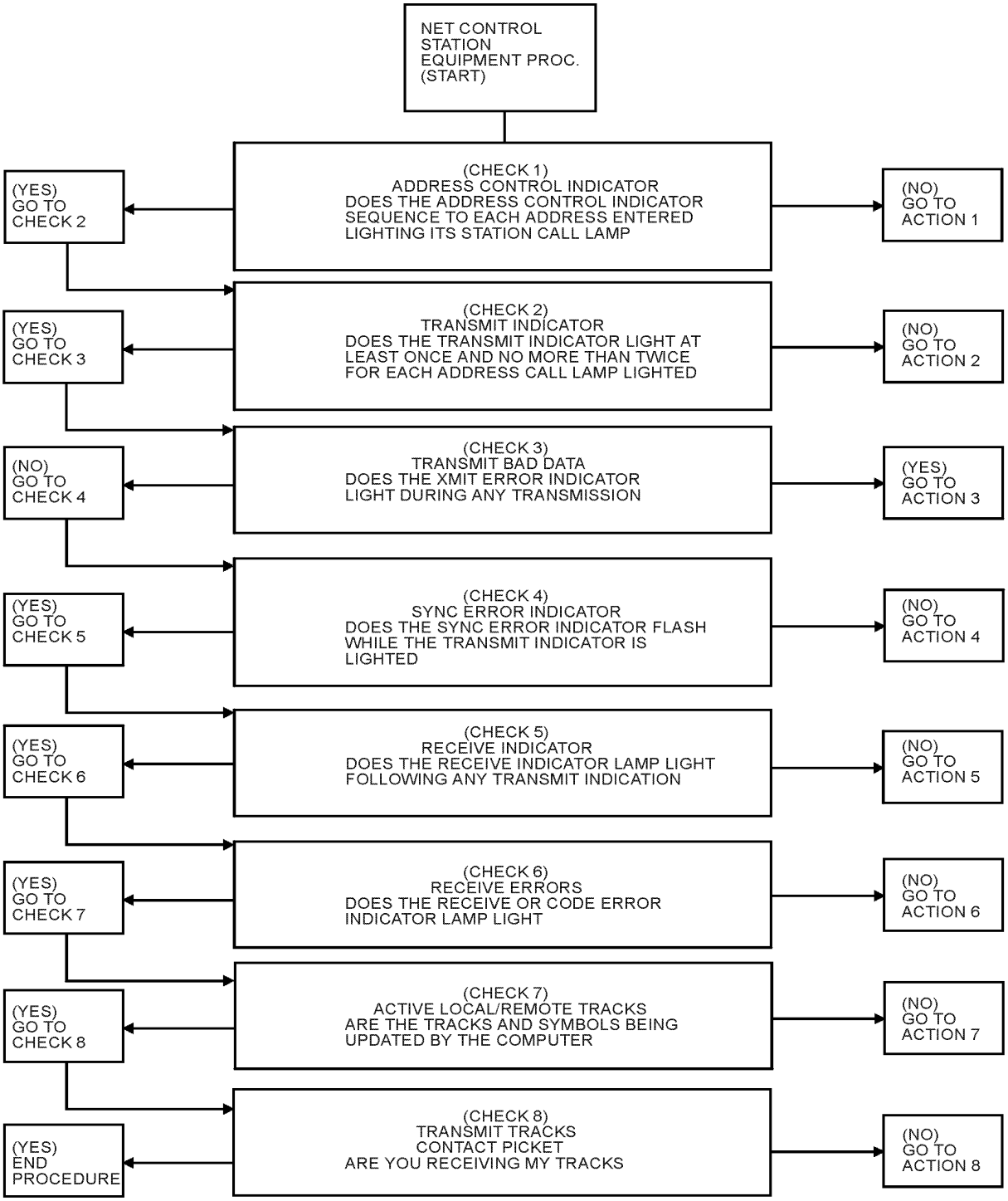

Figure C-9. DNCS Equipment Monitoring and Fault Location Procedure

C4.3.2.2 Actions Required As a Result of Checks. The following actions relate to the checks performed in the preceding paragraph.

a. Action 1. The first action that should be taken, following recognition that the address control-indicators are not sequencing, is to determine if a single address sequence problem or a multiple address sequence problem exists. If it is a single address problem, enter the address in another sequence position and enable the address. If problem still exists:

(1) Inform Link 11/11B Manager.

(2) Change DNCS to another PU.

(3) Remain in picket/Roll Call mode.

(4) Repair equipment at first available time.

b. Action 2. If Transmit function of DTS has problems:

(1) Inform Link 11/11B Manager.

(2) Change DNCS to another PU.

(3) Confer with FTC/TDC as to whether PU should remain in link in Radio Silence or take DTS down for repair.

c. Action 3. The transmit function or the radio transmitter has a problem. By monitoring the audio tones, it can be determined if the problem is at the DTS or radio. Some DTS (e.g., USQ-74/USQ-78) can monitor the audio at the control panels, while others (e.g., USQ-63) need to be monitored at the radio equipment. The audio being monitored is the transmitter side tone. If the data tones are weak the radio is faulty. If the data tones are loud and an interfering signal is also present, the interference must be isolated. If the data tones are loud and no interfering signal is present, the DTS is faulty and must be repaired:

(1) Inform Link 11/11B Manager.

(2) Change DNCS to another PU.

(3) Confer with FTC/TDC as to whether PU should remain in the link in Radio Silence or troubleshoot equipment.

d. Action 4. If DTS has a sync problem:

(1) Inform Link 11/11B Manager.

(2) Change DNCS to another PU.

(3) Take immediate action to repair DTS.

e. Action 5. If Receive function of DTS has problems or radio receiver weak:

(1) Inform Link 11/11B Manager.

(2) Verify radio receiver status.

(3) Change DNCS.

(4) Take immediate action to repair receiver or DTS.

f. Action 6.

(1) If both the code error and receive error indicators are lit, the DTS has a receive problem or the radio receiver is weak:

(a) Inform Link 11/11B Manager.

(b) Verify radio receiver status.

(c) Change DNCS.

(d) Take immediate action to repair receiver or DTS.

(2) If only the receive errors are indicated, the DTS is recognizing the control codes but the data is bad. This can be caused by a bad crypto device or a bad DTS.

(a) Inform Link 11/11B Manager.

(b) Check crypto device for alarms - switch devices if possible.

(c) If crypto device is OK, DTS problem.

(d) Change DNCS.

(e) Take immediate action to repair crypto device or DTS.

g. Action 7. If local tracks are being updated and remote tracks are not, this may indicate that the DTS is receiving good data, but the crypto device is not passing valid data. If neither local nor remote tracks are being updated, the problem is a program problem. DNCS functions can still be accomplished although the PU cannot be active in the link.

(1) Inform Link 11/11B Manager.

(2) Take immediate action to recycle program or repair crypto device as appropriate.

h. Action 8. If all other checks are good and PUs fail to receive DNCS tracks, the DNCS program has a problem or the crypto device has an output problem. DNCS functions can still be accomplished although the PU cannot be active in the link.

(1) Inform Link 11/11B Manager.

(2) Take immediate action to recycle program or repair crypto device as appropriate.

C4.3.3 Picket Station Equipment Monitor and Fault Location Procedure. The picket station equipment monitor and fault location procedure is intended as a guide to assist the operator in determining that this Link 11 equipment is operating correctly. This knowledge will allow the picket station to assist the DNCS in link analysis. This also ensures that the picket station is capable of assuming DNCS at any time and without delay. This procedure consists of a series of checks that are to be completed in sequence. If a check passes, the next check is performed; if not, the indicated action is accomplished. Figure C-10 provides a pictorial sequence of the required checks. Paragraph C4.3.3.1 provides the purpose and description of each check. Paragraph C4.3.3.2 provides the actions required in the event a check does not pass. Only those checks pertaining to the DTS equipment, including crypto device, and the computer program are discussed.

C4.3.3.1 Equipment Monitoring Checks. Completion of the following checks validates the Link 11 equipment at a PU.

a. Check 1. Monitor the receive indications. If the receive indicator lights, this indicates that start codes are being recognized and data is being received by the DTS. Proceed to check 2. If the receive indicator does not light, perform action 1.

b. Check 2. Monitor the code and receive error indications. The code error indicator illuminates when code errors are detected in the received control codes. The receive error indicator illuminates whenever an error is detected in the received data. Momentary flashes of the indicators do not indicate a hardware problem at own PU, but may be the result of a single PU transmitting problem. If neither indicator lights more than 90 percent of the time or there is a not a repetitions cycle of receive error indications, proceed to check 3. If either light remains on for greater than 90 percent of the time, perform action 2.

c. Check 3. Monitor the transmit indicator. The transmit indicator is illuminated whenever the DTS is transmitting. If the transmit indicator is never illuminated, perform action 3. If the transmit indicator illuminates for short periods of time, indicating the PU is responding to interrogations, proceed to check 4.

d. Check 4. Monitor the transmit error indicator. The transmit error indicator is illuminated to indicate the transmitting of bad data. If the transmit error indicator is illuminated each time the transmit indicator is illuminated, perform action 4. If the transmit error indicator does not illuminate or flashes only momentarily between long time intervals, proceed to check 5.

e. Check 5. Monitoring of audio tones. The data signal sounds like a bell tone followed by a raspy noise. The bell tone is the synchronization phase reference and AGC signals, while the raspy noise is the data signal. This audio can be monitored at the DTS, the DTS remote or at the radio. The upper sideband and lower sideband should be monitored independently. The audio tones should be present for both transmit and receive periods. If there is no audio present or there is a background noise indicating the signal has interference, perform action 5. If clear audio is present, proceed to check 6.

f. Check 6. No longer applicable.

g. Check 7. Monitor local tracks. If local tracks are being updated, i.e., tracked, proceed to check 8. This is an indication that the program is running and not hung up. If local tracks are not being updated, complete action 7.

h. Check 8. Monitor remote tracks. If TQ of remote tracks and RQ of received PUs are high, five or more, this indicates the total receive system is operating including the receive side of the crypto equipment, proceed to check 9. If remote tracks and RQ of received PUs are low, complete action 8.

i. Check 9. Verify own PU transmissions. Request DNCS monitor for receipt of your PU and track data. If data are being received, both the transmit and receive functions of your system are operable and the check is complete. If data are not being received, perform action 9.

C4.3.3.2 Equipment Monitor Check Actions. The actions required for failures of the above checks are:

a. Action 1. Receive indicator errors. If the receive indicator light does not illuminate, this indicates that the start codes are not recognized by the DTS. Inform the Link 11/11B Manager and repair the DTS.

b. Action 2. Code and receive errors. If code error indicator illuminates or the receive and code error indicators illuminate, the DTS has a problem in recognizing control codes; the DTS is down. Inform the Link 11/11B Manager and repair the DTS.

c. Action 3. Transmit indicator errors. If the transmit indicator does not light, there is a possibility that the DNCS has not enabled the PU's TA in its DTS for interrogation. This should be verified prior to attempting to isolate the problem to the DTS by requesting DNCS check its DTS. If DNCS states that the PU is being interrogated, then the receive portion of the DTS is not recognizing own unit's address or the transmit portion of the DTS is inoperative. Inform the Link 11/11B Manager. Repair the DTS or remain in Radio Silence, depending upon tactical situation.

d. Action 4. Transmit error indications. If the transmit error indicator is lit each time the transmit indicator is illuminated, there is a possibility of the transmit function or side tone function of the DTS being inoperative, or the modulation or side tone function of the transmitter being inoperative. Inform the Link 11/11B Manager. Isolate the problem or maintain Radio Silence, depending upon tactical situation.

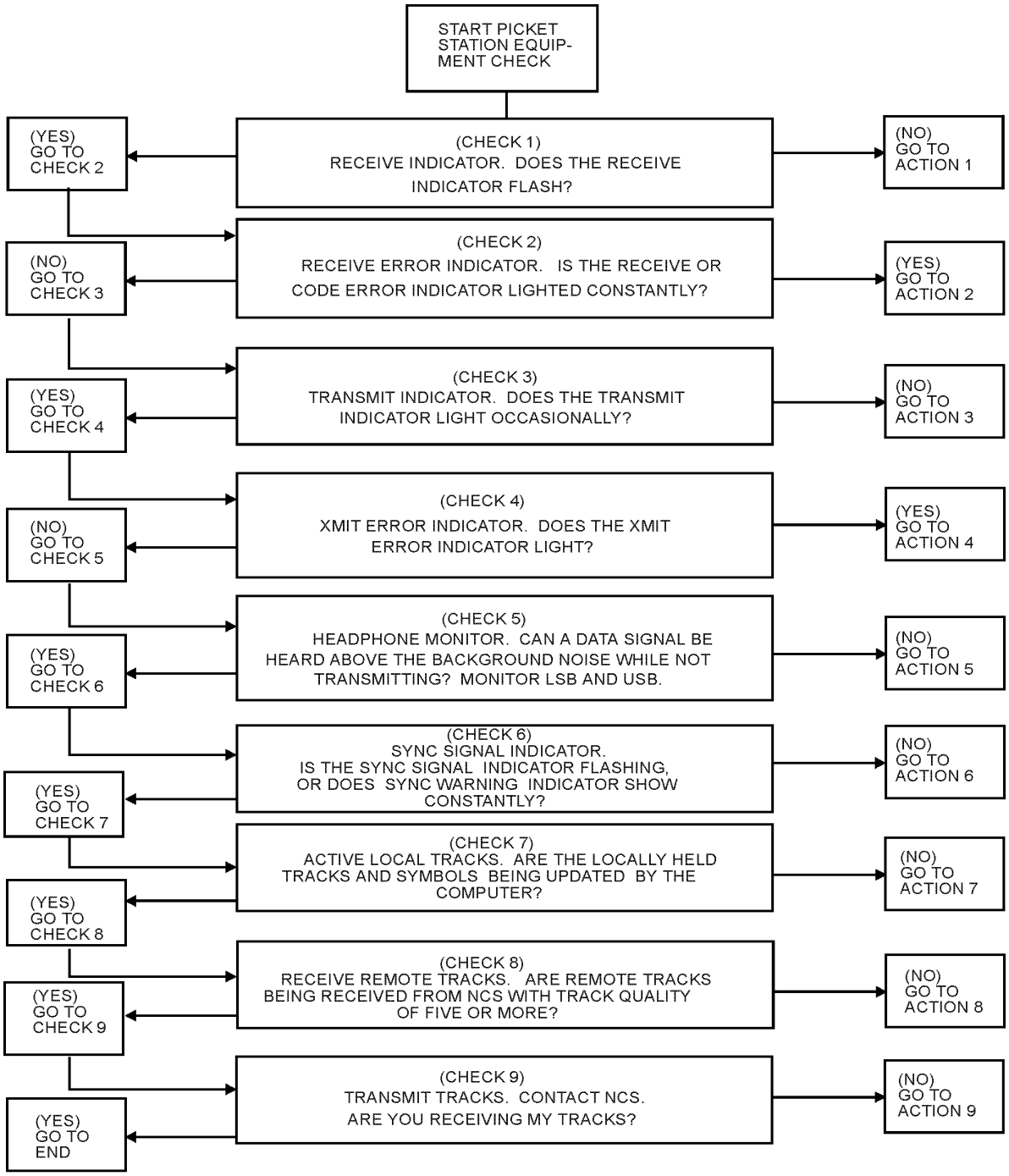

Figure C-10. Picket Station Equipment Monitoring Checks

e. Action 5. Audio tone errors. If no audio is present, the tone circuitry for both transmit and receive is bad. If audio is present during receive and not during transmit, the side tone circuitry or transmitter is bad. If audio is present during transmit and not receive, the receiver or the DTS may be bad. In all cases, inform the Link 11/11B Manager that PU is in degraded status and repair the DTS. If background noise is heard over the tones, then the presence of internal or external jamming is indicated. Isolate jamming, if internal interference and correct the problem, or determine if jamming is from external source or atmospheric condition and inform the Link 11/11B Manager and FTC/TDC.

f. Action 6. No longer applicable.

g. Action 7. Monitor local tracks. If local tracks are not being updated, this is an indication that the program is hung up. Verify program operation. If hung up, attempt restart. Inform Link 11/11B Manager and FTC/TDC if more than 60 seconds will be required for restart.

h. Action 8. Monitor remote tracks. If all other checks were satisfactory and remote tracks are not being received, either the Link 11 program function has not been initiated or the receive portion of crypto device is inoperative. Verify that the Link 11 program function is enabled. If so, have crypto device recycled. If remote tracks are still not being received, inform FTC/TDC and Link 11/11B Manager. Repair the DTS or crypto device as required.

i. Action 9. If all other checks are satisfactory and own PU is not transmitting tracks, the following conditions may exist:

(1) PU Address not entered in program (if required).

(2) Transmit function of crypto device has problems.

(3) Output of transmitter weak and the following steps should be accomplished:

(a) Verify PU Address entry in program (if required).

(b) If address entry OK, have crypto device recycled.

(c) If data still not being received by DNCS, inform FTC/TDC and Link 11/11B Manager and repair DTS, crypto device, or radio as required.

C4.4 Use of Net Test. The Net Test mode allows all PUs in the link to verify system performance from DTS to DTS by comparing data obtained from the DNCS with identical data locally generated. The Net Test signal from the DNCS consists of the normal preamble for synchronization purposes and a 21-word 30-bit word sequence. The word sequence is continually transmitted until manually reset. This mode shall not be used in an operational link. Any PU with the Net Test mode can be made the transmitting DTS. If time permits, when errors are received by PUs, it may be advantageous to restart the DNCS function through two or more stations to better isolate the cause of the errors.

C4.4.1 Net Test Analysis. At the receiving PUs, the equipment, when operating in the Net Test mode, compares the data received with known test data and, if the bit-by-bit comparison disagrees, error indications are displayed. The error indication may identify the bit(s) and tone(s) in error or give a general indication of Go/No-Go. By correlation between PUs the error can be pinpointed to either the transmitting or receiving PU. The use of Net Test mode prior to establishing the link will provide an overall indicator of Link 11 as well as equipment performance. The appropriate technical manuals for the DTSs provide detailed troubleshooting procedures using Net Test.

C4.4.2 Single Station Net Test. Net Test can be performed with a single PU and is very useful as a fault isolation tool when malfunctions occur in the modem portion of the DTS group. In a single station Net Test, the equipment is operated as DNCS. The use of Net Test forces the receive portion of the DTS to operate even though the PU is transmitting, thereby allowing the simultaneous transmission and reception of data. The transmitted test data is received via the radio sidetone path and the modem circuits compare the received data with the transmit data. Errors are displayed in the form of error lamps as described previously.

C5. Link Management Codes

a. Codes used in voice communications to manage Link technical operation are contained in Tables K-1 and K-4. Table K-1 provides Brevity Words from APP 7/MPP 7. Table K-4 provides Link Management Codes for all Links.

b. Link Management Codes Table K-4. The three-Letter Codes are to be used for brevity and clarity only. These codes are unchanging and provide no security when transmitted over clear radio circuits. Any data that require security protection are to be encrypted as specified by the Link 11 Manager or ICO.

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APPENDIX D TO ENCLOSURE A

Link 16 ESTABLISHMENT AND MAINTENANCE

D1. Introduction. This appendix contains the procedures for establishing and maintaining Link 16, and includes supporting information about JTIDS/MIDS network design. The entire comprehensive appendix applies to very few individuals. As an aid to distinguish the information of concern to specific individuals, an overview of the appendix indicating the intended audience for each subsection is provided below.

a. Section D2, "JTIDS/MIDS Network Management", provides an overview of the four stages of JTIDS/MIDS network management as an introduction to sections D3 through D6.

b. Section D3, "Network Design", provides guidance for designing JTIDS/MIDS networks prior to Link 16 operations. It is intended primarily for support facilities that design networks and produce the JTIDS Network Libraries (JNL).

c. Section D4, "Pre-mission Planning", provides criteria and procedures for selecting JTIDS/MIDS network roles and parameters and the specific JNL network to be used. It is intended primarily for Link planners, the Link 16 Manager, and unit-level operators.

d. Section D5, "Network Initiation", provides unit-level operator procedures for JTIDS/MIDS system initialization and establishing the JTIDS/MIDS network.

e. Section D6, "Network Control", provides Link 16 Manager and unit-level operator procedures for management and operation of the JTIDS/MIDS network.

f. Section D7, "Link 16 Management Codes", provides link management codes unique to Link 16 operation for use by unit-level operators during Link 16 operations.

D2. JTIDS/MIDS Network Management Process. JTIDS/MIDS network management process comprises the entire spectrum of actions and functions required to design, plan, establish, and maintain a JTIDS/MIDS network. Network management comprises four separate phases over the life cycle of a JTIDS/MIDS network (Figure D-1). These phases are:

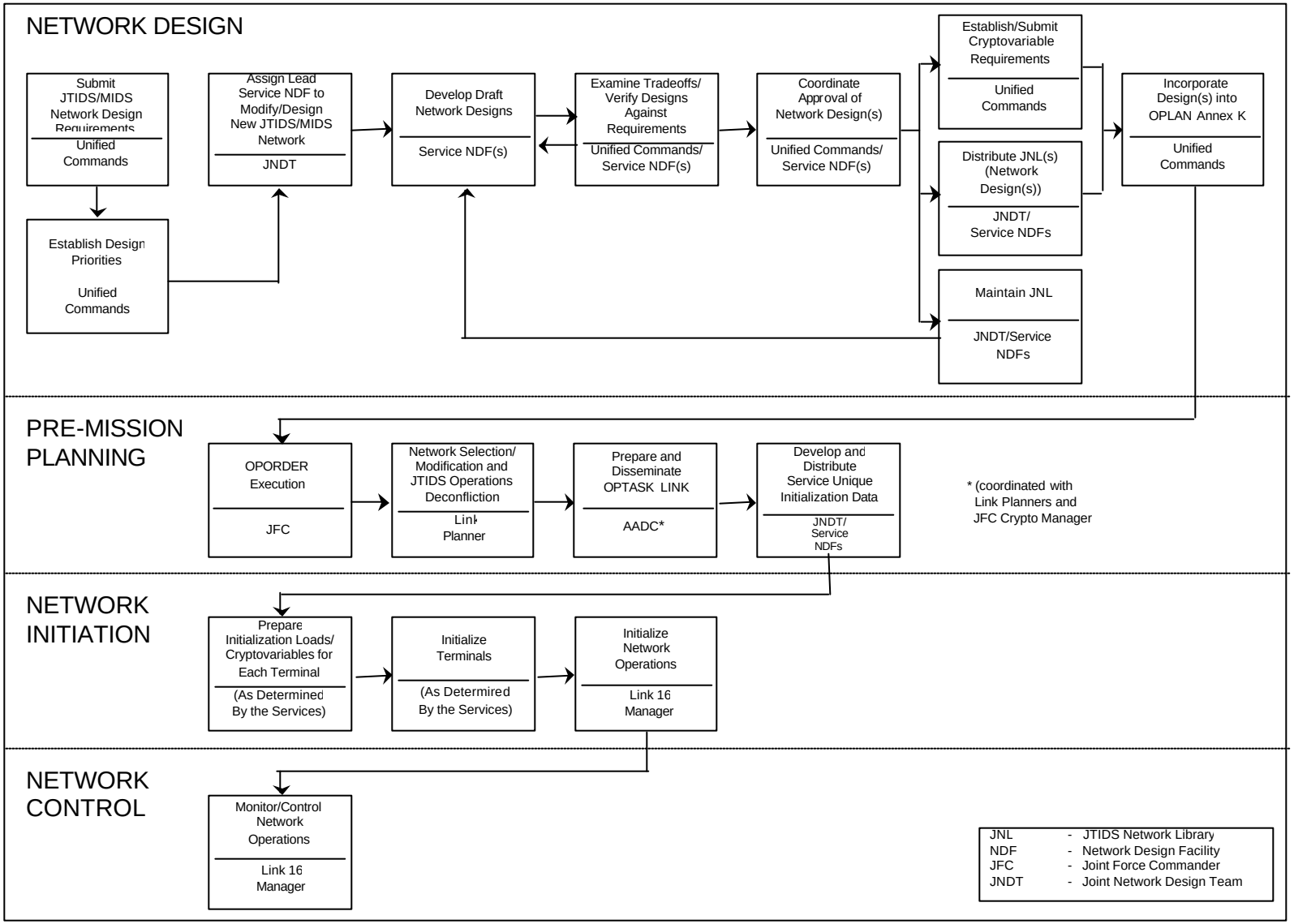

Figure D-1. Joint Network Design and Management Process for JTIDS/MIDS

a. Network Design.

b. Pre-mission Planning.

c. Network Initiation.

d. Network Control.

D2.1 JTIDS/MIDS Network Design

a. The first phase is the design of the JTIDS/MIDS network. The JTIDS/MIDS Network Request procedures are attached as Annex A to Appendix D. Force composition, projected track loading, and communications and connectivity requirements provided by operational commanders are the essence of network design requirements. Requirements for a single Service network are submitted to the Service Network Design Facility (NDF). Requirements for a joint or combined network are submitted to the UAFFORSCOM Joint Interoperability Division (JID) or one of the four Service NDFs. Once a request is received the other members of the Joint Network Design Team (JNDT) will be notified. The JNDT uses the requirements to determine if an existing network in the Master JNL will suffice, if an existing network can be modified to meet all the requirements, or if no network exists that will satisfy the requirements. If a network requires modification or a new network is required, the Service NDFs will determine the JNDT team leader. The JNDT team leader is responsible for conduct of team preparations and will orchestrate team efforts in support of mission requirements to modify the network or design the new network. Upon activation, JNDT will coordinate with the requester to validate and refine the network support requirements. The validation and refinement process may require the JNDT to deploy to the support combatant commander's AOR. Two types of parameters are defined at the design phase - network parameters and platform-unique parameters.

(1) Network parameters are universal to all JUs to ensure compatibility. These common values define the organization of the Network Participation Groups (NPGs), their net assignments and time slot block assignments, Cryptovariable Logical Label (CVLL) assignments, and relay functions.

(2) The platform-unique parameters are needed to complete initialization data for individual JUs, enabling each to enter and operate properly on JTIDS/MIDS. These parameters include transmit and receive time

slot assignments for individual platforms and other unique data, such as relay assignments.

b. Once the initialization parameters have been defined in the network design phase and the network design is built and accepted by the requesting command, the network is provided to the users as part of a library of networks called the JNL. The JNL is stored on magnetic tape, floppy disk, or other media.

D2.2 Pre-mission Planning. The second phase in the JTIDS/MIDS network management process is described as pre-mission planning. Pre-mission planning begins with the force Link planner selecting the JTIDS/MIDS network design from the JNL that best fits the operational situation and meets the needs of the JUs. The chosen design is then tailored to specific requirements. The Link planner aligns JUs of the force with generic platforms described in the chosen JTIDS/MIDS network design. Once the desired network design has been selected from the JNL and applied to the specific operation, the data needed for JUs' terminal initialization is transmitted in the OPTASK LINK message. This appendix only describes OPTASK LINK planning factors required for JTIDS/MIDS operation.

D2.3 Network Initiation. The terminal initialization process, phase three of the JTIDS/MIDS network management process, combines data provided by the OPTASK LINK message with platform-unique parameters provided by the platform operator. Using the appropriate Mission Support System (MSS) for the platform, the data specified in the OPTASK LINK message and the unique parameters associated with a specific platform are entered into the JTIDS/MIDS initialization program, creating a JTIDS/MIDS Network Design Load (NDL). Along with input of the specified cryptokeys, the NDL is used to program the JTIDS/MIDS terminal on a specific platform. Transfer of the NDL to the JTIDS/MIDS terminal completes the JTIDS/MIDS terminal initialization phase on each platform and prepares that platform for network entry. Initialization of JTIDS/MIDS network operations completes the Network Initiation phase.

D2.4 Network Control. Network Control, the final phase of the JTIDS/MIDS network management process, is the ongoing process of managing the operating JTIDS/MIDS network. The designated Link 16 Manager monitors force composition, geometry, proper network configuration, multi-link requirements, and general link administration. Network control constitutes those ongoing actions needed to establish, maintain, and terminate Link 16 communications between JUs and to accommodate a changing operational

environment. Network control may be carried out by Link 16 or by voice depending on the capabilities of the JUs in the network.

D3. Network Design

a. Network design consists of:

(1) Identifying a set of communications functions.

(2) Selecting different types of NPGs to support each function.

(3) Allocating each NPG a portion of network capacity appropriate to its needs.

(4) Translating the resulting network into the terminal initialization data needed to set up JTIDS/MIDS terminals to operate in the network.

b. The design process, while based on operational needs, is technically intensive. It is accomplished at a Service NDF prior to operations. The requesting operational authority must determine that the network design satisfies operational requirements. This can be done by several methods:

(1) Subjectively evaluating the network description versus network requirements specification.

(2) Comparing the network design with modeling/simulation results.

(3) Use of the network in actual operations.

(4) Using some testing methodology. The culmination of the Network Design phase is the distribution of the JNL (or network design if not part of the JNL) to the requesting operational authority and other users.

c. Figure D-2 is a timeline representation of a network design. The timeline depicts the allocations of the 1536 JTIDS/MIDS time slots that occur in a 12-second JTIDS/MIDS “frame”. This type of representation has been established to provide an overview of the network design. The timeline display shows the relative capacity of the NPGs and the stacked and multinet features of a network design. This timeline display of a network design is typically used by operators and planners to determine the relative merits of a network and

whether it may satisfy their requirements for data exchange. Figure D-2 shows both JTIDS/MIDS voice channels, control, NPG and Fighter-to-Fighter NPGs on stacked nets. Figure D-2 also shows a multinet condition between the EW and Fighter PPLI High Update Rate (HUR) NPGs. A timeline does not show the capacity assignments or connectivity of individual JUs.

d. The JTIDS/MIDS network design activity accommodates varying situations by providing multiple network configurations from which operational planners select the network most appropriate to the tactical environment. The design of a particular network depends upon the operational functions to be supported, the operating procedures of the forces involved, the roles and disposition of the various participants, and the operational environment. The network characteristics that can be adjusted to optimize the use of resources are:

(1) Multinets/stacked nets.

(2) NPGs.

(3) Message packing structure.

(4) Time slot access modes.

(5) Relay methods.

e. The functional building blocks of the network structure are the NPGs. NPGs are defined to support identified operational communications needs. The selection and sizing of appropriate NPGs is the essence of network design. The amount of network capacity allocated to a given NPG is a function of:

(1) The number and type of JUs and their required access time to the NPG.

(2) The expected volume of data to be transferred.

(3) The update rate of the information.

(4) Relay requirements.

(5) The variability in the quantity of data transferred by each user.

(6) Communications priorities.

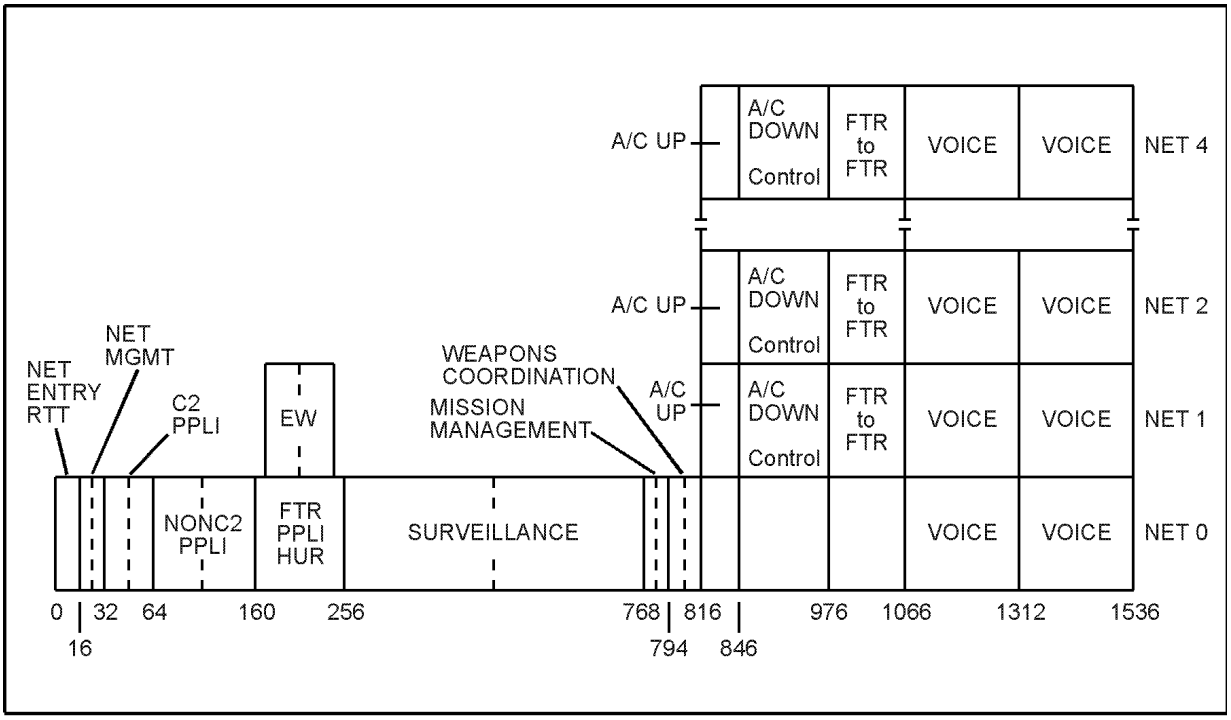

Figure D-2. Network Timeline Display

f. Specific NPG sizing is also a function of the host platform's ability to exchange information. The Communications Security (COMSEC) requirements of an NPG dictate to the JTIDS/MIDS network design activity which NPGs can belong to the same cryptonet for message security.

g. The network design is usually stored on magnetic media and copies are provided to all users as required to produce initialization data loads. The process of network design is an ongoing function providing the users with multiple networks, each targeted for different operational scenarios.

h. Each network design may have one or more design options for Navy platforms. These design options expand the utility of a network design by allowing the Link planner to select the most advantageous combination of network assignments during the pre-mission planning phase of an operation. Options also allow a network manager to adapt platform capacities to the effective traffic load during an operation. The options are effective on NPG 7,9 and 19.

D3.1 Multinets/Stacked Nets

a. A network architecture is created by assigning specific time slot blocks to NPGs that support various functions. NPGs may be assigned to operate on one or more nets. The NPGs that support functions that are common to all participants (e.g., Network Management) are assigned to a single net, referred to as the "Main Net." The Main Net is typically assigned as Net 0. A JTIDS/MIDS terminal transmits or receives on only one net during a time slot but can change nets in the next time slot. Each individual net is synchronized with all others such that each time slot of each net coincides with the corresponding time slot of every other net. A Network Time Reference (NTR) establishes the system time for the network.

b. Better use of communications capacity is obtained through the use of stacked net and multinet operation in which different groups of JUs transmit in the same time slot on different nets. Nets are distinguished by different frequency hopping patterns and cryptovariables. Stacked net operation involves having the same NPG occupy the same time slots on more than one net. Independent groups of JUs (groups that have no common members) that use the NPG are assigned to different nets; i.e., an E-3 and its controlled Fighters to Net 5, a cruiser and its Fighters to Net 11. In a stacked net structure, the blocks of time slots used by the NPG have the same time slot block assignments, but different net numbers; e.g., Air Control, Fighter-to-Fighter, and both Voice NPGs in Figure D-2. In a multinet operation, different NPGs that do not have common participants use the same time slots on different nets; e.g., EW and Fighter PPLI HUR in Figure D-2. A major difference between multinet and stacked nets is that multinet is design made and cannot be changed by an operator, while stacked nets are an operator selection or choice during the use of the network.

c. Sets of multinets or stacked nets must be properly placed in the network architecture to allow for operation without loss of required connectivity between individual JUs. A set of NPGs may be multinetted if the NPGs have no JUs in common.

d. While multinet and stacked nets increase overall Link 16 message throughput, neither method can increase the capacity of an individual JU. A JU's participation in a particular multinet is fixed at network design and cannot be easily changed. A JU's participation in stacked nets can be changed readily from one net number to another. The reason for using stacked nets is to allow operators to access another group of JUs, when appropriate, simply by selecting a different net number.

e. Stacked nets and multinets can operate on any net number from 0 to 126. However, if more than 15 to 20 stacked nets are active within LOS, there may be some degradation.

f. A default net, used for unassigned slots and for PPLI/RTT time slot assignments received in the Initial Entry message, is designated for each network.

D3.2 Participation Groups. The type of PG employed is determined according to the basis for categorizing Community of Interest (COIs) among participants:

a. Network PGs (NPGs). An NPG is a set of users exchanging a predefined set of messages in a predetermined set of time slot assignments in support of a tactical requirement. In order to transmit or receive data, a JU must know which blocks of time slots correspond to that NPG. A JU uses some of these time slots to transmit information on the NPG and the remainder to receive information transmitted by other JUs on that same NPG. Figure D-3 shows how various NPGs are interleaved in time, forming a single net multifunction network. The following is an overview of the NPGs their role in a network, and the intended use of NPG information transfer capability. Numbers following the NPG title are the NPG number, as summarized in Table D3-1.

b. Needline PGs. These PGs are destination orientated and defined according to intended network recipients. Within a Needline PG any message can be exchanged. They are defined by PG index numbers between 32 and 511.

D3.2.1 Initial Entry NPG (1). The initial entry NPG supports all JUs attempting to operate in a given network by disseminating system time for the purpose of coarse synchronization. All networks require a time slot block allocation for this NPG and a specific allocation is reserved in the system for its application. Time slot assignments for the PPLI and Voice NPGs are also announced on this NPG.

D3.2.2 Round-Trip-Timing (RTT) A and B NPGs (2 and 3). RTTs are automatically exchanged between JUs on these NPGs. RTT supports the process of fine synchronization, expedites JTIDS/MIDS net entry, and supports JTIDS/MIDS RELNAV computations. RTT-A transmissions are addressed to a specific JU. RTT-B transmissions are broadcast on a specific net number depending on the transmitting JU's time quality.

D3.2.3 Network Management NPG (4). The Network Management NPG provides the means for the Link 16 Manager to exchange Network Management information with all JUs participating on Link 16. Information supporting time slot assignments, radio relay control, and Over-the-Air Rekeying (OTAR) are transmitted on this NPG.

D3.2.4 PPLI A and B NPGs (5 and 6). The PPLI NPGs provide participant identification, location, and status information; time quality; position quality; and relay status. PPLIs are also used to support fine synchronization and provide JTIDS/MIDS RELNAV information.

D3.2.5 Surveillance NPG (7). The Surveillance NPG provides for the exchange of tactical information, including Surveillance Tracks, EW Products, Acoustic data, track management, filter management, and intelligence data among C2 JUs. The information on this NPG can be forwarded by a capable unit, to and from Link 11/11B. Non C2 JUs do not transmit on this NPG, but may receive the data on it in order to compile the tactical picture.

D3.2.6 Mission Management and Weapons Coordination NPG (8). The Mission Management and Weapons Coordination NPG provides a means for a C2 JU with command authority to order weapons engagements, and for controlling, reporting, and transferring assets. This information can be forwarded by a unit capable to transmit to and receive from a Link 11/11B unit. The following information is exchanged on this NPG:

a. Commands.

b. Engagement Status.

c. Handovers.

d. Controlling Unit Reports.

e. Pairings.

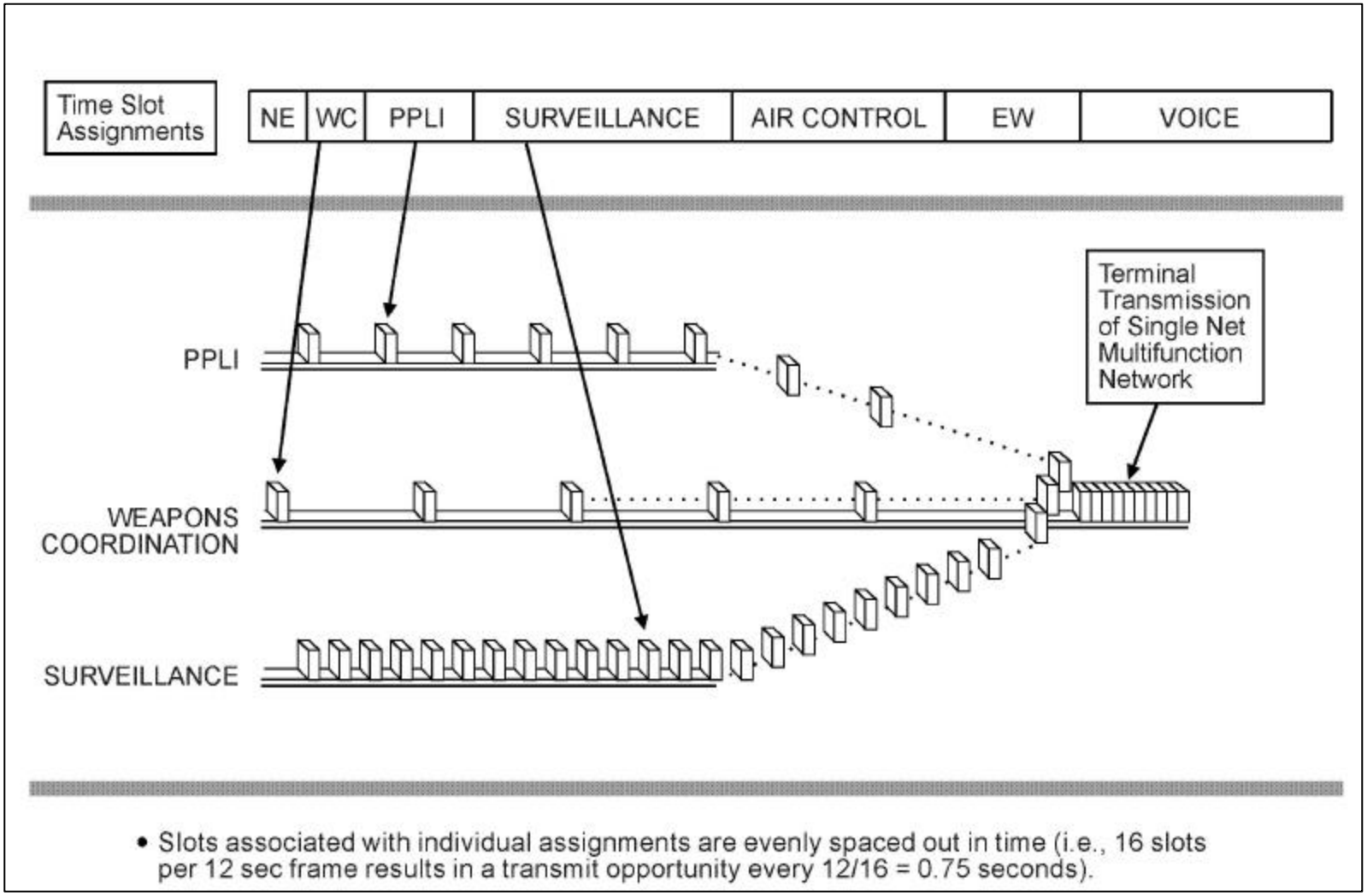

Figure D-3. Time Slot Interleaving

Table D3-1. Link 16 NPG Definitions

NPG Title	NPG Index No.
Initial Entry	1
RTT A	2
RTT B	3
Network Management	4
PPLI and Status A	5
PPLI and Status B	6
Surveillance	7
Mission Management/Weapons Coordination	8
Control	9
Electronic Warfare	10
Voice Group A	12
Voice Group B	13
Indirect PPLI	14
Fighter-to-Fighter	19
Secondary Fighter-to-Fighter	20
Engagement Coordination	21
Composite A	22
Composite B	23
Joint Net PPLI	27
Distributed Network Management	28
Residual Messages	29
IJMS Position and Status	30
IJMS Messages	31

D3.2.7 Control NPG (9). The Control NPG provides a means for C2 JUs to control nonC2 JU aircraft. It enables C2 JUs to provide nonC2 JUs with mission assignments, vectors and, optionally, target reports. Additionally if designed with options, time slot assignments can be provided to nonC2 JUs. It enables the controlled aircraft to report targets and engagement status to C2 JUs. Individual Net numbers on this NPG are referred to as "Control Channels." The following information is exchanged on the Control NPG:

a. Vectors (originated only by C2 JUs).

b. Mission Assignments (originated only by C2 JUs).

c. Controlling Unit Changes.

d. Target/Track Correlations (originated only by C2 JUs).

e. Target Sorting Messages.

f. Time Slot Assignments (originated only by C2 JUs).

D3.2.8 EW NPG (10). EW parametric information is originated on the EW NPG and may be forwarded to and/or from Link 11/11B depending on the EW Data Forwarding mode in use. EW Orders are originated on, and forwarded to and from, the EW NPG.

D3.2.9 Fighter-to-Fighter NPG (19 and 20). The Fighter-to-Fighter NPG (19) provides a means for nonC2 JU aircraft to exchange target information and report engagement status. It also provides the means for a selected nonC2 JU aircraft (normally the Flight Leader) to send assignments to other nonC2 JU aircraft when a C2 JU is not exercising control. This NPG may also be referred to as the "NonC2 JU-to-NonC2 JU NPG," because it can also be used for control of aircraft other than fighters. However, the term Fighter-to-Fighter is normally used for brevity and clarity. The secondary Fighter-to-Fighter NPG (20) provides the means for nonC2 aircraft to operate on a second Fighter-to-Fighter stacked NPG simultaneously.

D3.2.10 Engagement Coordination NPG (21). Engagement coordination actions are generally mission specific and are limited to a local engagement operations area or theater. The Engagement Coordination NPG allows two or more systems with common or shared defense responsibilities within an area of operations or a theater to coordinate their actions without impacting on larger area air defense or theater-wide network activities.

D3.2.11 Voice A and B NPGs (12 and 13). The Voice NPGs provide for secure Anti-Jam (AJ) voice communications. JTIDS/MIDS Voice may be used regardless of whether any other Link 16 NPGs are activated. In the event JTIDS/MIDS transmissions must be restricted to only voice, the JTIDS/MIDS terminal must be placed in the Data Silent mode to prevent transmissions on other NPGs. Up to 2 voice channels are available in most JTIDS/MIDS terminals although some terminals do not support JTIDS/MIDS Voice.

D3.2.12 Indirect PPLI NPG (14). This NPG is used by the some FJUs to support multi-link operations between Link 11/11B and Link 16 by providing time slots in which an FJU will transmit PPLIs containing position and identification information for Link 11/11B. The PPLIs are transmitted on the network for participants that are not operating directly on the JTIDS/MIDS network. The time slots are allocated as time slot reuse with only one FJU for a Link 11/11B network. Forwarding multiple Link 11/11B units onto Link 16 by different forwarders requires multiple time slot blocks for forwarding to prevent contention between FJUs.

D3.2.13 Composite NPGs (22 and 23). Composite NPGs are implemented by some JUs and may be employed in order to reduce network capacity requirements when available network capacity is limited (e.g. when operating under peacetime restrictions and required to operate on a single net). When Composite NPGs are utilized, Link 16 messages, with the exception of RTT and terminal-generated PPLIs, are selected for transmission in one of two NPGs, Composite A or Composite B, instead of the Standard Link 16 NPGs, as follows:

a. Composite A - covers the following Standard NPGs: Network Management; PPLI & Status A and B; Mission Management/Weapons Coordination Management; Control; Fighter-to-Fighter.

b. Composite B - covers the following Standard NPGs: Surveillance, EW.

NOTE: Link 16 networks may be designed to utilize both Composite NPGs and Standard NPGs, providing no JU is allocated time slot capacity for a Composite NPG and the corresponding Standard NPGs simultaneously. Network designs may incorporate Composite A and/or Composite B NPGs; however, Composite A and B cannot be used with stacked nets.

D3.2.14 Residual Messages (NPG 29). Textual Information may be exchanged between JUs by the use of JTIDS/MIDS text messages. JUs that implement this capability can transmit and receive alphanumeric text information via data link.

D3.3 Message Packing Structures. Packing refers to the number of Link 16 words that are transmitted in a single time slot and whether the data is transmitted either once or twice. Packing also affects propagation range and AJ margins.

D3.3.1 Message Packing Types

a. Packing is described as:

(1) Standard Double Pulse (DP): 3 Link 16 words are transmitted per time slot.

(2) Packed-2 Single Pulse (P2SP) or Packed-2 Double Pulse (P2DP): 6 Link 16 words are transmitted per time slot.

(3) Packed-4 SP: 12 Link 16 words are transmitted per time slot.

b. Double pulse means that each item of information is transmitted twice, first on one frequency and then on a different frequency. Single Pulse means that each item of information is only transmitted once.

D3.3.2 Message Packing Limitations

a. The range of Link 16 transmissions, data capacity, and AJ ruggedness of the Link 16 information exchange are partially a function of the density of message packing (throughput), redundancy of transmissions (double pulse), and whether jitter is employed. The JTIDS/MIDS terminal always attempts to use the least packing density, but automatically uses a greater packing density as appropriate to the message load conditions. The order of preference for message packing structure used by the terminal is Standard, P2DP, P2SP, and Packed-4. Packed-4 provides the greatest throughput and the least AJ margin.

b. The JTIDS/MIDS terminal can be limited to which packing structures it will use for an NPG through the Packing Limit initialization parameter, thereby ensuring a specified level of AJ ruggedness for that NPG. The terminal nonetheless receives and processes any Link 16 message regardless of packing structure. Use of Extended Range Mode (500 nm) can result in loss of data when using Packed-4 structure. Packed-4 structure does not allow sufficient propagation time for messages using a large number of extension and continuation words, such as used in Theater Ballistic Missile Defense, to arrive at the distant end before the time slot boundary is reached. In this instance the loss of any part of a message will result in the whole message being discarded. The packing limit is established for each NPG during network design. The implications of using the different packing structures are summarized in Table D3-2.

D3.4 Time Slot Access Modes. The three Link 16 access modes are Dedicated Access, Contention Access, and Time Slot Reallocation (TSR). The selection of an access mode by the JTIDS/MIDS network design activity is dependent on network loading and the communications mode in use. Access modes are assigned as part of the time slot block assignments for each NPG.

Table D3-2. Packing Structures and Implications

MESSAGE PACKING STRUCTURE	VOLUME OF DATA	EXTENDED RANGE	ECM RESISTANCE	DATA REPEATED
STANDARD DOUBLE PULSE	STANDARD	AVAILABLE	HIGH	YES
PACKED 2 SINGLE PULSE	TWICE STANDARD	AVAILABLE	REDUCED	NO
PACKED 2 DOUBLE PULSE	TWICE STANDARD	AVAILABLE	HIGH[1]	YES
PACKED 4	4 TIMES STANDARD	AVAILABLE[2]	LEAST	NO

NOTES:

[1]Slightly less than the Electronic Countermeasures (ECM) resistance provided by the standard packing structure.

[2]Using Packed 4 Structure with Extended Mode may result in the loss of messages at extreme ranges.

D3.4.1 Dedicated Access. Dedicated Access provides each JU on an NPG with a predetermined amount of system capacity for its information transmission. Dedicated Access guarantees there will be no transmission conflicts with another JU's transmissions in a single net environment. The JTIDS/MIDS network design activity must allocate a unique set of fixed transmit time slots in each NPG for each JU operating in the Dedicated Access mode. This allocation of system capacity remains fixed until a new network (or option) is chosen, or the allocation is changed automatically on line by a JTIDS/MIDS network management message.

D3.4.1.1 Time Slot Reuse in the Dedicated Access Mode

a. Time slot reuse is a technique whereby the JTIDS/MIDS network design activity may assign the same Dedicated Access time slot blocks to JUs that do not directly communicate with one another or do not communicate with a common third JU using these assignments (normally used in non-LOS, geographically stable situations).

b. Because of the highly mobile nature of some participants and relays, deliberate reuse of the same time slots in the same net must be carefully controlled. NPG designs that assign the same Dedicated Access time slots to two or more participants must have other protocols related to operation of that NPG to assure that conflicts will not occur, or that such conflicts will be

operationally acceptable. An example where this is the case is the Voice NPGs where the access is operationally controlled by "press-to-talk" methodology.

D3.4.2 Contention Access. Contention Access allows individual JTIDS/MIDS terminals to randomly select a transmit time slot from a pool of slots available to an entire community. The number of time slots per unit of time that a particular terminal can select is determined by the access rate assigned to that terminal. Access rate is a parameter that can assume 16 different values, ranging from two slots per 48 seconds to 64 slots per 12 seconds. The JTIDS/MIDS network design activity must size that pool of time slots appropriate to the expected number of JUs and their individual access rates to the pool. In this mode, more than one JU can transmit messages in any specified time slot. However, a JU receives data only from the nearest transmitting JU. The probability of one JU receiving a message of another JU within LOS depends on the number of intervening JUs operating in contention, their access rates, and their message traffic loads. Contention access offers the advantage of reduced network management because specific time slot assignment is unnecessary and also provides for automatic assignment of Link 16 capacity. However, it has the disadvantage of a reduced probability of message reception. Therefore, the use of relay with contention access NPGs adds a further element of risk and should be avoided.

D3.4.3 TSR Access Mode. The following describes the TSR Access Mode:

a. The TSR Access mode allows JUs in a Participation Group Community (PGC) to automatically reallocate a shared pool of time slots periodically so that each JU assigns itself time slots according to its expected demand and the announced demands of other JUs. The shared pool of time slots assigned to and shared by a number of JUs for exchanging messages in a particular PGC is known as the reallocation pool. If the aggregate JU demand for time slots exceeds the capacity of the reallocation pool, the JUs assign themselves time slots in proportion to their demands, but scaled down by a common factor so that the total allocation is within the reallocation pool capacity.

b. TSR conserves capacity by allowing the reallocation pool to be sized according to the expected aggregate capacity requirement rather than as the sum of the peak capacity requirements of all participating JUs. The reallocation period can be set to the expected rate of demand fluctuations with a minimum reallocation period of 6 seconds and a maximum reallocation period of 48 seconds. The access mode is designed to operate in conditions of poor connectivity and overload, and in these conditions it will result in graceful degradation in the probability of successful message transmission in the case

of time slot conflicts and subsequent reception in the case of jamming. This access mode is suitable for use in an environment where the available capacity is to be shared by a varying community of users with fluctuating demands.

D3.4.3.1 TSR Access Mode Details

a. TSR allows the sharing of a specified pool of time slots, referred to as a reallocation pool, with other participating terminals to exchange messages other than JTIDS/MIDS voice. A JU automatically determines its time slot requirements for each interval referred to as a reallocation period and automatically announces the percentage of the reallocation pool's time slots that it desires to use during the next reallocation period in a time slot reallocation message. A JU also repeats, in the same message, the requirements of any JUs previously received in a process known as mutual dissemination.

b. A JU that has implemented TSR will be able to operate simultaneously in at least two reallocation pools. Each reallocation pool is associated with only one NPG and time slots in that pool may be used only for messages from that NPG. More than one reallocation pool may be operated in a single PG. However, in a single PG, no JU may transmit in more than one reallocation pool. A reallocation pool must be specified in no more than three time slot blocks.

c. JUs automatically allocate capacity to themselves according to their own demands and those received from the other TSR Participants. JUs scale their demands so that the total scaled demand is within the pool capacity. JUs select time slots on a pseudo-random basis, avoiding time slots that they calculate have been allocated to JUs that have a higher priority in the selection sequence. The selection sequence is based on the number of JU demands received by a given JU, either directly, by relay, or by mutual dissemination. The JU receiving the lowest number of demand reports from other terminals selects time slots first and so on, ties being broken by Table Position Number and, if none, by Source Track Number. Thus, the Link 16 Manager has no involvement in the time slot selection ordering, either dynamically or at initialization. This combination of pseudo-random selection and ordering by receive count ensures that in very poor connectivity the access method degrades gracefully. In moderate connectivity a small amount of time slot reuse may occur.

D3.4.3.2 Time Slot Reuse in the TSR Access Mode. The TSR Access mode is designed to prevent time slot reuse by uniformly scaling down JU capacity allocations in overload conditions. Some reuse may occur in conditions of poor

connectivity. As an initialization option, the JTIDS/MIDS network design activity may limit the dissemination of the demand information deliberately so that reuse can occur among widely separated JUs. This is done by setting the maximum dissemination hops parameter to the required number of repetitions of demand information.

D3.4.3.3 Time Slot Reuse of the TSR Initial Entry. The JTIDS/MIDS network design activity may limit time slot reuse of the Initial Entry time slot assignments by giving JUs Dedicated Access mode assignments. However, in situations of limited net capacity, initial entry time slots can be shared by all JUs in an assignment with this access mode. Because these initial entry time slots are used only to enter the reallocation pool, there is a small probability of use by more than one JU in a single time slot. The JTIDS/MIDS network design activity assigns initial entry time slots to meet the response time requirements for JUs entering a reallocation pool.

D3.5 Relays. Relays must be planned when all JUs in the JTIDS/MIDS network are not within LOS or when any of them are beyond the selected range mode. The JTIDS/MIDS terminal has a LOS operating range of 300 nm (normal range mode) or 500 nm (extended range mode). A JU designated to relay a message must be provided with the capacity to relay the message.

D3.5.1 Paired Slot Relay

a. A relay operates on the principle of time slot delay in which messages received in one time slot are relayed at a later time in a specified pre-allocated or donated transmission time slot. A JTIDS/MIDS terminal must have previously achieved fine synchronization and be in the normal mode before it can participate in the relay of messages. The performance of relay functions does not degrade a JU's performance in other NPGs in which it participates. All data messages are error coded and corrected prior to retransmission. Messages that, upon receipt, have an uncorrectable error are not relayed.

b. In paired slot relay, a message received in one time slot is relayed in the paired relay time slot. Relay receive time slot blocks and relay transmission time slot blocks are assigned to each JU that may need to serve as a relay. Paired time slot blocks (a message received in a given Time Slot X is relayed in the next occurring Time Slot Y) must be assigned as a part of each NPG that requires relay support. The paired time slot relay provides a relatively fixed dedicated access relay capacity that can be changed only by network design.

c. Whenever a receive assignment is issued for time slots that will contain relayed messages in the Partitioned Variable mode, the recipient's time slot block assignments must contain the total relay delay (cumulative for all hops) and original net number. This is not required for messages transmitted in the Common Variable mode.

d. Relay capacity requirements for each NPG are directly proportional to the number of relay hops that are required to reach the destination. To properly estimate the required relay capacity at a particular relay terminal, the JTIDS/MIDS network design activity must sum the relay requirements of each NPG that will require support.

D3.5.1.1 Unconditional Relay. In the unconditional Relay mode, the JTIDS/MIDS terminal relays messages IAW assigned relay, receive, and transmit time slots. Relay occurs unless the terminal is ineligible (no fine synchronization, data silent, or polling mode selected) or until the mode is changed by receipt of the proper Link 16 Relay Control message.

D3.5.1.2 Conditional Relay. A JU is assigned to operate as a Conditional Relay either during initialization or by a Relay Control message. If other Conditional or Unconditional relays are active in the NPG and the geographic area covered by the active relay (as indicated in the height and range fields of their PPLI message) is significantly greater than the area covered by the JU under consideration, the Conditional Relay remains inactive as a relay for this NPG. If the geographic coverage by other JUs is not greater than the geographic coverage of the JU under consideration, then the Conditional Relay JU becomes active. Conditional relay mode is applicable to Main Net, JTIDS/MIDS Voice and Control relay functions only.

D3.5.1.3 Suspended Relay. Relay action can be overridden by placing the terminal in the Suspended Mode. Relay assignments are maintained, but are inactive until taken out of the Suspended Mode. A terminal that is initialized to relay may be placed in suspended relay mode while operating inside national airspace structure to reduce the possibility of harmful interference with air traffic control systems.

D3.5.2 Main Net Relay. When the paired blocks are labeled “Main Net Relay,” messages may be relayed in one or more NPGs. This relay-JU may operate in either of the terminal modes - conditional or unconditional. The terminal mode is assigned during initialization or via the Radio Relay Control messages. When operating in the Unconditional mode, the terminal will always actively carry out the relay assignment. When operating in the Conditional mode, the

terminal will carry out the relay assignment only when in a more favorable geometric position than any other terminal with the same relay assignment.

D3.5.2.1 JTIDS/MIDS Voice. When the paired blocks are labeled "Voice Net Relay," messages of the Voice NPG are relayed. If the net number of the Voice NPG assignments is specified as "No Statement," the JTIDS/MIDS voice relay net is selected by the operator for JTIDS/MIDS voice channel operation. The relay-JU may operate in either the Conditional or Unconditional mode.

D3.5.2.2 Control. When the paired blocks are labeled "Control Relay," messages of the control NPG are relayed. If the net number of the control NPG assignments is specified as "No Statement," the control relay net is selected by the operator for control channel operation. The relay-JU may operate in either the Conditional or Unconditional mode.

D3.5.2.3 Zoom. When the paired blocks are labeled "Zoom Relay," messages may be relayed in one or more NPGs (as for main net relay) but the relay transmit net number is different from the transmit net number assigned the main net relay function. The relay-JU must operate in the Unconditional mode.

D3.5.2.4 NPG Relay Function. For this relay function, the paired block assignments are labeled with the index number of the NPG whose message(s) are relayed. The relay-JU must operate in the Unconditional mode.

D3.5.2.5 Directed Relay. Performs in much the same way as PG Relay above but is not confined to a single NPG.

D3.5.3 Repromulgation Relay Mode. This mode allows an originating JU to transmit a Repromulgation Relay message and the message that is to be relayed in the same time slot. The Repromulgation Relay message requests all recipients to act as relays; therefore, preplanning and knowledge of LOS is not required. However, this mode uses more system capacity than paired slot. In this mode, all of the relay-transmit time slots are donated from the originating JU's time slot block. The originating JU indicates in the Repromulgation Relay message how many times the designated message is to be retransmitted and the exact delay between the receipt of the message and the relayed transmission. Each JU that receives the message on the subject NPG will retransmit the message. The relay-JU must operate in the Unconditional mode.

a. The Repromulgation Relay mode is designed to provide a way of distributing information in a multi-hop relay environment without depending

on a terminal knowing direct or indirect connectivity, relay address, or externally supplied routing information. Thus it is a distributed capacity that does not depend on a central control function for its normal operation. It also provides a means to conserve capacity in a multi-hop relay environment. It is suited to communications where a high throughput rate must be sustained or where messages have multiple destinations.

b. During Repromulgation relay operations, the JU originating a message designates the number of times the message should be relayed and donates the relay transmission time slots from its own time slot block. JUs are assigned to receive the message transmitted in the assigned time slots. Upon receiving a message, the JUs determine from the relay count whether the message has been retransmitted the correct number of times. The originating JU can begin to reuse the donated time slots within two time slots. The initial message will continue to be retransmitted by other terminals while a new message starts to be repromulgated. The Army uses a form of Enhanced Repromulgation Relay (ERR). ERR reduces the relay time slot penalty, from three times the time slots to two times the time slots, required for message throughput. Repromulgation Relay is only used in the Unconditional mode.

D3.5.4 Addressed Relay Mode. In this mode, all of the relay transmission capacity must be assigned to the message originator. He automatically selects the JUs (from a predetermined address database) that are to relay the message. In current design, the addressed relay mode can be used only to relay VMF. This relay-JU must operate in the Unconditional mode.

D3.5.5 Transmit Overlay. The JTIDS/MIDS terminal allows a transmit assignment to be overlaid on a relay assignment if these assignments are in the same net and use the same cryptokey. There are certain advantages to this type of assignment for some operations. However it could result in a terminal redundantly transmitting the same message in origination time slots and in relay time slots. Therefore, the JTIDS/MIDS network design activity must be aware that it is not only possible to initialize a terminal with a relay assignment for an entire NPG but also to initialize that terminal with one or more relay receive Time Slot Block assignments (TSB) and with one or more additional transmit-only TSB assignments in that same NPG. If the time slots of the transmit only TSBs do not overlay any of the time slots of the relay receive TSBs then the terminal does not redundantly relay its own transmissions that occur in these transmit-only TSB assignments.

D3.6 NPG Time Slot Assignments

a. Time slot requirements are primarily determined by the transmit time slot requirements of the individual JUs in the NPG, the number of JUs in the NPG, their relative locations, the recurrence rate, the chosen access mode(s), the relay requirements, and the chosen acknowledgement protocol. Time slot capacity is assigned at the JNDF that provides time slot assets for each JU's initialization process.

b. The terminal can store and operate with up to 64 TSB assignments regardless of the manner in which the 64 blocks are allocated to the NPGs. A terminal may therefore not be able to participate in all NPGs if the capacity of the NPGs is fragmented among several TSBs and the total TSB assignments exceed 64. The optimum number of TSBs to be assigned depends on the TSB size, required capacity, required fragmentation, and a terminal's capacity to accept additional TSBs.

D3.6.1 Transmission Requirements. The origination transmit time slot requirement of a JU is predicated on the throughput requirement (the number of time slots each frame required to support the JU's requirements for original transmissions and acknowledgements) and the response time requirements (the number of time slots each frame required to provide the specified response time for messages to be transmitted by the JU in that NPG). The number of transmit time slots assigned to a JU is the larger of these two requirements. Relay capacity is then added as needed to determine the total number of time slots required. The JTIDS/MIDS network design activity must exercise care to ensure that sufficient consideration is given to allocating transmit time slots sufficient to achieve the goal of a 1.0 to 2.5 second terminal-to-terminal response time (T^2RT) for priority message generation, including single hop relay if required. T^2RT is defined as the interval between the time an originating terminal receives a message from the host system for transmission and the time a receiving terminal notifies its host system the message is ready for transmission to the host. Network designs that compromise response times must include documentation that highlights the response time capabilities. The JTIDS/MIDS network design activity must design each NPG with transmit assignments for all participants and reserve some transmit assignments to be used as the situation demands. The designer must recognize that unused capacity (such as transmit assignments belonging to JUs that are not present) may also be redistributed by the Link planner and, perhaps, by the Link 16 Manager. Accordingly, each JU's initialization TSB assignments should be sized to facilitate redistribution to other network participants.

D3.6.2 Access Mode Requirements. Once an access mode for an NPG has been selected, the capacity requirements for the NPG may be calculated. For the Dedicated Access mode, the NPG time slot requirements (not including relay capacity) is equal to the sum of the transmit time slot requirements of the individual JUs in the NPG. For the Contention Access mode, the time slot requirement is a function of the JU's transmit time slot requirements, the density of the JUs, and the required message reception probability by specific receivers. For NPGs, in which it is necessary to receive from most or all JU participants with high probability, the use of Contention Access can require significantly greater capacity than Dedicated Access. For some NPGs with non-static participation, Contention Access may offer the possibility of simpler net management of transmit assignments, albeit at higher capacity needs. For an NPG, in which it is only necessary to receive from a relatively few close-range participants with high probability, or for which many JUs to whom time slots are allocated do not participate at the same time, Contention Access may actually require less capacity than Dedicated Access. However, for most NPGs, Dedicated Access will be the access mode used, because it will require less capacity than Contention Access and provide deterministic rather than probabilistic reception rates.

D3.6.3 Allocation of System Capacity. Once the time slot requirements for all NPGs have been computed, the JTIDS/MIDS network design activity may begin to allocate the system capacity. The first step in the process is to determine the time slot block requests for each NPG. Because JTIDS/MIDS terminals are assigned time slot blocks of size 2^n ($0 \leq n \geq 15$) per epoch and any single JU can accept only a limited number of block assignments, it might not be possible to match the exact number of time slots allocated to the NPG's specific requirements. Therefore, it may be necessary to round off the time slot requests of some NPGs. When time slot block requests have been determined for each NPG, the JTIDS/MIDS network design activity must assign each JU specific time slot blocks IAW these requests.

D3.6.4 NPGs on Multi-nets. If the throughput or response time requirements exceed the available capacity of a single net, NPGs may be assigned blocks of time slots on other nets. The JTIDS/MIDS network design activity must arrange the blocks from other nets so that minimum conflict results if users require interoperability on several NPGs. A multinetted NPG may have some time slot blocks on one net and other time slot blocks on another net. However, a JU is not able to transmit or receive in the same time slot on multiple nets.

D3.6.5 PPLI NPG Considerations. Dedicated Access or Contention Access can be independently selected for any of the PPLI A, or PPLI B or Joint PPLI NPGs.

The JTIDS/MIDS network design activity must be aware however, that the JTIDS/MIDS terminal automatically operates IAW the following rules. When assigned to transmit its PPLI messages in the Contention Access mode, the terminal accepts and operates with two specific subgroups or pools of PPLI message slots, referred to as the Special Pool (Pool A) and the Common Pool (Pool B).

a. The pools are specified as two different NPGs. The terminal also transmits its PPLI messages in the Special Pool when:

(1) So commanded through the subscriber interface.

(2) An unconditional relay in the active mode.

(3) A conditional relay in the active mode.

(4) It first goes to the Data Silent mode.

b. When the subscriber interface has caused the selection of PPLI message transmission in the Special Pool, the terminal causes all PPLI messages to indicate Flight Leader status active. The terminal transmits within each pool at the assigned rate for each pool specified in the message transmit rules or access rate entry of the slot assignments. Each transmit slot is selected randomly.

D3.7 Summary of Methods to Reduce Resource Utilization. The foregoing has described the various characteristics that should be considered by the JTIDS/MIDS network design activity in optimizing the use of resources. They are summarized below.

a. When capacity requirements exceed the available terminal, network or system capacities, multi-netting and stacking of NPGs may be employed to increase available capacity. If multi-netting and stacking do not provide enough additional capacity to meet the demand, the NDF has several other options available to reduce the time slot block allocations to the various NPGs. For a specific NPG, methods for reducing capacity requirements include:

(1) Time slot reuse.

(2) Changing the access mode.

(3) Increasing message packing limits.

(4) Reducing the number of relay hops.

b. The above methods may reduce the message reception probability and therefore must be used with caution. Time slot reuse permits two or more JUs to transmit in the same time slot, conserving system capacity. As a result, the probability of any one terminal's transmission being received is decreased because the destination terminal receives the transmission with the earliest Time of Arrival (TOA). A change in the network access mode might decrease consumption of system capacity, but could increase cycle time to transmit all data. Increasing the packing structure to Packed-2 or Packed-4 increases capacity but adversely affects other performance features such as range, jitter, or multi-path protection. A reduction in the number of relay hops decreases resource utilization, but this technique diminishes relay coverage and restricts the number of relay path alternatives. In some cases, it may be preferable to reduce capacity demands by easing performance requirements; i.e., lessening response time requirements.

D3.8 COMSEC. COMSEC is achieved through various technical and operational techniques as described below.

D3.8.1 Cryptonetting

a. The JTIDS/MIDS terminal can access several cryptokeys that can be used to partition the data exchange among need-to-know communities. The process of partitioning data within a JTIDS/MIDS network is known as “cryptonetting.”

b. In order for a JU to establish or operate on a secure data net it must first be provided with specific terminal initialization data. Required data consists of two parts:

(1) The first part deals with the technical characteristics of the assignment of specific time slot blocks to the NPGs.

(2) The second part of this initialization data deals with the assignment of specific cryptokeys that the JU requires in order to conduct operations in designated secure nets.

c. A cryptonet is a set of JUs synchronized in time and using the same cryptokey for message security. Individual cryptonets may contain one or more NPGs based on the operational data exchange requirements. The data exchange requirement is based upon the following:

(1) Operational need of each JU for the overall data content of the net.

(2) Operational impact of compromise of the data content of the net.

(3) Vulnerability of the net to compromise by either physical capture of the JTIDS/MIDS terminal or compromise of the cryptokey in use by other means.

d. Based on several factors, a JU is assigned to single or multiple cryptonets during network design. The basic and most important consideration is the need for the JU to have access to the NPGs served by the cryptonets. The second consideration is the sensitivity of the data access that the JU requires in order to complete the operational mission. All JUs require access to the main net PPLI NPG, Initial Entry NPG, and the Network Management NPG. Their assignment to other NPG/nets, however, is based on their need for access to each of the cryptonets. The Initial Entry cryptonet and the PPLI cryptonet normally utilize the same Transmission Security (TRANSEC) cryptokey. These cryptonets, however, may be divided into separate cryptonets or they may be subnetted using different Message Security (MSEC) cryptokeys to achieve separate cryptosubnets in order to reduce the number of JUs that participate on a single cryptonet.

e. Because only a finite number of cryptokeys are available for each day of operation, cryptonet design must provide for the most effective and secure use of those cryptokeys. Cryptonets should partition the available information on the basis of operational need-to-know and risk so that the information derived from a compromised terminal would not jeopardize the entire community of users.

f. The JTIDS/MIDS network design activity should consider the future use of OTAR when designing the cryptonet structure of networks. When possible, the designers should avoid using JTIDS/MIDS Secure Data Unit (KGV-8) memory locations 4 and 5 because these memory locations will be used for OTAR. Avoiding the use of memory locations 4 and 5 will ensure that initial network designs will be compatible with OTAR.

D3.8.2 Cryptonet Management. Cryptonetting can be used to limit the operational impact of a known or unknown compromise by assigning separate CVLLs to NPGs based on their need-to-know and risk of compromise of the data transferred within the NPG. JTIDS/MIDS provides for two uses of cryptokeys; a cryptokey for TRANSEC is required to initially enter or establish

the net. Once synchronization is achieved the MSEC cryptokey is required to exchange information on the net. Cryptokeys are used in one of two security modes: Common Variable mode and Partitioned Variable mode. Each time slot block assignment on a net can be designated to operate in the Common Variable or Partitioned Variable mode. When OTAR is implemented, each individual JU must be assigned a unique cryptokey required to process the OTAR messages.

a. Common Variable Mode. In the Common Variable mode there is one cryptokey used for both TRANSEC and MSEC. All JUs can receive and read the messages transmitted, thereby operating as single cryptonet.

b. Partitioned Variable Mode. In the Partitioned Variable mode there are two cryptokeys, one for TRANSEC and one for MSEC. Because all JUs hold the same TRANSEC cryptokey, but might not hold the same MSEC cryptokey, the nets may be divided into multiple cryptonets. However, in the Partitioned Variable mode any JU can relay any message even though the JU might not hold the same MSEC cryptokey.

D3.8.3 Cryptonet Size. The four considerations for establishing a cryptonet are community size, sensitivity of message traffic, possibility of compromise, and emergency supersession plan.

D4. Pre-mission Planning

a. Pre-mission planning consists of:

(1) Selecting a JTIDS/MIDS Network. There will likely be cases when the network design used for initial operations is not adequate for continued operations. Additionally, there will be instances during advanced planning for an operation or when an OPLAN is being developed that no design can be found in the appropriate network library that satisfies the requirements. If there is no acceptable JTIDS/MIDS network design in the appropriate network library, the Link planner needs to submit to the appropriate network design facility (for a joint or combined network) or a component NDF (for a single component network) a JTIDS/MIDS NDR for design of a new or modified network. This intermediate step will eventually result in a revised network design being provided to the operational commander by the appropriate JTIDS/MIDS Design Facility.

(2) Identifying any required modifications for the selected network designs.

(3) Making assignments for each JU in the force to the generic platforms in the network design.

(4) Preparing a list of specific parameters, or adaptations to parameters, to support the near-term force operations.

(5) Providing inputs for the OPTASK LINK message with the network structure selection and specific platform assignments to each JU.

b. Selecting and Modifying JTIDS/MIDS Network from JNL. The JTIDS/MIDS portion of the network design used for initial operations will normally be preplanned and selected from the JNL. The Link planner selects a JTIDS/MIDS network design from the JNL that best fits the operational scenario and best complements the other data links employed. The selection criteria includes such things as the numbers and types of JTIDS/MIDS-equipped participants that are available, enemy threat environment, LOS constraints, relay requirements, and the Electromagnetic Compatibility (EMC) requirements.

(1) Selecting a JTIDS/MIDS Network. There will likely be cases when the network design used for initial operations is not adequate for continued operations. Additionally, there will be instances during advanced planning for an operation or when an OPLAN is being developed that no design can be found in the JNL that satisfies the requirements. If there is no acceptable JTIDS/MIDS network design in the JNL, the Link planner needs to submit to the appropriate network design facility (for a joint or combined network) or a component NDF (for a single component network) a MIDS NDR for design of a new or modified network. This intermediate step will eventually result in a revised JNL being provided to the JFC by the JTIDS/MIDS Service Design Facility.

(2) Modifying a JTIDS/MIDS Network. The United States does not plan initially to have a capability to accomplish extensive on-line/real-time modifications to network designs. Some NATO nations plan to have the capability to be able to modify an existing JTIDS/MIDS network design and take the actions necessary via the OPTASK LINK and individual platform initialization action or over the air transmission of the changes to JTIDS/MIDS participants form a JTIDS/MIDS network management station with such a capability.

c. Generating a JTIDS/MIDS NDR. As indicated above, if there is no acceptable JTIDS/MIDS network design in the JNL, the Link Planner needs to submit to the appropriate network design facility (for a joint or combined

network) or a component NDF (for a single component network) a MIDS NDR for design of a new or modified network. Table D4-1 depicts the representative contents of a JTIDS/MIDS NDR. The actual NDR is contained in Annex A to Appendix D. The JNDT either identifies a network design in the existing JNL that satisfies the requirement or appoints a lead Service NDF to design a network. If the requesting command desires that a specific Service NDF design the network, the JNDT will appoint that NDF to design the network, if at all possible. Once the Service NDF designs a network to satisfy this design request, the JTIDS/MIDS JNDT incorporates the network design into the joint service Master JNL. The Service NDFs incorporate the new JTIDS/MIDS network design into the Service JNLs, prepare the NDLs for each involved Service JTIDS/MIDS platform, and distribute the revised Service JNL and Service NDLs. The JFC receives the revised JNL and proceeds to the next step in the process, applying the JNL network to the specific operation.

(1) In-Theater Design Capability. During contingency operations and selected major exercises, a Service NDF may augment the JFC with a JTIDS/MIDS network design team, consisting of one or two designers to provide an in-theater capability for design of JTIDS/MIDS networks. This team will be able to modify an existing network design or build a new network design. The procedures for generating NDLs in-theater for all S/A platforms and distributing them are still being developed.

(2) Applying Selected JTIDS/MIDS Network. The Link planner associates each operational unit/participant to the general types of participants (i.e., network participant identifier) specified in the design. The Link planner also specifies certain additional initialization parameters to tailor the network to specific requirements.

D4.1 General Net Parameters. Data that define the network structure and time slot assignments, along with basic JTIDS/MIDS terminal parameters common to all JUs, are stored in the JNL. Additional parameters required for network initialization shall be determined by the Link planner. The network identifier, JTIDS/MIDS terminal initialization parameters, and additional planning parameters are promulgated in the OPTASK LINK.

D4.1.1 Network Roles

a. Link 16 requires several roles to be performed by JUs. Functions assigned to a JU are entered by initialization or by the operator and may be changed during operation by the operator or the Link 16 Manager. Roles are listed below; those that require operator action on the platform are marked with an asterisk (*).

(1) Link 16 Manager (use OPTASK LINK Duty=Network Manager [NETMGR])(*).

(2) Standby Link 16 Manager (use OPTASK LINK Duty=STANDBY NETWORK MANAGER [STBYNETMGR])(*).

(3) Network Time Reference (NTR)(OPTASK LINK Duty=NTR).

(4) Initial Entry JTIDS/MIDS Unit (IEJU)(OPTASK LINK Duty=IEJU).

(5) Navigation Controller (NC)(OPTASK LINK Duty=NC).

(6) Link 16 Secondary Navigation Controller (SECNC)(Link Duty Code 822).

(7) Position Reference (PR)(OPTASK LINK Duty=POSREF).

(8) Primary User (PRU)(OPTASK LINK=use AMPN set).

(9) Secondary User (OPTASK LINK=use AMPN set).

b. These roles have been designed to ensure that Link 16 can be established and maintained in a long-term, dynamic environment. The roles of NTR, Primary Users and Secondary Users support network time synchronization. The roles of NC, SECNC, and PR support the JTIDS/MIDS RELNAV function. These roles are performed automatically by the JTIDS/MIDS terminal, with the operator only required to activate the appropriate function based upon direction from the Link planner via the OPTASK LINK message or upon direction from the Link 16 Manager by voice. Table D4-2 shows which of the synchronization and RELNAV roles can be performed simultaneously by a JTIDS/MIDS terminal.

D4.1.1.1 Link 16 Manager. The C2 JU assigned responsibility for initiating and administering the minute-by-minute operation of the Link 16 network is the Link 16 Manager. The Link 16 Manager is responsible to the ICO for all facets of operation that lead to successful, continuous data exchange. The Link 16 Manager's actions are described in paragraph 3.6.1 of this manual.

D4.1.1.2 Standby Link 16 Manager. When circumstances preclude the Link 16 Manager from discharging his duties, or when directed, the Standby Link 16 Manager should assume the responsibilities of Link 16 Manager.

Table D4-1. Representative Contents of a JTIDS/MIDS Network Design Request

JTIDS/MIDS Network Design Request

General Information:

1. Requestor (name, phone numbers, organization, address).
2. Projected use (operation, exercise, test; dates of projected use).
3. Requested delivery date.
4. Media for delivery of network design (load sheets, floppy disks, Modem Exchange Terminal Initialization [ETI] Program, E-mail).
5. Mailing address for delivery of network design.
6. Name and phone number of additional points of contact.

Specific Information:

1. Information exchange requirements (IERs) (depicted by requestor in a summary table).
   a. Network participants, number, and types of platforms.
   b. Position Reports (update rates for PPLI or P-Messages by platform).
   c. Surveillance (desired number of tracks/update rate by platform).
   d. Control (match C2 platforms and controlled assets).
   e. Mission Management.
   f. Fighter-to-Fighter (identify fighter target exchange by platform and update rates).
   g. EW.
   h. Voice.

2. Geographic disposition of forces (depicted by requestor in a rough, scaled drawing).
   a. Distances/scale in drawing.
   b. Locations of participants, orbit areas.
   c. LOS restrictions between participants (mountains, valleys, LOS obstruction).

3. General Network Information.
   a. Specify net entry transmitter and alternate(s).
   b. Specify how many different digital control subnets are required (designation of main net; dial-up for control, for fighter-to-fighter, for voice).
   c. Secure voice requirements (1 or 2 channels; 2.4 kbps, 16 kbps, or both).
   d. Jamming environment (none, low, medium, high).
   e. Interference protection constraints/pulse density restrictions (e.g., 40/20, 100/50, wartime).
   f. Crypto net requirements (e.g., separate crypto variable for specific information exchange).

Table D4-2. Simultaneous Link 16 Network Role Assignment

	NTR	IEJU	PR	NC	SECNC	PRU	SU
NTR	--	No	Yes	Yes	Yes	No	No
IEJU	No	--	Yes	Yes	Yes	Yes	No
PR	Yes	Yes	--	Yes	Yes	Yes	No
NC	Yes	Yes	Yes	--	No	Yes	No
SECNC	Yes	Yes	Yes	No	--	Yes	No
PRU	No	Yes	Yes	Yes	Yes	--	No
SU	No	No	No	No	No	No	--

LEGEND:
Yes = Can be assigned this combination of roles.
No = Cannot be assigned this combination of roles.

D4.1.1.3 JTIDS/MIDS Cryptonet Management

a. Cryptonet management is not performed by an individual assigned only to this task, but is a function of the Link 16 Manager. The responsibilities of cryptonet management are to provide sound cryptonet management practices by:

(1) Establishing procedures that are consistent with established COMSEC doctrine to minimize the exposure of sensitive operational information.

(2) Establishing procedures that provide for the most effective and secure use of the finite number of cryptokey memory positions in the Secure Data Unit (SDU).

(3) Establishing procedures that provide and maintain a relationship of cryptokeys to CVLLs by using short titles.

(4) Establishing procedures that provide effective methods of recovery from a security compromise that has resulted from a loss of a cryptokey such as a keyed terminal or a cryptokey device.

(5) Establishing a method of rekeying JTIDS/MIDS terminals after loss, suspected loss, or a change of cryptokey due to operational considerations.

(6) Advising the Link planner on selection of the network that provides for partitioning information into separate cryptonets based on the operational need-to-know and risk.

b. The Link 16 Manager is responsible for supporting the Link planner by ensuring the proper dissemination of instructions to all JUs for loading cryptokeys into the JTIDS/MIDS terminals. The Link 16 Manager is responsible for reviewing the assignments prepared by the Link planner and preparing the cryptokey usage guidance for inclusion in the OPTASK LINK message.

D4.1.1.4 NTR. Accurate time is of critical importance in the operation of JTIDS/MIDS. The time held by each JU must be synchronized to prevent mutual interference. This is done by designating one and only one JU as NTR. The NTR is assigned based on LOS considerations, survivability and availability. The NTR transmits on the Initial Entry NPG in addition to its participation in normal data exchange. As each new JU joins the network, it first synchronizes its time to the NTR by receiving messages on the Initial Entry NPG. Another suitable unit should be designated to replace the NTR if the NTR can no longer function. If a group of JUs transit out of LOS of the NTR, the Link 16 Manager should consider assigning the most appropriate unit as NTR to maintain network connectivity.

D4.1.1.5 IEJU. A JU entering the JTIDS/MIDS network that is beyond the LOS of the NTR may achieve synchronization using a secondary source termed an IEJU. The IEJU, once synchronized with the NTR, transmits Initial Entry messages on the Initial Entry NPG, echoing the NTR information. All JUs are capable of providing this service. Any number of IEJUs can be active at one time. All active relay JUs transmit the Initial Entry message. A terminal that is using an IEJU for net entry depends upon the time accuracy of the IEJU.

D4.1.1.6 NC. The NC establishes the relative grid coordinate system for Link 16, using the pre-defined grid origin and grid orientation. The grid origin must be made available to all network participants. The NC's relative grid position coordinates are error-free by definition. Other JUs align to the grid reported by the NC. See paragraph D4.1.1.8 for assignment criteria.

D4.1.1.7 SECNC. The SECNC must be able to exchange messages without relay with the NC. The SECNC and NC must have relative motion in order for the SECNC to assist in defining the grid.

D4.1.1.7.1 NC/SECNC Assignment Criteria. The criteria for assigning NC or SECNC are based on several factors: number of JUs to be assigned, mobility and relative motion, LOS communications, geometry between JUs, minimum range, and in some cases, quality of geodetic data. Relationships of these criteria are:

a. If only a single JU is to be assigned, it must be mobile, and must have significant relative motion that will create bearing drift observable by other JUs.

b. If two JUs are to be assigned:

(1) If both are fixed, Q_{pg} 15 allows both to be NC. If both are designated NC, there is no requirement for them to be in LOS. Positional accuracy is critical when more than one NC is designated. If either JU does not have Q_{pg} 15, the lesser Q_{pg} should be designated SECNC. Any NC/SECNC combination must be within LOS communications and must exchange link messages.

(2) If one is fixed and the other is mobile, or both are mobile: A NC/SECNC combination must be used when either JU is mobile. Either JU may be designated NC. Any NC/SECNC must be within LOS communications and exchange link messages.

c. If three or more JUs are to be assigned: All must be fixed land JUs and be designated NC only.

D4.1.1.7.2 Geometry Considerations and Range Factors Affecting Choice of NC/SECNC. Other factors to consider are the relative locations between NC(s) and SECNC and other JUs of the network. The purpose in having more than one NC or NC/SECNC combination is to create bearing separation so other JUs can calculate grid positions accurately in two axes. An ideal situation would permit each user to observe the NC(s) or NC/SECNC with approximately a 90-degree angular spacing. There is a minimum range consideration for NC/SECNC combinations. If the NC/SECNCs are very close it reduces the bearing separation observable from other JUs. NC/SECNCs that are located in close proximity will also reduce their ability to accurately define the grid orientation.

D4.1.1.8 PR. PRs provide a stable geodetic reference for other JUs to use in determining their own geodetic position via JTIDS/MIDS RELNAV. PRs also assist the NC(s) in aligning the relative grid with the geodetic grid. Airborne platforms are not good candidates as PRs. The criteria for assigning a PR are based on the JU's ability to accurately fix its geodetic position. A JU having independently derived knowledge of the geodetic position (external to JTIDS/MIDS RELNAV) to an accuracy of 50 feet should be designated as a PR. There is no limit to the number of PRs that can be assigned. Because PRs know their geodetic position accurately, they do not attempt to update their position from JTIDS/MIDS RELNAV. Other JUs, however, use the PR's geodetic reports to increase the accuracy of their own reported geodetic position. When two or

more PRs are available other JUs can upgrade their geodetic accuracy. PRs can aid the NC in refining the accuracy of the relative grid, although the absence of PR support does not significantly degrade the grid. The disposition of force assets is not a consideration in assigning a PR. However, favorable geometry enhances a JU's ability to upgrade its position based on the PRs. Favorable geometry in this context means a JU is able to observe two or more PRs with bearing separation of about 90 degrees. A JU satisfying both PR and NC criteria could perform both roles simultaneously.

D4.1.1.9 Primary and Secondary Users. The PR, NC, IEJU, and SECNC are automatically Primary Users. All other JUs, except the NTR, are designated as Primary or Secondary Users. The Primary or Secondary User designation determines how a JU achieves and maintains fine synchronization by definition. If more users are in the network than it is designed for, some must be designated as Secondary Users. Each network design provides initialization recommendations on Primary/Secondary User status where appropriate.

D4.1.1.10 PRU. PRUs routinely transmit RTT messages to achieve and maintain fine synchronization. Any JU can be designated a PRU unless it is operating in Data Silent.

D4.1.1.11 Secondary User. Secondary Users primarily use passive techniques to synchronize with the network. Secondary Users process messages from other JUs to maintain synchronization; however, they may occasionally transmit RTT messages to aid the process. Data Silent JUs automatically become Secondary Users and do not transmit RTT messages.

D4.1.1.12 Relay. During Pre-mission Planning, the Link planners must take into consideration the relay requirements of the mission and choose a network that will satisfy these requirements. The communications requirements of JUs and their location relative to other JUs in the network, determine relay needs. The relay capacity must be designed into the network at the design facility. No relay can exist without this prior design action. If relay is not currently needed but will be required at some point, a suitable network with relay capacity should be selected; otherwise the JUs will need to switch to a new network when relay is needed. This switching may be cumbersome and could disrupt the operation.

D4.1.1.13 FJU. An FJU may be designated to perform data forwarding in any multi-link operation involving Link 16, Link 11 and/or Link 11B units. Selected JUs shall be C^2 JUs with included software capabilities to perform data forwarding. When multiple FJUs are available, FJUs should be selected according to best location and LOS capability, survivability and relative

permanence at the selected location. An FJUB should be selected for each Link 11B interface and one FJUA for each Link 11 network.

D4.1.2 Transmit Modes. There are three operator-selectable transmit modes for a JU: Normal, Polling, and Data Silent. The selected mode determines the conditions under which a JU may transmit messages. The selected transmit mode applies to all nets and NPGs on which the JU is operating. JTIDS/MIDS voice transmissions can be conducted in all modes.

D4.1.2.1 Normal Mode. In the Normal mode, a JU transmits messages during assigned time slots and receives messages in all time slots not assigned for transmission.

D4.1.2.2 Polling Mode. In the Polling mode, a JU only transmits Link 16 formatted message when required for synchronization or testing purposes, in response to a PPLI interrogation, or when an operator acknowledgement or machine receipt is required. A JU can transmit unformatted digital JTIDS/MIDS voice messages in the Polling mode but does not relay either JTIDS/MIDS voice or Link 16 messages.

D4.1.2.3 Data Silent Mode. A JU does not transmit any Link 16 messages while in the Data Silent mode, except that when entering the mode it transmits a message of intent to go “Data Silent”. While in Data Silent, Fine Sync is achieved and maintained passively. A JU can transmit and receive unformatted digital voice messages and receive Link 16 messages while in the Data Silent mode. The Data Silent mode is not an EMCON condition, because the JTIDS/MIDS terminal is capable of transmitting JTIDS/MIDS voice messages in Data Silent. A JU operating in the Data Silent mode does not relay Link 16 messages or unformatted digital JTIDS/MIDS voice transmissions. The Data Silent mode can be used when no transmission other than JTIDS/MIDS voice is desired.

D4.1.3 Test Mode. This mode is not used operationally.

D4.1.4 Communications Modes. While there are three communications modes for a JTIDS/MIDS network only Mode 1 will be used operationally. Mode 1 is the most secure, using frequency hopping, is encrypted and can be multi-netted. The communications mode is set at network design. It can be modified during initialization but not during network operation. All JUs in a JTIDS/MIDS network must use the same mode. Modes 2 and 4 are authorized only for test purposes. Mode 2 is encrypted and operates on a single net at a fixed frequency of 969 MHz. Mode 4 is also transmitted at 969 MHz but is not

encrypted. The modes and their characteristics are shown in Table D4-3. Do not use Mode 4 for passing tactical data.

D4.1.5 Range Mode. The range mode is selectable as Normal (300 nm) or Extended Range (500 nm). The extended mode increases propagation guard time of a time slot by decreasing the AJ features and the data capacity. The range mode is set at network design. It can only be modified during initialization. All JUs in the JTIDS/MIDS network must be set to the same range mode.

Table D4-3. Communications Modes

Communications Mode	Multiple Nets/AJ Capability	Data Encryption Capability
1 (Operational Use)	Yes	Yes
2 (Test Only)	No/Reduced AJ	Yes
3 (Not used)	Not used	Not used
4 (Test only)	No	No

D4.1.6 External Time Reference. The Class 2 terminal is capable of using an External Time Reference (ETR) as a synchronization source. Normally, this will be a source of accurate time, such as GPS, located on the same platform as the terminal. In order for the terminal to actually use the ETR, it must be enabled to use the ETR (via initialization data), and the time and quality information must be received by the terminal from the ETR equipment. If the use of ETR is not enabled, the terminal will not use the ETR as a synchronization source, even if the timing pulses and related information are being provided by the ETR equipment. The use of an ETR applies to the entire network and not to individual network participants. The Class 1 terminal cannot use an ETR.

D4.1.7 Reference Grid Origin. The Reference Grid Origin is the same as the relative grid origin as specified in D4.1.1.6 through D4.1.1.8. This initialization parameter shall be specified in the OPTASK LINK in the REFPOINT GRIDORG field. This parameter must be initialized properly by all JUs. Failure to initialize the identical parameter degrades the Relative Grid portion of JTIDS/MIDS RELNAV. See Relative navigation below for rules defining the grid origin.

D4.1.8 JTIDS/MIDS RELNAV. JTIDS/MIDS terminals incorporate two basic coordinate systems: the standard geodetic system that uses latitude and longitude, and a relative rectilinear planar grid system tangent to the earth's surface at an arbitrary grid origin. The JTIDS/MIDS RELNAV function can operate simultaneously in both coordinate systems. A shift in the geographic area of interest may necessitate that the NC redefines the origin of the relative

grid. The NC should define the origin of the relative grid after consulting with the ICO to determine which geodetic coordinates should be used for grid origin. The grid origin should normally be a point at the center of the region of activity. Due to limitations of the size of the fields for transmitting relative grid coordinates, the JTIDS/MIDS RELNAV function generates valid data only if network participants are 1024 or fewer miles from the grid origin.

D4.2 COMSEC

a. The establishment of cryptonets is an integral part of Network Design and Pre-mission Planning. Manual initialization provides the JTIDS/MIDS terminal with the cryptokeys necessary for its planned employment. The cryptokeys are associated with the 127 available CVLLs for use as:

(1) Service interoperability keys.

(2) Warfare area interoperability keys.

(3) Theater interoperability keys.

(4) National interoperability keys.

(5) International interoperability keys.

(6) Default and contingency keys.

b. The Link 16 Manager assigns JUs to a cryptonet based on network design. Only the TRANSEC cryptokey is required to initially enter or establish the JTIDS/MIDS network. Once synchronization is achieved, the MSEC cryptokey is required to exchange information on Link 16. However, in the Partitioned Variable mode any JU can relay any JTIDS/MIDS message even though the JU does not hold the same MSEC cryptokey. A JTIDS/MIDS terminal participates in only those cryptonets for which it was initialized until it is rekeyed with replacement cryptokeys. During rekeying, the terminal shall be placed in the Standby mode.

c. An initialization load designates the CVLL(s) to be used in each time slot block. The initialization load also includes the Cryptoperiod Designator (CPD) for each CVLL to reflect which cryptokeys in the Secure Data Unit (SDU) are for the present cryptoperiod and which are for the next cryptoperiod.

d. Cryptokeys are distributed via the COMSEC material control system, as specified by the communications/COMSEC plan(s), and are stored in a safe

or vault by the COMSEC custodian. The COMSEC custodian is responsible for preparing the cryptokey initialization load as specified in the OPTASK LINK. A cryptokey load specialist loads the SDUs of the JUs specified in the OPTASK LINK.

D4.3 JTIDS/MIDS World Wide Transmission Restrictions and Deconfliction Procedures. Each country regulates the use of radio frequencies within its borders to minimize mutual interference. Regulations exist concerning JTIDS/MIDS transmissions because JTIDS/MIDS operates in the frequency band used for world wide aircraft radio navigation. The Link planner needs to determine the appropriate EMC features for all JTIDS/MIDS terminals in addition to complying with JTIDS/MIDS transmission restrictions and deconfliction procedures. Policies for deconflicting JTIDS/MIDS operations within the US and its territories are contained in CJCSI 6232.01 (series).

D4.3.1 US Civil Restrictions on JTIDS/MIDS Transmissions. JTIDS/MIDS users and Link Planners should verify, through the respective frequency manager chain of command for the area of operations, what the actual restrictions are for their respective operations area. The restrictions contained in a specific frequency assignment for a particular area always take precedence. Operational requirements above these restrictions are possible, but must be submitted with sufficient justification and are handled on a case-by-case basis.

D4.3.2 EMC Features. JTIDS/MIDS terminals incorporate both hardware and software controls known as EMC features to conform with the national frequency allocation constraints. These features are used to ensure minimum or no interference with IFF (including military IFF) and Air Traffic Control Radar Beacon Systems (ATCRBS) and with other navigation systems such as Tactical Aid to Navigation/Distance Measuring Equipment (TACAN/DME). The EMC constraints are an important factor in the network design process, and the network design must be developed according to the applicable EMC constraints specified in the frequency assignment for the area of operation. The network EMC features are controlled by IPF override settings in the terminal.

D4.3.3 Frequency Assignments. Prior to transmitting JTIDS/MIDS, an approved frequency assignment or clearance as described in paragraph D4.3.3.1 must be granted. Frequency assignments can take anywhere from 90 to 120 days depending on the area of the world operations will be conducted in and whether a permanent frequency assignment exists. Most countries have established procedures for requesting frequency assignments as well as established restrictions. Typically all restrictions concerning JTIDS/MIDS operations associated with the frequency approval will be contained in the message or letter response to the requester. If a permanent frequency

assignment does not exist or the current assignment is too restrictive, the Link planner must submit a request for a frequency assignment with sufficient information to justify a relaxation/waiver that will permit the planned operations.

D4.3.3.1 Frequency Assignment Process. All requests for frequency assignments are prepared in a standard GENADMIN, Message Text Formatting (MTF) message, and must contain as much information as possible to justify the need but should not contain any classified information. The following is the minimum information required.

a. Area of Operations (e.g.,W-291,within 300nm of 323200N/1183000W).

b. Participating platforms (e.g., DDG, CVN, E-2).

c. Stop Buzzer POC (Include Name, Rank (if military) and 24 hour phone number).

d. Time Period of Operations (e.g., 061300ZJAN91 TO 062300ZJAN91).

e. Maximum Time Slot Duty Factor (TSDF) (e.g., 100/50).

f. Network to be used (e.g., JNL 198, network 26).

g. Crypto (e.g., AMST 264).

h. Justification (Must provide strong justification for requests that exceed current restrictions).

NOTE: Link planners requiring assistance in selecting an appropriate network or calculating actual TSDF for an operation, exercise or test should contact their service specific Network Design Facility (NDF).

D4.3.3.1.1 Procedures for Submitting Frequency Assignment Requests Within US and Possessions

a. US Navy and Marine Corps will submit frequency requests to the Regional Area Frequency Coordinator with information copies to the appropriate combatant commander (CINCPACFLT/CINCLANTFLT), local deconfliction coordinator (GAAC) and the Navy Electromagnetic Spectrum Center (NAVEMSCEN).

b. US Air Force will submit frequency requests to the installation spectrum manager.

c. US Army will submit frequency requests to the post frequency manager.

d. Visiting non-US JTIDS/MIDS platforms will submit frequency requests though their US DOD host.

D4.3.3.1.2 Procedures for Submitting Frequency Assignment Requests Outside US and Possessions. Frequency requests for operations outside the US & Possessions (US & P) will be submitted to the commander of the Area of Responsibility (AOR) as indicated in Table D4-5 below.

D4.3.4 JTIDS/MIDS Deconfliction Procedures for the United States and Possessions. All JTIDS/MIDS operations, including tests and evaluations, within 200 nautical miles of the US & P require deconfliction prior to transmitting. CJCSI 6232.01A mandates the establishment of the JTIDS/MIDS Deconfliction Authority and Service designated Deconfliction Coordinator for all areas within 200nm of the US & P. Service designated Deconfliction coordinators schedule JTIDS/MIDS operations within a geographic area encompassing one or more frequency assignment authorization areas. JTIDS/MIDS operations must be logged on the deconfliction server with the time, location and level of JTIDS/MIDS activity. The US Navy's Geographic Area Assignment Coordinator (GAAC) performs this function for their frequency assignments and individual units of other services will coordinate JTIDS/MIDS activity on the server. CJCS Instruction 6232.01A mandates that all JTIDS/MIDS activity will be coordinated through the JTIDS/MIDS deconfliction server. This server is located at the JID, Ft. McPherson, GA and can be accessed via the Internet at: http://WWW.FORSCOM.ARMY.MIL/INTEROP; POC JID Pulse Deconfliction Server; COMM: (404) 464-3136/4611; DSN: 367-3136; PLAD CDFORSCOM FT MCPHERSON GA//AFOP-JT. The Deconfliction Authority is defined as the senior joint operational commander, at the lowest level of command, common to all units operating JTIDS/MIDS within a common geographic area during the same time period. The following list contains all current JTIDS/MIDS deconfliction coordinators within US&P:

a. CINCPACFLT AOR:

FACSFAC San Diego
POC: GAAC, (619) 553-1742/4742
DSN: 735-1742/4742
PLAD: FACSFAC SAN DIEGO CA//N3//

Responsible for the Californian littoral area extending 200nm seaward.

FACSFAC Pearl Harbor
POC: GAAC, COMM (808) 472-7333/32/30
PLAD: FACSFAC PEARL HARBOR HI//N3/N33//
Responsible for all areas within 200nm of Hawaiian Islands.

NAVCOMTELSTA GUAM
POC: GAAC - N351, (671) 355-5260
DSN 315 355-5260
PLAD: NAVCOMTELSTA GUAM//N351//
Responsible for all areas within 200nm of Guam.

NAVSHIPYD Puget Sound
POC: GAAC - Mr. Ronald Cammers, (360) 476-6625
PLAD: NAVSHIPYD PUGET SOUND WA//1125.2//
Responsible for the Puget Sound littoral area extending 200nm seaward.

NAS Fallon
POC: GAAC - Mr. Randy Shepherd, (702) 426-3778
PLAD: NAVSTKAIRWARCEN FALLON NV//N8C1//
Responsible for a 200nm area originating at 392602N2/1183280W3.

MAWTS One
POC: GAAC, (520) 341-3679/23
PLAD: MAWTS ONE YUMA AZ//C3//
Responsible for the area within the following points: Mexican Border/11615W4, 3335N4/11615W4, 3335N4/11330W8, 3300N6/11330W8, 3300N6/11130W6, Mexican border/11130W6. AOR includes extreme southeastern California and southwest Arizona ranges. (AFC).

b. CINCLANTFLT AOR:

FACSFAC Vacapes
POC: GAAC - N32, (757) 433-1220
DSN 433-1220
PLAD: FACSFAC VACAPES VA//N32//
Responsible for the following areas: W-50, W-72, W-102 Machais ME, W-103Casco Bay Me, W-104 Boston MA, W-105 Narragansett RI, W-106 Patchogue NY, W-107 Atlantic City NJ, W-108 Chincotegue VA, W-110 Elizabeth City NC, W-122 Cherry Point NC, W-386, W-387, W-506 Nantucket Shoals MA.

FACSFAC Jacksonville
POC: GAAC - N32, (904) 542-2025
DSN 542-2025
PLAD: FACSFAC JACKSONVILLE FL//N31//
Responsible for the following areas: W-132/133 Charleston SC, W-134 Beaufort SC, W-151 Valpariso FL, W-155 Pensacola FL, W-157C Fernandina FL, W-158 Mayport FL, W-159 Jacksonville FL, W-168 Tampa FL, W-174 Key West FL, W-177 Myrtle Beach SC, W-453 Gulfport MS, W-456 Key West FL, W-470 Panama City FL.

AFWTF Puerto Rico
POC: GAAC, (787) 865-3319/5227
DSN 865-3319/5227
PLAD: AFWTF Roosevelt Roads//96/92//

Responsible for the following areas: Atlantic Fleet Weapons Ranges, North/South PROA, AFWTF OPAREAS 1 – 4, W-601, W-237A/B, W-460A/B.

c. USN Operations planned for areas not specifically designated to a coordinator will contact the coordinator whose AOR is closest to the area of anticipated operations. Additional information and support may be obtained through the Joint Frequency Management Office (JFMOPAC/LANT) and Area Frequency Coordinators (AFC).

d. Air Force/Army JTIDS/MIDS units will have designated deconfliction coordinators.

D5. Network Initiation. This section contains procedures required to initialize the JTIDS/MIDS terminal and the JTIDS/MIDS network. These procedures are performed at the unit level. Detailed equipment operating procedures can be found in equipment manuals.

a. JTIDS/MIDS Terminal NDL. The OPTASK LINK data resulting from the network selection process is used by individual units or support facilities to develop the NDL for each JU. The following list of data is defined in the NDL:

(1) JTIDS/MIDS Network Identifier.

(2) Stacked net, multinet designation.

(3) Access mode.

(4) Joint Network PGs.

Table D4-5. PLADS for Requesting Temporary Frequency Assignments Outside US & Possessions

AOR	BRANCH OF SERVICE	ACTION:	PLAIN LANGUAGE ADDRESS INFO:
United States Atlantic Command (USACOM)	ALL	JFMO LANT//NORFOLK VA//	SHAPE//DATALINK MANAGEMENT AND INTEROPERABILITY CELL/SHOPC// NAVEMSCEN WASHINGTON DC//323/00J/00M//
European Command (EUCOM)	ARMY	CINCUSAREUR HEIDELBERG GE// AEAGC-0-C2/AEADC/AEAIM//	SHAPE//DATALINK MANAGEMENT AND INTEROPERABILITY CELL/SHOPC// USCINCEUR VAIHINGEN GE//ECJ6-F/ JFMOEUR// USCINCEUR FMFO BRUSSELS BE// JFMO LANT NORFOLK VA// NAVEMSCEN WASHINGTON DC//323/00J/00M//
European Command (EUCOM)	NAVY MARINE CORPS	CINCUSNAVEUR LONDON UK//N6/ N631/N632/N613// COMSIXTHFLT//N3/N312/N6/N62 //	SHAPE//DATALINK MANAGEMENT AND INTEROPERABILITY CELL/SHOPC// USCINCEUR VAIHINGEN GE//ECJ6-F/ JFMOEUR// USCINCEUR FMFO BRUSSELS BE// JFMO LANT NORFOLK VA// NAVEMSCEN WASHINGTON DC//323/00J/00M//

Table D4-5. PLADS for Requesting Temporary Frequency Assignments Outside US & Possessions (Continued)

AOR	BRANCH OF SERVICE	ACTION:	PLAN LANGUAGE ADDRESS INFO:
European Command (EUCOM)	AIR FORCE	HQ USAF RAMSTEIN AB GE//SCC/DOR/DOY//	SHAPE//DATALINK MANAGEMENT AND INTEROPERABILITY CELL/SHOPC// USCINCUER VAIHINGEN GE//ECJ6-F/JFMOEUR// USCINCUER FMFO BRUSSELS BE// JFMO LANT NORFOLK VA// NAVEMSCEN WASHINGTON DC//323/00J/00M//
Central Command (EUCOM)	ALL	USCINCCENT MACDILL AFB FL//CCJ6-COF// JTF-SWA//J6/JFMO// CDR COALITION TASK FORCE CAMP DOHA KUWAIT//C6//	COMUSARCENT FT MCPHERSON GA//G6/AFRD-IM-PO// USCENTAF SHAW AFB SC//A6-SC/A6-SCX// COMUSNAVCENT//N6A/N61B// COMSOCCENT MACDILL AFB FL//SOCJ6// COMUSMARCENT//G6// CGI MEF//G-6// NAVEMSCEN WASHINGTON DC//323/00J/00M//
Pacific Command (PACOM)	ALL	USCINCPAC HONOLULU HI//J6//	JFMO PAC SAN DIEGO CA// NAVEMSCEN WASHINGTON DC//323.00J/00M// HQ PACAF HICKAM AFB HI//SCMTR//
Southern Command (SOUTHCOM)	ALL	USCINCSOUTH//	NAVEMSCEN WASHINGTON DC//323/00J/00M// HQ 12AF DAVIS-MONTHAN AFB AZ//SCXPF//

(5) Recurrence Rates.

(6) Relays.

(7) JTIDS/MIDS Voice Nets.

(8) Message Packing Structure.

(9) Default Net, Default MSEC CVLL, and Default TRANSEC CVLL.

(10) Cryptographic netting information.

(11) IPF Override.

b. The operator must determine which data in the OPTASK LINK are applicable to own platform and enter the appropriate values at the Mission Support System (MSS). Other platform-unique parameters, such as time of day or present position, must be determined locally at the platform at the time of initialization load. Other information pertaining to overall network operations may be specified in the OPORD or in a pre-mission briefing.

D5.1 System Initialization. System initialization involves the loading of specific initialization parameters into the JTIDS/MIDS terminal in order to program it to operate in a desired fashion. The terminal retains in memory a set of default values that if no other instructions are received are used by the terminal. In many cases, these default values never change. Other parameters, such as the NPG assignments, reflect current operational requirements as determined during pre-mission planning. The procedures for loading the initialization data into each JU are dependent upon system's design. System initialization parameters that may need to be tailored on a specific JU are identified below. The entry of these initialization parameters is as automated as possible in the non C2 JUs.

a. JU Number. A track number is assigned to the JU for use as its Address for Link 16 operations, and for Link 11/11B operations if so equipped. A JU uses the same Address on all directly interfaced digital data links on which it operates.

b. Geodetic Position and Quality. This parameter identifies the geodetic position of the JU at the time of Link 16 entry and the estimated accuracy of that position.

c. System Time and Quality. This parameter contains the current value of system time and the estimated accuracy of the time value.

d. NPGs. This parameter indicates those NPGs to be activated following Link 16 entry. This parameter permits changing the net number of each available NPG.

e. PRU/Secondary User Designation. This parameter designates the method that a JU is to use to attain fine synchronization. PRUs use the Active method. Secondary Users use the Passive method. The parameter is automatically set to PRU if the JU is selected as the NC, SECNC, or PR.

f. Communications Management Assignments. This parameter designates the JU to function as the NTR, IEJU, NC/SECNC, and/or PR.

g. Flight Leader Designation. This parameter allows designation of the JU as the Flight Leader.

D5.2 Link 16 Network Entry. Link 16 network entry is the process of establishing time synchronization among all JUs in a network. One JU is assigned as the NTR whose task is to establish network time. All JTIDS/MIDS terminals synchronize to network time automatically based on the reception of messages directly from the NTR or an IEJUs.

D5.2.1 Designated NTR. The Link 16 network is established by the NTR. The NTR is the first JU to transmit on the network. There is only one NTR in a Link 16 network. The NTR is initialized with cryptokeys and time during the initialization process. The operator may enter a time value, or time may be taken from the terminal's embedded 30-day chronometer, or the value is automatically received from an external time standard. The NTR's transmit time slots are assigned during terminal initialization. Once time slots are assigned and the terminal is placed in a transmit mode, messages may be sent, thus establishing the network.

D5.2.2 Non-NTR JU Entry. The NTR begins the synchronization process with the transmission of Net Entry messages on the Initial Entry NPG. These messages are received by other JTIDS/MIDS terminals that are trying to join the Link 16 network. The operator must enter time as accurately as possible, if the Link 16 terminal chronometer is not operating. Each JU then automatically achieves coarse synchronization to the timing of the Initial Entry message transmitted by the NTR, an active relay terminal, or an IEJU terminal. The Initial Entry message is never relayed. After achieving coarse synchronization and prior to transmitting operational data messages, the

terminal must achieve fine synchronization. Fine synchronization is achieved and maintained automatically. The entire synchronization process can be accomplished while the terminal being synchronized is in the Data Silence mode. IEJUs transmit Initial Entry messages only after achieving fine synchronization. Once fine synchronization is achieved, the terminal automatically begins transmitting and receiving data on the NPGs activated by its NDL. Figure D-4 shows the Link 16 network entry process in flowchart form

D5.3 Crypto Initialization Process. Prior to commencing JTIDS/MIDS operations, each JU must have the SDU of its JTIDS/MIDS terminal initialized with the appropriate cryptokeys.

D6. Network Control. Operational control consists of the network management activities required to maintain successful communications on Link 16. The Link 16 Manager is responsible for monitoring force composition and geometry and for maintaining the proper network configuration. Most functions critical to system operation are maintained by the JTIDS/MIDS terminal, with no operator action required. While many functions are automated, the operator has the option of intervening throughout operations to satisfy his own communications requirements.

D6.1 Network Maintenance Functions

a. Network maintenance requires real-time actions to preserve synchronization and connectivity in a dynamic operational environment where NPGs are being activated and deactivated and JUs are entering and exiting the network.

b. Most surface and land C2 JUs have the capability to perform all functions specified in this section. Most air C2 JUs have the capability to perform all functions except Link 16 Manager; however, air C2 JUs should normally not be assigned as NTR or PR. Non C2 JUs have the capability only to act as participating JUs on NPGs. Network maintenance actions and procedures to assume network management functions are described in the following paragraphs.

D6.1.1 Link 16 Manager. The Link 16 Manager shall monitor the assigned NTR and be responsible for maintaining sufficient IEJUs to support net entry. Additionally, the Link 16 Manager shall assume, delegate, or make provisions for the assignment of any functions such as NC or PR that are associated with the network. The monitoring of relays requires Link 16 Manager actions.

Usually a Standby Link 16 Manager is designated at Pre-mission Planning. Only the CJTF or ICO can assign another JU to function as Link 16 Manager.

D6.1.2 NTR. Once a synchronized JTIDS/MIDS network is established, maintenance of synchronization is automatic. Even with the loss of the NTR, the time value in terminals already in fine synchronization permits continued communication for up to 3 hours. However, without an NTR, terminals wishing to enter/re-enter the network are not able to synchronize. Therefore, a replacement NTR must be activated. Care must be taken to ensure that only one NTR is active. When directing transfer of the NTR function from one JU to another, the Link 16 Manager shall ensure that each JU complies with the activation/ deactivation assignment. A JU designated NTR transmits Initial Entry messages automatically. Positive operator action is required to prevent transmission of those messages. If the operator selects other than the normal transmit mode while designated NTR, an alert is generated.

D6.1.3 IEJU. IEJUs cannot function without an NTR. C2 JUs can be directed to activate or deactivate the IEJU function at any time. Non C2 JUs can only be designated as an IEJU prior to takeoff.

D6.2 Subscriber Functions

a. Initialization of NPGs by Message. JUs automatically accept and process time slot assignments if the terminal is operating in the normal transmit mode and has achieved fine synchronization.

b. Net Number Selection. The operator can, by switch action, select a desired net number. The operator can select a JTIDS/MIDS voice net, air control channel, and fighter-to-fighter net.

c. Platform Indicators. A transmitting JU may designate its current situation as any of several conditions:

(1) Bail Out. The aircrew has left an aircraft while airborne. This indicator is automatically set when the ejection seat leaves the aircraft.

(2) Flight Leader. The flight leader's aircraft.

(3) Airborne. The transmitting JU is an airborne JU (permanently activated on carrier-based aircraft, even when on the flight deck or land).

d. Change Transmit Mode. Transmit mode changes are selectable only by operator action. When the operator selects a transmit mode change, the

transmit mode is changed for all nets on which the JTIDS/MIDS terminal is operating. When a JU's transmit mode is changed to Data Silent, that JU automatically transmits a Network Participation Status (NPS) report of Data Silent on the PPLI NPG prior to ceasing transmission. When such a message is received from a JU performing an assigned user role, the Network Manager is alerted. The receive-only limitation of the Data Silent Mode applies only to fixed-format messages; the terminal is still able to transmit JTIDS/MIDS voice messages in the Data Silent mode.

e. NPS. Each JU automatically reports its NPS on the PPLI NPG. The NPS is available for display at any other surface JU. The Link 16 Manager can determine each individual JU status by monitoring the network participation and active relay statuses for each JU. The Network Manager can use this information to effectively assign relay duties and other communication management functions as shown in Table D6-1 to the various JUs. The following statuses are indicated in the PPLI messages:

(1) Active. The JU is operating in the normal transmit mode, is in fine synchronization, and is capable of exchanging messages on Link 16. JUs must be in Active status to function as NTR, NC, SECNC, PR, IEJU, and relay.

(2) Inactive. A JU has ceased transmission on Link 16. Inactive terminals cannot be used for JTIDS/MIDS voice, data exchange, or relay. For a planned terminal inactivation, a JU reports that it is Inactive in the last PPLI message sent before going inactive. A JU is also automatically considered Inactive if a PPLI message has not been received from it for 60 seconds.

(a) Changing to Inactive Status. A JU is required to set its NPS to Inactive immediately prior to leaving Link 16 on a planned basis. JUs performing functions critical to network maintenance shall inform the Link 16 Manager by voice prior to leaving the network.

(b) Return to Active Status. A JU shall return to Active status after leaving the network (terminal off or loss of fine synchronization) by following the JTIDS/MIDS network entry procedure. A JU automatically returns to Active status from the Data Silent mode, the Polling mode, loss of fine synchronization, TDS Failure, Received high Message Error Rate, Transmission Failure, Out of Range/Masked, or Receiver Failure by setting the NPS to Active in its PPLI messages.

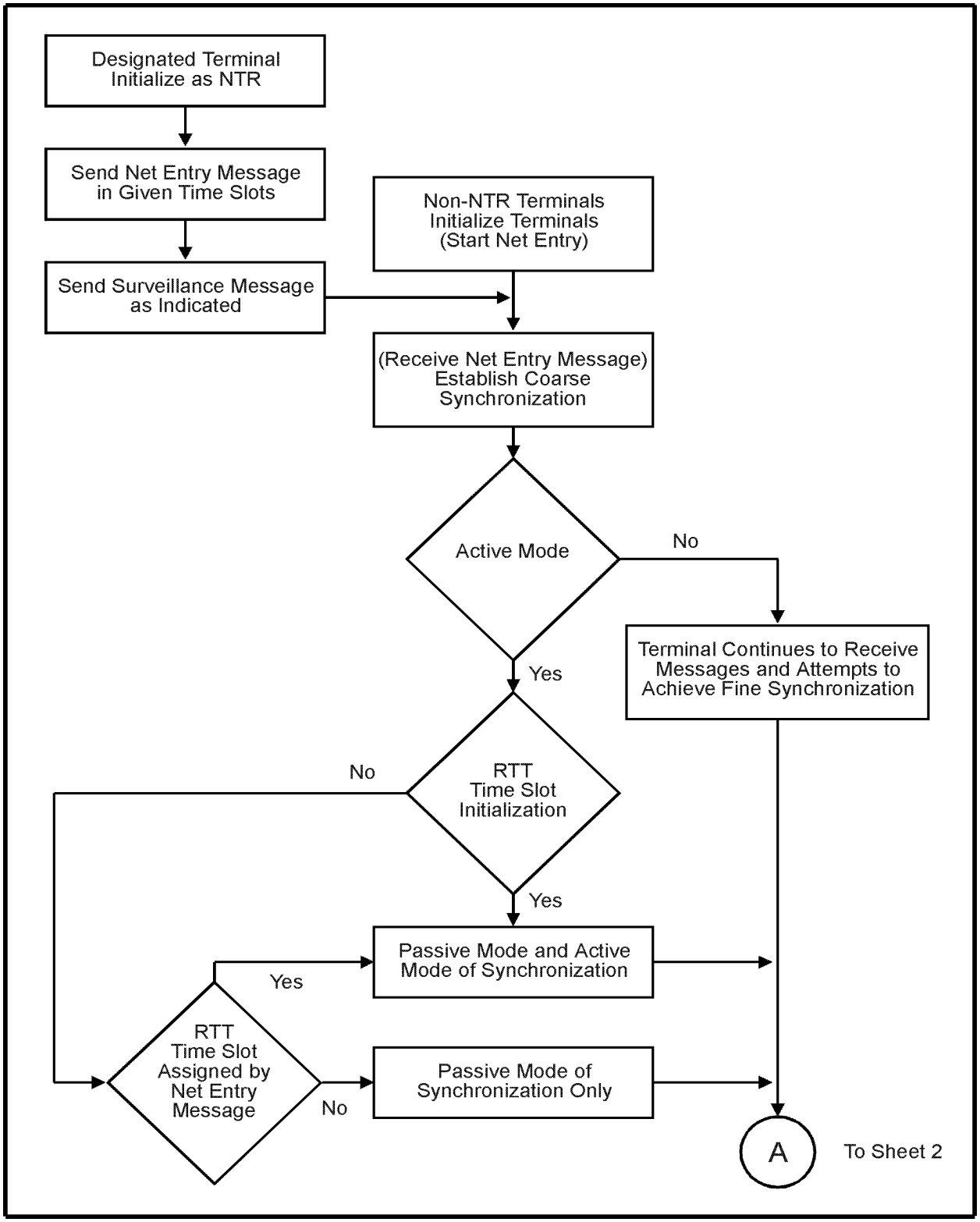

Figure D-4. Link 16 Network Entry Process (Sheet 1 of 2)

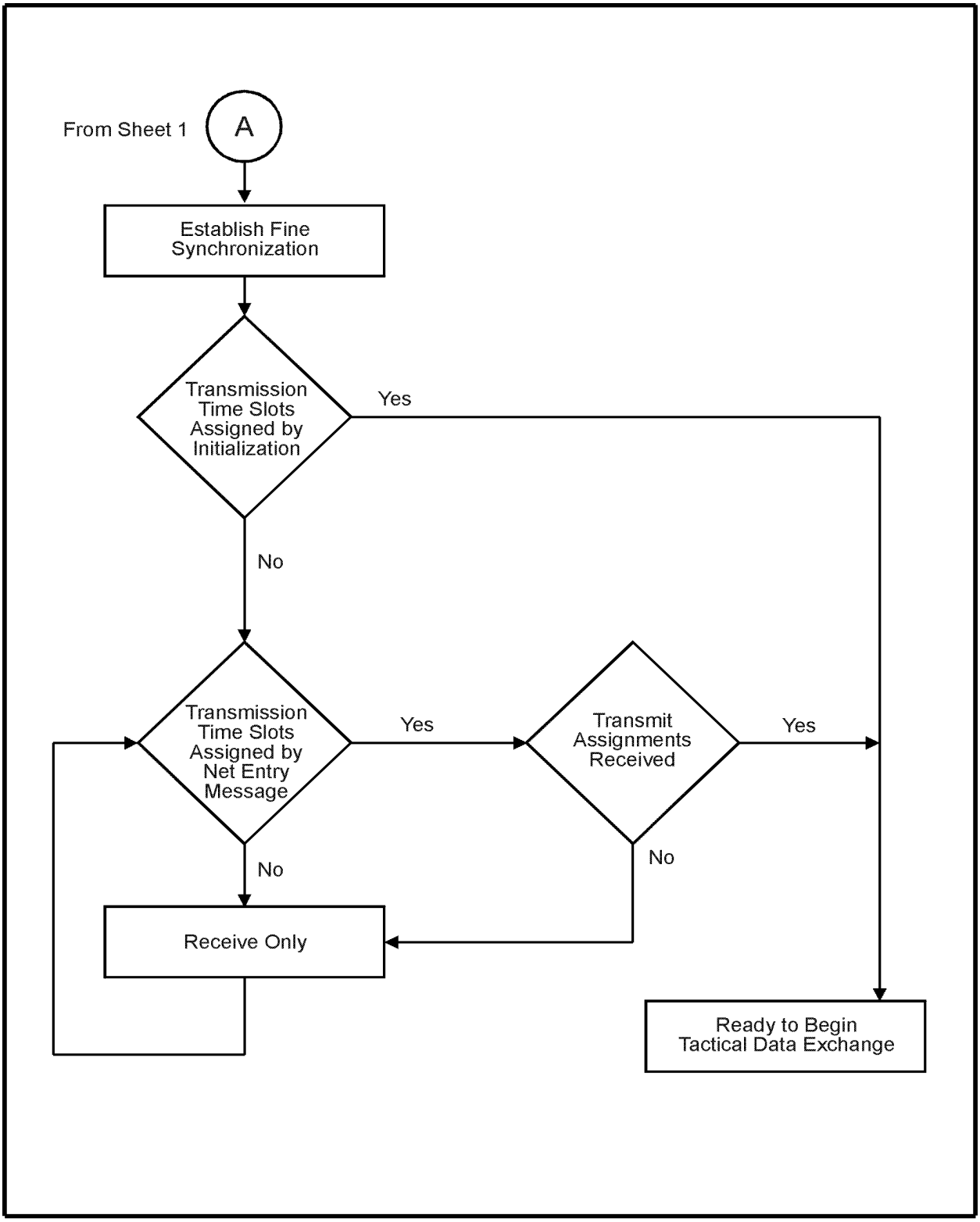

Figure D-4. Link 16 Network Entry Process (Sheet 2 of 2)

(3) Limited Status. A JU is considered to be in Limited status when its NPS is any of those listed below. The decision on retention of time slots shall be an operator decision. If the operator no longer requires transmit assignments, the Link 16 Manager should be notified by voice. Functions performed in limited status in each of the modes is shown in Table D6-2. The impacts of changing from Active to Limited Status, and from Limited to Active Status, are summarized in Tables D6-3 and D6-4, respectively.

(a) Data Silent Mode. The JU has elected only to receive messages and not to transmit data messages. This limited status is reported only once. The terminal is capable of transmitting JTIDS/MIDS voice messages in the Data Silent mode.

(b) High Error Rate. A high error rate of received messages can be caused by a number of conditions, including jamming. The NPS is automatically set by the terminal to High Error Rate when the ratio of messages received with error to total messages received exceeds 10 percent.

(c) No Initial Entry Message Being Received. Some causes of no Initial Entry message being received are receiver failure, being out of range, or being out of LOS. When a Initial Entry message has not been received for 120 seconds, the operator is alerted and the NPS is set to “No Initial Entry Message Being Received” in the JU's PPLI messages. Upon being alerted of this NPS, the operator should attempt to locate and resolve the problem.

(d) TDS Failure. The terminal can no longer communicate with its host TDS.

(e) Polling Mode. The terminal transmits messages only when specific responses are required.

D6.3 Maintenance of System Time. Network time is based on GPS derived UTC. Network time is maintained by the JU performing the function of NTR. Time is maintained on the NTR JU's terminal clock and requires no operator action.

NOTE: For operational reasons a time offset from UTC may be used to define network time.

D6.4 Data Registration. General data registration criteria are contained in Chapter 5. Link 11 data registration procedures and criteria are contained in Appendix C. Link 11B site registration procedures are contained in Appendix E. Gridlock and site registration are not used for data registration on Link 16.

Instead, the following data registration processes are performed automatically by all C2 JUs:

a. Geodetic registration.

b. Sensor registration.

c. Remote IU registration.

D6.4.1 Geodetic Registration

a. Geodetic registration is a process in which a JU monitors its reported geodetic positional data, periodically adjusting these data with information derived from active participation in the JTIDS/MIDS RELNAV function. Geodetic registration begins with the JU's capability to determine and maintain accurate positional coordinates in terms of geodetic latitude, longitude, and altitude.

b. Relative geodetic position is provided by active participation in the JTIDS/MIDS RELNAV function during netted operation. Through active participation in the JTIDS/MIDS RELNAV function, highly accurate adjustments to the reported geodetic position are obtainable. The JTIDS/MIDS terminal provides JTIDS/MIDS RELNAV adjustments to the TDS for latitude, longitude, and altitude correction. These correction factors are applied to the JU's own latitude, longitude, and altitude.

D6.4.2 Sensor Registration

a. Sensor registration is the process of determining and maintaining the correct alignment of the sensor elements used for the measurement of a tracked object's position. Monitoring is accomplished by comparing the geodetic position of a remote IU reported in the PPLI messages and the observed position of the remote IU obtained from active local sensor. A JU periodically monitors the remote IUs and, through automated analysis techniques, calculates the mean correction variations in terms of differences in azimuth, elevation, and range.

b. Sensor registration is performed periodically, and calculated correction factors are applied to the sensor's data to compensate for sensor alignment differences. Sensor data are smoothed through a digital filter such as a recursive Kalman filter, and sensor alignment adjustments are made at this stage of sensor data processing.

c. Each JU participating in the surveillance function automatically monitors sensor registration using remote IU positional messages and local sensor returns. Periodically, the JU adjusts sensor registration IAW the following criteria:

(1) The remote IU used in the sensor registration process are normally selected automatically, but may be selected manually in some JUs.

(2) Results of the sensor registration are available for operator appreciation.

(3) Sensor registration processes, detects, and corrects sensor errors so that the azimuth/elevation angle errors do not exceed one-half degree and range errors do not exceed 500 feet.

D6.4.3 Remote IU Registration. Remote IU registration is the procedure for determining data registration corrective values by comparing remote tracks received from a selected remote IU to local data and applying corrective values to positional data received from that IU. Remote IU registration is performed automatically for all IUs from which tracks are received on the Surveillance NPG.

D6.4.4 Additional JTIDS/MIDS RELNAV Considerations. A shift in the geographic area of interest may necessitate that the origin of the relative grid be changed. All JUs are required to initialize the new grid origin parameters at the same time. When forces are transiting, the relative grid origin should be defined successively in the general direction of the transit.

D6.5 Terminal Interrupts. During operation, several events may occur that create terminal downtime, or period of time when the terminal does not operate. Some of these are operator initiated. Identified interrupts are listed below, and the procedures for returning to Active status after each are specified in the subsequent paragraphs.

a. Terminal off.

b. Power failure.

c. Loss of fine synchronization.

d. Loss of coarse synchronization.

Table D6-1. Link 16 Network Participation Status

PRIORITY	NETWORK PARTICIPATION STATUS INDICATOR	OPERATOR SELECTABLE	TERMINAL IMPLEMENTED	TERMINAL OUTPUT											TERM. REC.	
				PPLI	RTT-I	RTT-R	VOICE	MOST FIXED FORMAT MESSAGES	INITIAL NET ENTRY & TEST	MACHINE RECEIPT	OPERATOR ACKNOWLEDGE	COMM CONTROL MESSAGE RESPONSES	RELNAV	SYNCHRONIZATION RETENTION	VOICE	FIXED FORMAT MESSAGES
7	ACTIVE–NONSPECIFIC	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1	INACTIVE-NONSPECIFIC		X													
2	RADIO SILENT (1)	X	X		(5)		X						X	X	X	X
3	HIGH MESSAGE ERROR RATE–10% (1)		X	X	X	X	X	X	X	X	X	X (2)	X (3)	X (3)	X (3)	X (3)
4	NO INITIAL ENTRY MESSAGE BEING RECEIVED–120 SECS (1)		X	X	X	X	X	X	X	X	X	X (2)	X	X	X	X
5	TDS FAILURE (1)			X (3)	X	X	X	X (6)	X	X	X	X (2)	X	X	X	(4)
6	POLLING (1)	X	X		X		X			X	X	X (2)	X	X	X	X

NOTES: (1) LIMITED STATUS.
(2) RESPONDS WITH PPLI OR TEST MESSAGE ONLY. CANTPROs ANY OTHER REQUESTS.
(3) QUALITY SUSPECT DUE TO ERRORS.
(4) CANTRPOs ANY MESSAGE ADDRESSED TO HOST.
(5) MANUALLY INITIATED BUT WILL GENERATE AN RTT.
(6) ONLY THOSE THAT ARE TERMINAL GENERATED.

Table D6-2. Functions Performed in Limited Status

Limited Status	Can JU Transmit/ Receive Fixed Format Messages?	Can JU Perform NTR Function? [8]	Can JU Perform Position Reference Function? [9]	Can JU Perform Navigation Controller Function? [10]	Can JU Perform Primary User Function?	Can JU Perform Relay Function? [11]	Can JU Perform IEJU Function? [8]	Can JU Transmit/ Receive Unformatted Voice?
Data Silent	No[1] / Yes	No	No	No	No	No	No	Yes / Yes
High Error Rate	Yes / Yes	Yes[4]	Yes[4]	Yes[4]	Yes[4]	Yes[4]	Yes[4]	Yes / Yes
No Initial Entry Message Being Received	Yes[12] / Yes[12]	N/A	No[5]	No[5]	No[5]	No[5]	No	Yes[12] / Yes[12]
TDS Failure(Not implemented by USN)	Yes[3] / Yes[13]	Yes[7]	No[6]	No[6]	No[6]	Yes[7]	Yes[7]	Yes / Yes
Polling (Not implemented by USN)	No[2] / Yes	No	No	No	No	No	No	Yes / Yes

Notes:
1 A PPLI message is sent prior to going into this status to alert the network.
2 JUs transmit RTT interrogations, responses to Communications Control messages or machine acknowledgement messages.
3 Terminal generated messages will be transmitted.
4 If unresolved may lead to degradation of the network.
5 Operationally, being out of range/LOS suggests this function not be performed in this status.
6 PPLI messages may not have valid values in all their fields.
7 As long as initialization was performed before TDS failure.
8 If answer is No, alternate should be activated.
9 A PR is not essential to the network, but if an alternate PR is available, it should be activated.
10 If answer is No, an alternate should be activated. If there is only one NC, it must be a moving platform. When there is a stationary NC, there must be a secondary NC or other NCs.
11 If answer is No, alternate relays should be activated.
12 Only if course/fine sync has been achieved (TX) or if coarse sync has been achieved (RX).
13 Host processed messages will be CANTPRO.

Table D6-3. Impact of Change of Status from Active to Limited

Limited Status	JU T	JU R	Reinitialize Terminal	Reinitiate Link 16 Data	Link 16 Manager Action	Relay Capable	Network Impact	Operational Status Report to Link 11/11B
Data Silent	No[1]	Yes	No	N/A	• Coordinates with JUs to reassign network functions. • Make reassignments IAW the EMCON plan.	No	•No further transmission from this JU. •JUs position must be reported by other units if possible. •Voice capability retained.	Inactive
High Error Rate	Yes	Yes	No	N/A	• Attempts to determine cause and resolve.	Yes[4]	If unresolved, may lead to degradation of the network	Active
No Initial Entry Message being Received	Yes	Yes	No	N/A	• Attempts to determine cause and resolve.	No	•Any change in initial entry message will not be received. •New participants may not be able to join the network.	Active
TDS Failure	Yes[2]	Yes	No	N/A	• If required, will assign new alternate navigation controller.	Yes[4]	•No data from host system. •Affects all functional areas the JU participates in.	Inactive
Polling	No[3]	Yes	No	No	• Coordinates with JUs to reassign network functions. • Make reassignments IAW the EMCON plan.	No	• JU will not function in any NPG unless requested all required functions.	Inactive

Notes:
[1] Except as noted in paragraph D6.2.e.3.(a).
[2] Terminal generated messages will be transmitted.
[3] Except as noted in paragraph D6.2.e.3.(d).
[4] Unless error correction fails.

Table D6-4. Impact of Change of Status from Limited to Active

Limited Status	JU T	JU R	Reinitialize Terminal	Reinitiate Link 16 Data	Link 16 Manager Action	Relay Capable	Network Impact	Operational Status Report to Link 11/11B
Data Silent	Yes	Yes	No[1]	Yes	None[1]	Yes	Participates in all required functions.	Active
High Error Rate	Yes	Yes	No	No	None	Yes	Problem has been resolved.	Active
No Initial Entry Message being Received	Yes	Yes	No	No	None	Yes	Problem has been resolved.	Active
TDS Failure	Yes	Yes	No	Yes	Yes	Yes	Participates in all required functions.	Active
Polling	Yes	Yes	No[1]	Yes	None	Yes	Participates in all required functions.	Active

Note:
[1] Unless functions/time slots have been reassigned.

e. Rollover of cryptovariables.

f. Loading of cryptovariables.

D6.5.1 Terminal Off. Once the JTIDS/MIDS terminal is functioning, the JU reenters the network using the network entry procedures.

D6.5.2 Power Failure

a. If a JU experiences a power failure, the JTIDS/MIDS terminal provides emergency power for 2 minutes. Time synchronization, terminal initialization parameters, and cryptographic variables are sustained using emergency power. If the primary power is regained within 2 minutes, the terminal resumes operations without the need to reinitialize or reestablish synchronization. In terminal overheat, OVERHEAT OVERRIDE can be ordered and the terminal will continue to operate for a short while. This should be ordered only under extreme circumstances because the JTIDS/MIDS terminal will be damaged by the overheat condition.

b. Terminal operations are affected differently in the event that primary power is not regained. Terminal initialization parameters and the cryptovariables in KGV-8 memory are erased unless the terminal is switched to the Standby Mode. While in the Standby Mode, the terminal maintains the cryptovariables in KGV-8 memory for 48 hours; it also maintains the Link 16 initialization data for the same amount of time. However, time synchronization is not maintained. Therefore, when the JU re-enters Link 16, it must follow the JTIDS/MIDS network entry procedures in order to reestablish fine synchronization. However, if the terminal has been able to maintain fine synchronization for at least 8 minutes while active on the link, it can continue to maintain accurate system time for 3 to 5 hours with no further time updates required. This does not eliminate the requirement to follow network entry procedures, but it lessens the time it takes the JU to become Active on Link 16 again.

D6.5.3 Loss of Fine Synchronization. A JTIDS/MIDS terminal that has lost fine synchronization still maintains coarse synchronization, but the only messages it can transmit are RTT messages. The JTIDS/MIDS terminal automatically attempts to regain fine synchronization in either the active or passive mode, as initialized. Messages are still received while in coarse synchronization.

D6.5.4 Loss of Coarse Synchronization. A JTIDS/MIDS terminal that is out of range, beyond LOS, or has a receiver failure cannot receive the Initial Entry

messages and loses coarse synchronization. A terminal that has lost coarse synchronization automatically reinitiates the JTIDS/MIDS network entry procedures once the condition that caused the loss of coarse synchronization is corrected.

D6.5.5 Rollover of Cryptovariables

a. The cryptokey for each cryptonet is changed periodically (every 24 hours) or in reaction to compromise situations. The periodic change, known as rollover, occurs automatically in the terminal but must be coordinated by the Link 16 Manager among all the participants within the network. Network time update should not be performed at crypto rollover.

b. When crypto rollover occurs, JTIDS/MIDS terminal operation is interrupted for approximately 7 time slots, or 55 milliseconds. Upon completion of rollover, the JTIDS/MIDS terminal resumes operation without resynchronization. Operation on Link 16 should not be impacted inasmuch as JUs do not have to re-establish synchronization because only seven time slots of data are interrupted.

D6.5.6 Loading of Cryptovariables. If JUs are maintaining continuous operation, new cryptovariables for the next day's operations must be loaded each day after cryptovariable rollover occurs. Loading of next-day cryptovariables can be done any time prior to the next rollover time. When the JU leaves Link 16 to load cryptovariables, it can no longer support network operations because all terminal functions are suspended during cryptovariable loading. The effect upon Link 16 is minimal if the JU coordinates its departure with other JUs. The following describes the effect of cryptovariable loading on the individual JU.

a. To load cryptovariables into the KGV-8, KGV-8A, KGV-8C and JTIDS Class 2M with DS-102 CSP, the JTIDS terminal must be placed in the Standby mode. To load cryptovariables into the KGV-8B, JTIDS Class 2M with DS-101 CSP and MIDS, the terminal may be either be placed in the Standby mode or left in the ON mode. In addition, the MIDS terminals may be loaded while OFF, and will automatically change to the Standby mode to retain the key load.

b. Link 16 initialization is not affected by cryptovariable loading unless the new cryptovariables create the need to reinitialize the terminal. If the cryptovariables being loaded correspond to the same CVLLs that have been initialized in the terminal previously, then the terminal does not have to be reinitialized. However, if the new cryptovariables are designated by a different CVLL, then the terminal must be reinitialized. Consequently, the JU remains

off Link 16 for a longer period of time. The impact on the JU of cryptovariable loading is also affected by the number of variables being loaded.

c. The Link 16 Manager should ensure that reloading does not occur simultaneously on multiple JUs.

D6.5.7 Effects of a JU Temporarily Leaving Link 16. The temporary loss of a JU normally does not disrupt Link 16 operations. However, a JU that has lost coarse synchronization cannot perform any functions and requires replacement if it cannot resume normal operations within a specified time period. The Link 16 Manager should notify pre-selected alternates (NTR, SFJU) that are to assume that function. Active JUs that meet the qualifying requirements should replace IEJUs, PRs, NCs, and relay JUs that drop out of Link 16.

D6.5.8 Built-In Test (BIT). The JTIDS/MIDS terminal has an automatic BIT for on-line performance monitoring, as well as manually initiated BIT for fault isolation. During manual BIT, the terminal cannot receive or transmit. If an operator has an alert and must conduct BIT, the Link 16 capability is down for the duration of the test or repair.

D6.6 Cryptonet Compromise

a. A cryptonet compromise is the loss or exposure of the cryptokeys being used by a net for communications security. Containment and prevention are the only protective measures against compromise. Containment means reducing the impact of compromise on operating cryptonets. Prevention includes the protective measures used to prevent the loss or exposure of cryptokeys during distribution and use.

b. Although several NPGs may use the same cryptonet, a compromise of any JU using any of these NPGs would compromise the data on all of the NPGs on that cryptonet. A degree of protection against compromise is provided by the implementation of different cryptonets. Because different sets of messages are transmitted using different cryptokeys, only a subset of system information can be compromised when a single cryptonet is compromised. Therefore, the smaller the cryptonet and the shorter the cryptoperiod, the smaller the impact of a compromise.

c. Compromise of a cryptonet can have serious consequences to the physical security (e.g., targeting) of the JUs operating on the network as well as to the content of data passed on that net. Compromise may or may not be detected at the time of occurrence. If an unauthorized unit obtains the cryptokey and remains completely passive, it may gain useful intelligence

during the period that the cryptonet continues operation using that same cryptokey.

d. Any suspected compromise, no matter how small, shall be reported immediately to the Link 16 Manager. A compromised JTIDS/MIDS terminal can be used to defeat network management, relay, time reference, and other system services. A compromise can be detected by any of the following:

(1) Verification of an actual overrun or capture of a JU or evidence of a penetration.

(2) A unit requests access to a cryptonet that it should not be in.

(3) Any sudden disruptions resulting from jamming or any other loss of operational effectiveness.

(4) The detection of data that is incorrect in style and/or content.

(5) Recognition of a false unit reporting on the net.

e. When the Link 16 Manager suspects a compromise of a given JU, that JU shall be isolated from other NPGs on the cryptonet by changing the cryptokey(s). Uncompromised JUs must be manually rekeyed.

D6.7 Entering Link 16 Operations. A C2 JU enters the Link 16 Network according to the following procedures:

a. The C2 JU that is planning to enter the network shall contact the Link 16 Manager as early as possible and inform him of the following:

(1) Reason for entry.

(2) Time/date of entry.

(3) Anticipated length of time of participation.

(4) Request OPTASK LINK information.

b. The Link 16 Manager shall then determine the impact on the interface and determine the approval or modification of the request for entry and inform the requesting C2 JU of the decision.

c. If approved or approved with modifications, the Link 16 Manager or ICO shall provide the C2 JU with the OPTASK LINK and an effective date/time that coincides with the unit's entry.

D6.8 Terminating Link 16 Operations. A C2 JU exits that Link 16 network in one of two ways: either a normal, planned exit, or an unscheduled exit.

D6.8.1 Normal Network Exit. The following procedure will be used for a normal, planned exit from a Link 16 network.

a. The C2 JU that is planning to depart the network shall contact the Link 16 Manager on the DCN as far in advance as possible and inform the Link 16 Manager of the following:

(1) Reason for departure.

(2) Time/Date of departure.

(3) Anticipated length of time of non-participation.

(4) Identification of functions currently performed for the integrity of the network (i.e., NTR, IEJU, relay, etc.).

(5) Desire to maintain/release time slots assigned.

b. The Link 16 Manager shall then determine the impact on the interface and determine the approval or modification of the request and departure and inform the requesting unit of the decision.

c. If approved or approved with modifications, the Link 16 Manager shall reassign to other JUs those interface functions being performed by the exiting unit with an effective date/time that coincides with the unit's departure.

d. At the designated time, the departing C2 JU shall cease JTIDS/MIDS transmissions.

D6.8.2 Unscheduled Network Exit. The following procedure will be used if an unscheduled exit from the net occurs:

a. The Link 16 Manager shall attempt to contact the departing C2 JU to determine the following:

(1) Reason for departure.

(2) Estimated time/date of reentry.

b. The Link 16 Manager shall then determine the impact on the interface and reassign to other JUs those interface functions necessary to maintain the Link 16 network and inform all participants of the departure of the unit.

D7. Link Management Codes

a. Codes used in voice communications to manage Link technical operations are contained in Tables K-1 and K-4. Table K-1 provides Brevity Words from APP 7/MPP 7. Table K-4 provides Link Management Codes for all Links.

b. Link Management Codes (Table K-4). The three-Letter Codes are to be used for brevity and clarity only. These codes are unchanging and provide no security when transmitted over clear radio circuits. Any data that require security protection are to be encrypted as specified by the Link 16 Manager or ICO.

ANNEX A to APPENDIX D to ENCLOSURE A

JTIDS/MIDS NETWORK REQUEST FORM

PURPOSE

This form is used to request a joint JTIDS/MIDS network from the USAFORSCOM Joint Interoperability Division (JID) or a single Service network from a Network Design Facility (NDF). Addresses for the JID and the NDFs are listed in Appendix C of the Network Design Catalog.

INSTRUCTIONS

To request an existing JTIDS/MIDS Network by name, fill out Part One of this form and send it to the appropriate unit (JID or NDF). The nine character code names and codes are contained in the Network Design Catalog. To request a JTIDS/MIDS Network by function (name not known), fill out Parts One and Two of this form and send it to the appropriate unit (JID or NDF). That unit will then conduct a search to determine the applicability of existing networks. If no existing network meets mission requirements, an existing network will be modified or a new network design created to meet customer requirements.

DISTRIBUTION

This form should be maintained on file by all JTIDS/MIDS equipped units. Contact the JID or NDFs for additional copies of this form. Local reproduction of this form is authorized.

REQUEST PROCESSING

When a network request form is received, the JID or NDF will evaluate the proposed design requirements against existing networks. If an existing network meets mission requirements, the JID or NDF will provide that network to the requester.

If only minor changes are required to a network in the JTIDS/MIDS Network Catalog, a network modification may be issued to the projected users without a catalog change.

If no existing network meets the customer requirements, a new network will be designed. For joint network designs, the JID will coordinate construction with the NDFs.

The Service NDFs will distribute terminal load files to all potential network users. Completed network designs will then be incorporated into the Service JNL and copies sent to the JID for inclusion in the master library and the JTIDS/MIDS Network Catalog.

The JID is tasked to maintain all existing JTIDS/MIDS networks used by US Forces. Each Service NDF is responsible for maintaining network designs and distributing load files to operating units.

SECURITY CLASSIFICATION

JTIDS/MIDS network designs are not classified because they contain only generic terminal loads. Classification of a Network Request is based on Operations Security (OPSEC) criteria. Once complete, Section Two is classified if it contains actual operational units and units locations, or it will be used to support combat contingency plans.

INSTRUCTIONS - PART 1

Requesting Unit	Enter the requester's military unit or facility name.
Message Address	Enter the requester's Plain Language message address.
Mailing Address	Enter the address where the network design should be sent.
Points of Contact (POC)	Enter the name, rank, and assignment of the individual(s) who can answer detailed questions concerning the information exchange requirements.
Telephone Number	Enter POC phone numbers (DSN, commercial, Fax, STU-III).
Electronic Mail Address	Enter the requester's electronic mailing address.

JTIDS/MIDS Network Name	Enter the name of the requested JTIDS/MIDS network from the JTIDS/MIDS Network Catalog. If unknown leave blank. If requesting a modification, enter "MOD" after the network name.
Date/Time Required	Enter the date/time required for network design delivery.

INSTRUCTIONS - PART 2A

Network Use	The terms "Combat," "Exercise," "Full Protect," and "Test" relate to how the network is intended for use in the National Airspace System (NAS) or within the US Air Defense Identification Zone (ADIZ).
Handling Precedence	Establishes JID/NDF response time for handling customer requests. For near term use (5-7 days), check priority. For needs in excess of 1 week, check Routine. Routine will be handled based upon the network "Date/Time Required."
Operation/Exercise	Enter an unclassified reference name.
Reference Name	EXAMPLE: "Korean Linkex 95-1."
Network Type	When all the participants are from one Service, choose "Single Service". For US participants from more than one Service, choose "Joint." For networks involving other nations, choose "Combined."

INSTRUCTIONS - PART 2B

Message Standard	Select TADIL-J, IJMS, or MIXED (both).
Reference Position	Enter the Reference Position that will be used on the Force Layout. "ZZ" designates the center of a mobile group.

Voice Configuration	Assign a requirement priority for the use of capacity to support voice. Use "0" for no voice. Indicate the type of voice sampling to be used. NOTE: Only class two terminals support 16KB voice.
Jamming Environment	Specify the expected electromagnetic environment.
Crypto Nets Required	If some units will be denied information on the link choose "Yes." Which units and what information must then be specified in the "Participant Table." The resulting network will be a partitioned variable mode (PVM) network and will require more than one crypto key.
Additional Information	Enter any instructions to the network designer that you feel is important. Highlight any peculiar information exchange requirements. EXAMPLE: "This Link 16 network will be used to test bridging (interfacing) between two collocated Link 11 networks. Units 3 and 4 are IUs operating on the two Link 11 networks."

<u>INSTRUCTIONS - PART 2C</u>

Participants	Group designators are used to separate the network into mutually exclusive connectivity groups (members of Group A and Group B may not communicate with each other except for PPLIs, Voice, RTTs). Unit numbers are consecutive and are reference numbers only (1,2,3...). ID is the type unit (F-14, E-3, CRC etc.).
Position	Enter either the Lat/Long of the unit or its distance in nm from an established reference point (e.g., 090-200 miles).

Track Loading	Enter the expected track transmit load for the unit on each of the three nets. Surveillance: For a C2 unit, enter the expected number of tracks to be reported and the required update rate. Control: For a C2 unit, enter the expected number of targets to be transmitted to a nonC2 unit under control.
Target Sorting	For a nonC2 unit, enter the number of targets to be sorted between nonC2 units (fighter to fighter).
Voice Participation	Enter intent for voice participation (Y or N).
Msn Mgt/Wpns Coord	Enter “M” if the unit will perform Mission Management. Enter “W” if the unit will perform Weapons Coordination.
Electronic Warfare	Enter “E” for units that will generate EW parametric data.

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JTIDS/MIDS NETWORK REQUEST FORM

PART 1

Requesting Unit	
Message Address	
Mailing Address	
Points of Contact	
Telephone Numbers	
Electronic Mail Address	
JTIDS/MIDS Network Name	
Date/Time Required	

Note: This information is not "format dependent." Forward the information to the appropriate design agency using ASCII text via US Mail, E-mail, MODEM, message, FTP, etc.

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JTIDS/MIDS NETWORK REQUEST FORM

PART 2A - NETWORK INFORMATION

Network Use	Combat _____ Exercise _____ Full Protect _____ Testing _____ Operations other than War _____
Handling Precedence	Immediate_____ Priority_____ Routine_____
Operation/Exercise Reference Name	
Network Type	Single Service _____ Joint _____ Combined _____

PART 2B - NETWORK PARAMETERS

Message Standard	TADIL -J _____ IJMS_____ MIXED_____
Reference Position	Lat. _____ Long. _____
Voice Configuration	Channel A Priority (0-10) ____KHz (2.4 or 16) ____ Channel B Priority (0-10) ____KHz (2.4 or 16) ____
Jamming Environment	High Threat ____ Medium Threat ____ Low Threat ____
Special Crypto Isolation	Yes ____ PVM No ____ CVM
Additional Information	

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JTIDS/MIDS NETWORK REQUEST FORM

PART 2C - Participants List

Participants	Position	Track Loading/ Update Rate			Voice		Mission Mgt/Wpns Coordination	EW
Group/Unit #/ID	Lat/Long, X/Y	Surv	Control	Target Sorting	A	B		

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JTIDS/MIDS NETWORK REQUEST FORM

PART 2D DIAGRAM OF FORCE LAYOUT

<--------->

Choose a convenient scale and label the diagram.

Show the location of the “REFERENCE POINT” indicated in the NETWORK PARAMETERS or of “ZZ” the center of the mobile force.

Depict the most likely positions of the units contained in the Participant List (Use group/unit#).

Depict the threat axis.

Depict any geographic obstructions to LOS connectivity.

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APPENDIX E TO ENCLOSURE A

LINK 11B ESTABLISHMENT AND MAINTENANCE

E1. Operational Capabilities of Link 11B

E1.1 General Description. Link 11B is a dedicated, point-to-point, full duplex, digital data link employed to exchange real-time tactical data between land units. Units that exchange data via Link 11B are designated RUs, FRUs, FJUs or FPUs (see paragraph 2.3.1). Section E1 describes the Operational Capabilities of Link 11B. Section E2 describes the Technical Characteristics of Link 11B. Section E3 describes Planning and Operation of Link 11B.

E1.2 Communications Medium. Link 11B can be transmitted over landlines (wire or fiber optic cable) or single/multi-channel radios. Single/multi-channel radios may be established within LOS, using troposcatter techniques for over-the-horizon communications, or employing satellite communications. Both ends of the Link 11B link must use a compatible communications system. There are two basic communications systems employed by US forces, the Direct Current (DC) digital form and the quasi-analog form.

a. All Marine Corps and Air Force systems use the quasi-analog transmission design using Modulator/Demodulator modems; (e.g., TD 1089 or TD 1316).

b. Army Air Defense Artillery (ADA) C2 systems operate using a quasi-analog form. Transmission and reception of Link 11B data is accomplished using DC Digital form and bulk encryption. The conversion is accomplished using an Air Defense Interface (ADI) to convert analog signals to digital signals (or visa versa) for transmission or reception over the Mobile Subscriber Equipment (MSE) net. Data transmissions are bulk encrypted by the MSE equipment. Army ADA units directly interfacing with USAF or USMC C2 facilities will provide the necessary communications equipment for both ends of the Link 11B link. Bulk encryption will be provided by MSE. No point-to-point (line) encryption devices will be provided by Army agencies. Where MSE connectivity cannot be established with Army ADA C2 systems due to unit locations, range, etc., communication equipment (radio, SATCOM, Tri-Service Tactical Communication System (TriTac), etc.) including any required encryption devices must be provided by USAF, USMC, or when available, from Army and/or ARNG units. The PATRIOT ICC establishes the Link utilizing its quasi-analog modulator/demodulator equipment.

E1.3 Data Encryption. Encryption of Link 11B is always required. Link 11B is normally operated in the secure mode with the KG-30 (analog) or KG-84A/C (digital) single channel data encryption devices. Both the KG-30 and KG-84 use two keys, one for transmitted data and one for received data. The configuration of the encryption device at both ends of a Link 11B link must be the same. The configuration of the encryption device is known as "strapping" and is dependent on TDS configuration. Some systems (e.g., US Army) use a bulk encryption device (KG-27/KG-194/KG-197) that uses different encryption techniques and is not compatible with that used by other systems. Therefore, it is essential for interconnecting Link 11B units to use compatible encryption devices. In addition, care is to be taken to ensure that the correct encryption type and key list are used. Some nations operate KG-84 compatible equipment, although some modes are not interoperable.

> NOTE: When establishing a secure data link between a KG-84A (USAF/USMC) and a KG-84C (Patriot ICC), the KG-84C must be correctly strapped to allow communications.

E1.4 Communications Architecture. Link 11B units can be linked together to form a chain or use a single forwarding unit as a hub with multiple units tied through the hub. Link 11B communications requires a separate, dedicated link between each reporting unit that simultaneously transmits and receives data on two channels, one dedicated transmit and one dedicated receive line. When data messages are not being transmitted, a continuous standby signal is transmitted by each unit to maintain time synchronization.

E1.5 Data Rates. Link 11B can be transmitted at the basic rate of 1200 bps with optional capabilities of 600, 2400, 4800 and 9600 bps (as available in some systems). If the quasi-analog transmission scheme is used, the audio signals will be modulated using Frequency Shift Keying (FSK). See E2.1 of this Appendix for detailed technical requirements for each Link 11B data rate.

E1.6 Message Standard. Link 11B uses a 48 bit "M series" message and transmits the data as a single 72-bit data message. This is the same message standard used in Link 11 but transmitted over a different communications architecture with a different message packing structure.

E1.7 Information Exchange Scheme. Link 11B units exchange positional information on units, tracks, and points by transmitting an X and Y coordinate that is measured from the unit's SCC. A Link 11B unit's location is reported to other interfaced units by transmitting its X and Y coordinates measured from either the DLRP or its SCC. Once the SCC is known, all positional information received from that unit is displayed in relation to the SCC.

E1.8 Transmission Structure. Three types of transmission structures are employed to initialize and operate Link 11B. These are defined as Link 11B Link States, see Table E1-1.

Table E1-1. Link 11B Link States

State #	State	Description
0	Inactive	Link not selected for use.
1	Ready	Operator selects the link for use. (Idle Pattern is transmitted.)
2	Active	Test messages are exchanged.
3	Operational	Data Link addresses/Track reports exchanged.

a. Standby Signal. Once a Link 11B link has been activated by operator action, a constant standby signal is transmitted. This signal consists of alternating marks and spaces (1 0 1 0) and is continuously transmitted by each unit. This signal permits the two modems to remain in time synchronization and is interrupted only for the transmission of a data message, termination of the link by operator action, or equipment malfunction. When a good standby signal is received, a sync indicator is illuminated on the modem. The Standby Signal, or Idle Pattern, always ends with a one (1) to distinguish it from the beginning of a start code.

b. Link 11B Data Message. Link 11B uses a 72-bit message that consists of Start group, Data Group, and Check Group.

c. Link 11B Test Message. Once the Link 11B link has been fully initialized based on the mutual exchange of required information messages, the continuing operational status of the link depends upon the exchange of the Test Message. This is a special message that is transmitted on a periodic basis by both Link 11B TDSs. Failure to receive this message for a specific period of time causes Link 11B to lose its Operational status. When the link status drops to less than Operational, all data exchange ceases except for the Standby Signal and the Test Message.

E1.9 System Employment. The Army, Marine Corps, and Air Force employ Link 11B. Link 11B capabilities and the equipment of each Service system is provided in Appendix A.

E1.10 Link 11B Operation. Each Link 11B unit will be assigned a unique address. This address or TN is assigned in the OPTASK LINK message and will normally be a three-digit octal number from 100_8 to 175_8. A unit operating on multiple Link 11B links will use the same address for all links. Units operating on a single Link 11B link are designated RUs, units operating on multiple Link 11B links are designated FRUs, units operating on Link 11 and Link 11B are designated FPUs and units operating on Link 11B and Link 16 are designated FJUs. For an FPU, a single two-digit address is used in place of the normal three-digit address. Additionally when establishing voice communications, inform the FTC/TDC on the TSN and Link 11/11B Manager on the DCN of intent to join the link using appropriate authentication procedures. Request permission to enter the Link 11 net from the Link 11/11B Manager on the DCN. After permission is received, the DNCS will enable the entering units TA in its DTS.

E1.11 Link 11B Link Initialization

a. Full Transmission of Data (FTD) Mode. Once a Link 11B link has been designated for use by the operator, it is physically activated. Upon activation, the Link 11B Standby Signal is transmitted along with the periodic Test Message. The Test Message contains the data link address of the transmitting unit that provides a capability to perform a loop-back check of the communications path, data path, and encryption path. The FTD mode provides for the automatic reporting of all tracks and information as soon as the link is Operational.

b. Limited Transmission of Data (LTD) Mode. When an RU requests to initialize its Link 11B link it may be directed to enter in the LTD mode as a means of resolving Dual Designations prior to activating its FTD mode. This allows the reception of track reports but inhibits the transmission of local air, surface, and subsurface tracks until an operator or system action is taken to switch to the FTD mode. The unit in the LTD shall begin transmitting its surveillance tracks after:

(1) The operator has determined that all necessary correlations are complete.

(2) A maximum time limit has elapsed since the transition to an Operational link state; i.e., Link State 3. The time limit is 40 seconds for systems that perform automatic correlation processing, or 120 seconds for systems that perform manual correlation processing.

E1.12 Loop-back Check. A loop-back provides a positive means of isolating system problems. There are two types of loop-backs, internal and external.

E1.13 Link Initialization. Once valid Test Messages are received at both TDSs, automatic link initialization occurs. When the required information elements have been exchanged, the link becomes Operational and data messages are transmitted by both TDSs. Failure to receive a Test Message for a specified time period will cause the link to be removed from the Operational status and assume the Ready status (State 1) until automatic link initialization reoccurs. The Test Message is essential for maintaining an Operational Link 11B link.

E2. Technical Characteristics of Link 11B

E2.1 Data Signal Rates. Link 11B can be transmitted at 600, 1200, 2400, 4800 or 9600 bps. If the quasi-analog transmission scheme is used, the audio signals will be modulated using FSK. The characteristics of Link 11B modems are defined in the current edition of MIL-STD-188-110.

a. Basic Characteristics for 1200 bps. For the data signaling rate of 1200 bps, phase continuous FSK shall be used with a center frequency of 1700 Hertz (Hz), a mark frequency of 1300 Hz, and a Space (0) frequency of 2100 Hz in accordance with MIL-STD-188-110.

b. Basic Characteristics for 2400 bps. For the data signaling rate of 2400 bps, Quadrature Phase Shift Keying (QPSK) shall be used with a carrier frequency of 1800 Hz IAW MIL-STD-188-200, resulting in a modulation rate of 1200 bps at the Voice Frequency (VF) channel interface.

c. Basic Characteristics for 600 bps. For the data signaling rate of 600 bps, phase continuous FSK shall be used with a center frequency of 1500 Hz, a mark frequency of 1300 Hz, and a Space (0) frequency of 1700 Hz IAW MIL-STD-188-110.

d. Basic Characteristics for 4800 bps. TBD

e. Basic Characteristics for 9600 bps. TBD

E2.2 Data Signaling Rate Tolerance. The tolerance of all data signaling rates of the transmitted signal shall be +/- 1 part in 100,000, measured at the output of the transmitting terminal subsystem, properly terminated. Received terminal subsystems shall be capable of accepting data signaling rate variations of up to +/- 0.5 percent.

E2.3 Switched Multi-channel Communications Subsystems

a. Tactical Subsystem Type I is a multi-channel transmission subsystem using Frequency Division Multiplex (FDM) equipment and Frequency Modulation (FM) wideband LOS or tropospheric scatter radio links or radio relay to cover distances up to 180 miles (290 km). The FDM equipment provides nominal 5 kHz VF channels and has been designed to operate with the quasi-analog signal level of -13 dBm0 and a test tone level of -10 dBm0 at the 4-wire input and output terminal of each VF channel and with a zero (0) Transmission Level Point (TLP) at these terminals.

b. Tactical Subsystem Type II is a multi-channel transmission subsystem using Time Division Multiplexing/Pulse Code Modulation (TDM/PCM) equipment and wideband LOS, tropospheric scatter or satellite radio links or radio relay links, cable links with repeaters transmitting digital signals over distances of up to 180 miles (290 km). The TDM/PCM equipment provides nominal 4 kHz VF channels and has been designed to operate with a quasi-analog signal level of -6 dBm0 and a test tone level of -3 dBm0 at the 4-wire input and output terminals of each VF channel and with a -4 TLP at these terminals. For transmitting data in digital form over the Type II tactical subsystem two types of equipment are employed, Time Division Digital Multiplexer (TDDM) and the High Speed Serial Data Buffer (HSSDB). The TDDM is capable of accepting up to 24 digital telegraph or data signals and combining these signals to a 32 kbps bit stream that is fed into the HSSDB. For digital signals, the HSSDB automatically bypasses the analog-to-digital/digital-to-analog converters in the TDM/PCM equipment and provides direct action into the digital bit stream of the TDM/PCM link. As this equipment becomes available, it is recommended that data signals not be converted into quasi-analog signals and transmitted through a TDM/PCM VF channel, but rather be transmitted as digital signals through the TDM link.

c. Tactical Subsystem Type III is a multi-channel transmission subsystem using FDM equipment and FM wideband LOS or tropospheric scatter radio link or radio relay links. The subsystem had been designed for much longer distances (1100 miles) than the tactical subsystem Types I and II. The FDC equipment provides nominal 4 kHz VF channels and has been designed to operate with a quasi-analog signal level of -13 dBm0 and a test tone level of -10 dBm0 at the 4-wire input and output terminals of each VF channel and with a 0 TLP at the terminals.

d. Tactical Subsystem Type IV is a multi-channel TDM transmission subsystem under development that will employ Continuously Variable Slope Delta (CVSD) modulation as the analog-to-digital conversion method and digital

wideband LOS, tropospheric scatter and satellite radio links. The subsystem will have the capability to interface with existing nominal 4 kHz VF channels and will also have the capability to interconnect Link 11B terminal subsystems operating with digital signals at 1200 bps and 2400 bps over a digital channel. Access over digital channels will be the primary and the preferred method of transmission in lieu of converting digital signals into quasi-analog signals for transmissions over analog channels.

E3. Planning and Operation of Link 11B

E3.1 Establishing Link 11B Communications. Information required to establish Link 11B communications between units or Service components is distributed in the OPTASK LINK. It is the responsibility of the Commander to promulgate the information required to establish a Link 11B architecture. All units concerned should receive the following Link 11B information:

a. Data Terminal and Communications System.

(1) Data Link and Voice Net, DCN, Primary and Alternate, Frequency and Channel assignments.

(2) Data Rate.

(3) Encryption equipment and Key List Assignment.

(4) Radio Transmit Power Level.

b. TDS Computer Entry.

(1) Own Unit Position in Latitude and Longitude.

(2) DLRP in Latitude and Longitude.

(3) Unit Address (Normally a RU is a three-digit number).

(4) TN Block Allocation (Start and Stop Number).

(5) Prearranged Data Filters.

(6) Reference Points - Point Type and Location in Latitude and Longitude.

(7) Link 11B Initialization and Reinitialization Mode - FTD or LTD.

c. Voice Communications.

(1) Net Control Station.

(2) Unit Call Signs.

E3.2 Coordination Communications. Initial communications between two Link 11B units is normally established on single channel tactical voice radios. These radios provide a means of aligning the directional antennas of the data radios used for Link 11B communications. At this time the Link 11B units may enter the TSN to monitor the tactical situation and begin the coordination function that confirms the OPTASK LINK data in preparation for link initialization.

E3.3 Data Communications. Because Link 11B communications are normally transmitted with a directional antenna aimed at the receiving antenna whether LOS, bounced off the troposphere or relayed by an orbiting satellite, Link 11B circuits are normally engineered by communications personnel. Link 11B uses multi-channel radios or multiplexing to provide a full duplex circuit for data exchange; extra channels are normally available on the data radios for voice communications between directly tied Link 11B units. Once "directional" communications are established between two Link 11B units, voice coordination is used to initialize data communications.

E3.4 Tactical Data System. While the directional communications are being established, the TDS is initialized with the OPTASK LINK data and any unique system data required to establish data link communication and conduct operations. At this time, a system may perform internal loop-back checks to verify connectivity between the TDS, encryption equipment and modems. Once the directional communications are established, the unit is ready to perform an end around loop-back, which is a loop-back check of the entire communications path. The Link 11B loop-back is performed by patching the Transmit output of the Link 11B modem into the Receive input of the Link 11B modem at the distant end of the communications path. Each unit performs this end around loop-back check to adjust system levels and evaluate system performance.

E3.5 Link Initialization. The Operator activates Link 11B communications, which initializes the transmission of the Idle Pattern, bringing the system to Ready State (State 1). This is validated by an illuminated light on the modem. Next the encryption device is "prepped", which synchronizes the time signal between the units, and the input/output channel of the TDS is initialized, which transmits the initial sequence of messages. When these initial messages

are transmitted, the Active State (State 2) is achieved. When the TDS responds to a request with its Own Unit Address, the link goes from the Active State into the Operational State (State 3) and the TDSs are interfaced. Track data will be exchanged between the systems depending on the whether the systems are in the FTD or LTD Mode. The Operational State is maintained as long as Test Messages are exchanged.

E3.6 Link Management Codes

a. Codes used in voice communication to manage Link technical operations are contained in Tables K-1 and K-4. Table K-1 provides Brevity Words from APP 7/MPP 7. Table K-4 provides Link Management Codes for all Links.

b. Link Management Codes (Table K-4). The three-Letter Codes shall be used for brevity and clarity only. These codes are unchanging and provide no security when transmitted over clear radio circuits. Any data that require security protection must be encrypted as specified by the Link 11B Manager or ICO.

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APPENDIX F TO ENCLOSURE A

IJMS ESTABLISHMENT AND MAINTENANCE

F1. Introduction. This appendix contains the procedures for establishing and maintaining JTIDS/MIDS with respect to the IJMS. Because both Link 16 and IJMS are based on the JTIDS/MIDS TDMA architecture, several planning and operational considerations will be similar, if not identical. Although several topics in this section have been previously addressed in other sections of this manual, their applicability to IJMS warrants their inclusion in this appendix. Throughout this appendix, frequent reference will be made to Link 16 to highlight the differences between Link 16 and IJMS with regard to planning and operations.

F1.1 IJMS Terminals. Units with JTIDS Class 1 Terminals and JTIDS Class 2 Bilingual Terminals can participate in an IJMS network. The NATO Ground Environment sites have JTIDS Class 1 Terminals. The E-3 has bilingual pass-through JTIDS Class 2H Terminals, and their host software can concurrently operate on IJMS, Link 11 and Link 16. Other US Air Force platforms are equipped with the F-15 bilingual terminals that translate IJMS and Link 16 so that the host just has to process Link 16 messages. Platforms equipped with the Army's JTIDS Class 2M Terminal can translate IJMS and Link 16 so that the host just has to process Link 16 messages. These platforms can be designed into networks to operate with IJMS and Link 16 platforms. The MIDS variant Fighter Data Link (FDL) terminal and the MIDS terminals will also provide this IJMS translation capability in the terminal.

F1.2 IJMS Platforms. The following Air Force platforms are equipped with the F-15 Class 2 Terminal: F-15, Rivet Joint, Joint Stars and ABCCC. The F-15 C/D/E with the FDL MIDS terminal and the F-16 with the MIDS terminal will also have this IJMS translation capability. The US Army PATRIOT, Forward Area Air Defense (FAAD), Joint Tactical Ground Station (JTAGS), Air and Missile Defense Planning and Control System (AMDPCS) and Theater High Altitude Air Defense (THAAD) also have this IJMS translation capability.

F1.3 IJMS/Link 16 Track Numbers. The E-3 C2 computer is designed to concurrently operate on more that one link at one time. The E-3 software can keep up with different TNs on the same track on different Links. Platforms that only use the translation capability of the JTIDS terminal to transmit and receive IJMS messages do not have host computer capability to keep track of different TNs. Most of these platforms that use this terminal translation capability are not primary surveillance C2 platforms. However, circumstances could occur when a Rivet Joint could take R^2 of an original IJMS track, but

would use a Link 16 TN, vice the original IJMS TN that may be a NATO TN or another IJMS TN. Data Link Managers (ICO/FTC/TDCs) must be aware of this possibility and deal with the TN problem.

F2. JTIDS/MIDS Network Management Process. As with Appendix D to Enclosure A, "Link 16 Establishment and Maintenance," JTIDS/MIDS Network Management, Network Design, Pre-mission Planning, Network Initiation, and Network Control considerations apply to IJMS with variations to accommodate its limited capability. This process is the same for both Link 16 and IJMS, and includes four management phases: Network Design, Pre-mission Planning, Network Initiation, and Network Control.

F2.1 Network Design. As with Link 16, this is the first phase in the design of the IJMS network. Considerations include force composition, projected track loading, and communications and connectivity requirements. Network request procedures are identical to those for Link 16. Of the two types of parameters defined during the design phase, network and platform-unique, consideration must be given to the former with respect to IJMS. Currently, the only US design facility that can support the development of an IJMS network is the Air Force Network Design Facility (AFNDF).

F2.1.1 IJMS Parameters. Network parameters are universal to all IUs to ensure compatibility. These common values define net assignments, time slot block assignments, CVLL assignments, and relay functions. Unlike Link 16, IJMS in the Class 1 Terminal does not utilize NPGs. Time slot assignments in the Class 1 Terminal are made in terms of only three message categories: position and status messages, JTIDS/MIDS voice (free text) messages, and all other messages.

F2.1.2 IJMS Platform Parameters. Platform-unique parameters are needed to complete initialization data for individual IUs, enabling each to enter and operate properly on JTIDS/MIDS. These parameters include the transmit and receive time slot assignments for individual platforms and other unique data, such as relay assignments.

F2.2 Pre-mission Planning. See Appendix D.

F2.3 Network Initiation. See Appendix D.

F2.4 Network Control. See Appendix D.

F3. IJMS Network Design. IJMS Network design consists of:

a. Identifying a set of communications functions.

b. Identifying network participants by general type.

NOTE: Because JTIDS Class 1 Terminals do not utilize NPGs, network participants are identified by general type; however, certain Class 2 Terminals are bilingual, and are capable of processing IJMS information on Link 16 NPGs 30 and 31 that are reserved for IJMS messages.

c. Allocating to each participant a portion of network capacity appropriate to its needs.

d. Translating the resulting network into the terminal initialization data needed to set up JTIDS/MIDS terminals to operate in the network.

F3.1 IJMS Network Design Process. The design process, while based on operational needs, is technically intensive. Because the USAF is a primary user of IJMS capable platforms, design is accomplished at the AFNDF prior to operations. The requesting command must determine that the network design satisfies operation requirements. This can be done by several methods: subjectively evaluating the network description versus network requirement specification; comparing the network design with modeling/simulation results; use of the network in actual operations; and/or using some testing methodology. The culmination of the Network Design phase is the distribution of the JNL (or network design if not part of the JNL) to the requesting operational authority and other users.

F3.2 Timeline for IJMS. See Appendix D.

F3.3 IJMS Network Design Activity. The JTIDS/MIDS network design activity accommodates varying situations by providing multiple network configurations from which operational planners select the network most appropriate to the tactical environment. The design of a particular network depends upon the operational functions to be supported, the operating procedures of the forces involved, the roles and disposition of the various participants, and the operational environment. IJMS considerations with respect to the optimization of various network characteristics include the following:

F3.3.1 Multi-nets. IJMS is limited to transmitting Position and Track messages on only one net, termed the main net, and receiving in time slots on up to three other nets. The Class 1 Terminal can relay IJMS on to other nets,

but normally by network design, the Class 1 Terminal only transmits on the main net. JTIDS/MIDS voice can be transmitted on another net.

F3.3.2 NPGs. Certain bilingual Class 2 Terminals are capable of processing IJMS information on Link 16 NPGs 30 and 31.

F3.3.3 Message Packing Structure. IJMS employs only the DP message packing structure.

F3.3.4 Time Slot Access Modes. The Class 1 Terminal implements only the dedicated access mode.

F3.3.5 Relay. The Class 1 Terminal implements only the Unconditional Relay mode.

F3.4 JTIDS/MIDS Architecture. The JTIDS/MIDS architecture, signal structure, and message structure provide the building blocks for a wide variety of information distribution techniques that can be configured by the user to match particular needs. Because JTIDS Class 1 Terminal does not utilize Link 16 NPGs, information distribution is accomplished by the allocation of time slots to message categories. Message categories for IJMS include the following:

F3.4.1 P-Messages. These messages convey the mission type, position, and status of air and ground JTIDS/MIDS participants.

F3.4.2 T-Messages. These messages include track reports, command and control messages, and weapons/engagement status messages.

F3.4.3 JTIDS/MIDS Voice Messages (free text). Free text channels are used primarily for ECM Resistant Voice (ERV), also known as JTIDS/MIDS voice.

F3.5 Network Library. Only network designs that have been approved become part of the JNL. The network design is usually stored on magnetic media and copies are provided to all users as required to produce initialization data loads. The process of network design is an ongoing function providing the users with multiple networks, each intended for different operational scenarios. These design options expand the utility of a network design by allowing the Link planner to select the most advantageous combination of network assignments during the pre-mission planning phase of an operation.

F3.6 Multi-nets. JTIDS/MIDS can operate in a multi-net mode where several terminals can transmit in the same timeslot but with different net numbers.

However, by network design, IJMS operations with Class 1 Terminals are normally limited to a single net, termed the main net.

F3.7 Message Packing Structures. Packing refers to the number of Link 16 words that are transmitted in a single time slot and whether the data is transmitted either once or twice. Packing also affects propagation range and AJ margins.

NOTE: IJMS employs only the DP message structure that does not support packed messages.

F3.7.1 Standard Double Pulse. Unlike Link 16, which transmits up to three Link 16 words per time slot, IJMS utilizes the entire portion (225-bits for data, or 450-bits for JTIDS/MIDS voice) of the time slot to represent a single message. Double pulse means that each item of information is transmitted twice, first on one frequency and then on a different frequency. Because IJMS is limited to the DP message structure, range considerations are limited to terminal settings (Normal or Extended).

F3.8 Time Slot Access Modes. Of the three time slot access modes available to Link 16 (i.e., Dedicated Access, Contention Access, and TSR), IJMS employs only the Dedicated Access Mode.

F3.8.1 Dedicated Access Mode. See Appendix D.

F3.9 Relays. Relays must be planned when all IUs in the JTIDS/MIDS network are not within LOS or when any of them are beyond the selected range mode. The JTIDS/MIDS terminal has a LOS operating range of 300 nm (Normal Range mode) or 500 nm (Extended Range mode). An IU designated to relay a message must be provided with the capacity to perform this function. Of the various relay modes available to Link 16, the Class 1 Terminal employs only the Unconditional Relay mode. The Class 1 Terminal relays only IJMS messages.

NOTE: The Class 1 Terminal does not have a selective relay capability (i.e., NPG relay).

F3.9.1 Paired Slot Relay. See Appendix D.

F3.9.2 Unconditional Relay. See Appendix D.

F3.10 JTIDS/MIDS Voice. On the Class 1 Terminal, each JTIDS/MIDS voice channel is activated separately by manual initialization via the Unformatted

Message Element (UME), which is the interface between the vocoder and the terminal. The UME provides the capability to connect voice or teletype instruments to the terminal. This data is transmitted as free text messages rather than IJMS fixed format messages. UME initialization is done at the UME control head: no entry is made at the terminal. E-3s and ASITs are each equipped with one 2.4 kbps UME. The UME initialization data includes the JTIDS/MIDS voice channel number, error-coding selecting, the net number, and the relay delay (if the JTIDS/MIDS voice channel is relayed).

NOTE: The Class 1 UME Net number is equivalent to the Class 2 JTIDS/MIDS Voice Channel number.

F3.11 Transmit Overlay. The Class 1 Terminal will not accept a relay transmit assignment over a relay receive assignment (i.e., a relay receive block and a relay transmit block cannot overlap).

F3.12 Time Slot Assignments. Time slot requirements are primarily determined by the transmit time slot requirements of the individual IU, the number of IUs, their relative locations, the relay requirements, and the chosen acknowledgement protocol. Time slot capacity is assigned at the NDF, which provides time slot assets for each IU's initialization process.

F3.12.1 Time Slot Blocks. A Class 1 Terminal can accept up to three transmit time slot blocks assignments, one assignment for the P-message block, one net entry block, and six relay pair assignments. In addition, it can accept up to nine receive only assignments and up to three net numbers other than the main net number. All unassigned slots default to the receive mode on the same net as the main net number. When not transmitting, the Class 1 Terminals revert to the receive mode on the main net.

F3.13 Transmission Requirements. See Appendix D.

F3.14 Access Mode Requirements. See Appendix D.

F3.15 Allocation of System Capacity. See Appendix D.

F3.16 Summary of Methods to Reduce Resource Utilization. See Appendix D.

F3.17 COMSEC. See Appendix D.

F4. Pre-mission Planning. See Appendix D.

F4.1 Selecting and Modifying JTIDS/MIDS Network from the JNL. See Appendix D.

F4.2 General Net Parameters. See Appendix D.

F4.2.1 IJMS Network Duties. IJMS requires several duties to be performed by IUs. Functions assigned to an IU are entered by initialization or by the operator and may be changed during operation by the operator or the JTIDS/MIDS Network Management Station. IJMS duties are listed below, standby units are identified by suffixing the duty number with an "S". These roles have been designed to ensure that IJMS can be established and maintained in a long term, dynamic environment. Duties that require operator action on a particular platform are marked with an asterisk (*).

a. JTIDS/MIDS Network Management Station (OPTASK LINK Duty Code=810)(*).

b. JTIDS/MIDS NTR/Master (OPTASK LINK Duty Code=812).

c. IJMS Change Data Authority (OPTASK LINK Duty Code=830).

F4.2.2 JTIDS/MIDS Network Management Station. The C2 IU assigned responsibility for initiating and administering the minute-by-minute operation of the network is the JTIDS/MIDS Network Management Station. The JTIDS/MIDS Network Management Station is responsible to the ICO for all facets of operation that lead to successful, continuous data exchange. The actions taken by the JTIDS/MIDS Network Management Station are similar to the Link 16 Manager's actions described in Appendix D.

F4.2.3 JTIDS/MIDS Network Management Station Standby. When circumstances preclude the JTIDS/MIDS Network Management Station from discharging duties, or when directed, the JTIDS/MIDS Network Management Station Standby should assume the responsibilities of the JTIDS/MIDS Network Management Station.

F4.2.4 JTIDS/MIDS Cryptonet Management. See Appendix D.

F4.2.5 JTIDS/MIDS NTR/Master. Accurate time is of critical importance in JTIDS/MIDS operations. The time held by each IU must be synchronized to prevent mutual interference. This is achieved by designating only one IU as the NTR/Master. The NTR/Master is assigned based on LOS considerations, survivability, availability, and access to GPS time base. The NTR/Master transmits a Net Entry message on the main net. Any IU within LOS of the

NTR/Master can receive this message and synchronize its time to the NTR/Master. This process is referred to as coarse synchronization.

F4.2.6 Secondary Time Source. An IU entering the IJMS network that is beyond the LOS of the NTR/Master may achieve synchronization using a secondary source. Terminals initialized to do so, after synchronizing with the NTR/Master, transmit the Initial Entry messages echoing the NTR/Master information. All IUs are capable of providing this service.

F4.2.7 IJMS Change Data Authority. A fully functioning network subscriber designated/assigned to generate CDOs.

F4.2.8 IJMS Reporting Unit (Normal Mode). A fully functioning network subscriber that uses active or passive synchronization to maintain connectivity, and is capable of exercising full JTIDS/MIDS voice and relay options as dictated by the network design.

F4.2.9 IJMS Non-Reporting Unit (Radio Silence). A network subscriber that uses passive synchronization to maintain connectivity and receive information.

F4.2.10 Relay. See Appendix D.

F4.2.11 Transmit Modes. IJMS, or Class 1 Terminals may be operated in one of four transmission modes: Net Time Reference/Master, Normal, Polling, and Radio Silence.

F4.2.11.1 NTR/Master Mode. The NTR, or Master maintains system time and does not transmit RTT interrogations nor compute local time corrections from information provided by other subscribers. Since the Master terminal defines network time, it is immediately in fine synchronization with a time quality equal to 15. It is the only terminal that may make adjustments to network time. It does not transmit the Net Entry message unless initialized to do so.

F4.2.11.2 Network Time Reference. Terminals that are designated NTR normally operate in the Normal mode and transmit position and status messages containing data fields for reporting time quality and position quality. Messages transmitted by the NTR terminal should have the highest time quality, above that of any other terminal, unless an external time standard is used.

F4.2.11.3 Normal Mode. Normal terminals must enter the network and perform clock synchronization with the Master terminal or other Normal terminals already in fine synchronization with the Master. Once in fine

synchronization, Normal terminals have the same capabilities as the Master except they cannot adjust network time.

F4.2.11.4 Polling Mode. A terminal in the Polling mode transmits data only on demand, except when passing an RTT interrogation message for synchronization purposes, or when automatic message acknowledgement is required; it does not respond to RTT interrogations. The time quality data field in transmitted messages is set to indicate the lowest time quality status. The terminal will set its reported TQ to zero so that it will not have to respond to RTT interrogations. The Master terminal cannot be placed in the Polling mode. JTIDS/MIDS Voice transmissions are not allowed.

F4.2.11.5 Radio Silence Mode. The terminal transmits a last P-message with the Radio Silence bit set in the next available P-message time slot following switch activation, and ceases all further transmission while Radio Silence. Normal terminals will maintain synchronization in the Passive mode. The initialized Passive/RTT sync mode is restored upon leaving Radio Silence. The Master may also go Radio Silence but time qualities will degrade as if there were no Master in the network.

F4.2.12 IJMS Communications Modes. There are four communications modes for an IJMS network. The selected mode determines whether the network can operate on multiple nets by employing frequency hopping, and whether the transmitted data may be encrypted. The communications mode is determined at network design. It can be modified during initialization, but not during network operation. All IUs in an IJMS network must use the same mode. Only Mode 1 will be used operationally. Mode 1 is the most secure. It uses frequency hopping, encryption, and can be multi-netted. Modes 2 and 4 are authorized only for test purposes. Mode 2 is encrypted and operates on a single net at a fixed frequency of 969 MHz. Mode 4 is also transmitted at 969 MHz, but it is not encrypted. Mode 4 should not be used to pass tactical data. Mode 3 is encrypted and operates on a single net at a fixed frequency of 969 MHz; however, this mode only applies to the Class 1 Terminal. The communications modes and their characteristics are shown in Table F4-1.

Table F4-1. IJMS Communications Modes

Communications Mode	Multiple Nets/AJ Capability	Data Encryption Capability
1 (Operational Use)	Yes	Yes
2 (Test Only)	No/Reduced AJ	Yes
3 (Class 1 only)	No/Reduced AJ	Yes
4 (Test only)	No	No

F4.2.13 Range Mode. The range mode is selectable as Normal (300 nm) or Extended Range (500 nm). The extended mode increases the propagation guard time of a time slot by decreasing the AJ features and the data capacity. The range mode is set at network design. It can only be modified during initialization. All IUs in the IJMS network must be set to the same range mode.

F4.2.14 External Time Reference. The Class 1 Terminal cannot use an ETR.

F4.2.15 Reference Grid Origin. IJMS superimposes a flat plane grid similar to the 1024 mile Link 11/11B grids over the JTIDS/MIDS spherical Latitude and Longitude or geodetic grid. The IJMS grid is tangent to the geodetic grid at the Grid Origin (a terminal entry parameter). If both grids are used, a unit will normally process position information on only one grid. Unlike the geodetic grid, the further a position report is from the Grid Origin, the greater the positional error will be.

F4.2.16 JTIDS/MIDS RELNAV. The Class 1 Terminal does not perform relative navigation.

F5. COMSEC. See Appendix D.

F6. JTIDS/MIDS Transmission Restrictions. Each country regulates the use of radio frequencies within its borders. Regulations exist concerning JTIDS/MIDS transmissions because JTIDS/MIDS operates in the frequency band used for aircraft radio navigation. The Link planner needs to research and comply with JTIDS/MIDS transmission restrictions for each operation. Policies for de-conflicting JTIDS/MIDS operations are contained in CJCSI 6232.01A.

F6.1 Interference Protection Features. JTIDS/MIDS terminals are provided with hardware and software controls to conform to frequency interference and allocation constraints. These EMC features are used to ensure minimum or no interference with IFF (including military IFF), ATCRBS and other navigation systems such as TACAN/DME. For Class 1 Terminals, the IPFs are controlled by settings of Full Protection or Peacetime (EMC 2), Partial Protection (EMC 1), and No Protection (EMC 0). The JTIDS/MIDS Network Management Station shall select the appropriate IPF override for the network.

F6.1.1 Full Protection. The Full Protection IPF (EMC 2) selection provides full interference protection. This selection imposes the following limits and constraints:

a. The Class 1 Terminal monitors its own emissions and automatically inhibits transmission if it exceeds specifications for the following conditions:

(1) Incorrect frequency hop, pulse width, or spurious emissions in IFF bands.

(2) Assignment of adjacent time slots or more than 304 (20 percent) of the time slots in a cycle.

(3) Assignment of adjacent time slots or more than 608 (40 percent) time slots in a net.

(4) Selection of high power, multi-net operation and communications in other than Mode 1.

(5) Transmission in disallowed time slots.

F6.1.2 Partial Protection. The Partial Protection IPF (EMC 1) selection bypasses the constraints of Full Protection IPF. This feature does, however, have the following limits and constraints:

a. Prevents the terminal from transmitting in Mode 1 if the frequency-hopped carriers are not distributed uniformly over the allowed bands of operation.

b. During Mode 1, 2, or 4 operation, prevents transmission if the transmitted pulse width is excessive (e.g., deviates from the norm more than 50 percent), or if the radiated energy in the bands 1030 ± 7 MHz or 1090 ± 7 MHz is excessive (e.g., exceeds the -60 dB/300 kHz level).

c. Coordination with the Federal Aviation Administration (or other appropriate authority when outside the United States) is required before using Partial Protection IPF.

F6.1.3 No Protection. The No Protection IPF (EMC 0) selection is a wartime-only selection that bypasses all constraints of the IPF.

F7. Network Initiation. See Appendix D.

F7.1 JTIDS/MIDS Terminal NDL. See Appendix D.

F7.2 OPTASK LINK Data. Operators must determine which data in the OPTASK LINK are applicable to their own platforms and enter the appropriate

values at their MSS. Other platform-unique parameters, such as time of day or present position, must be determined locally at the platform at the time of initialization load. Other information pertaining to overall network operations may be specified in the OPORD or in a pre-mission briefing.

F7.3 System Initialization. System initialization involves the loading of specific initialization parameters into the JTIDS/MIDS terminal in order to program it to operate in a desired fashion. The terminal retains in memory a set of default values that if no other instructions are received are used by the terminal. In many cases, these default values never change. The procedures for loading the initialization data into each IU are dependent upon system's design (e.g., MSS, or direct entry from the Radio Set Control (RSC) keyboard). System initialization parameters, which may need to be tailored on a specific IU, include transmit, receive, and relay time slot blocks as well as parameters for position and status reporting, net entry support, cryptovariables, and JTIDS/MIDS Voice channels. The entry of these initialization parameters is as automated as possible in the nonC2 IUs.

F7.3.1 PU Number. A TN is assigned to the IU for use as its address for IJMS operations, and for Link 11/11B operations if so equipped. An IU uses the same address on all directly interfaced digital data links on which it operates.

F7.3.2 Geodetic Position and Quality. This parameter identifies the geodetic position of the IU at the time of IJMS entry and the estimated accuracy of that position.

F7.3.2.1 JTIDS/MIDS RELNAV. Class 1 Terminals do not perform JTIDS/MIDS RELNAV so their reported Position Quality (PQ) remains equal to their initialized values as long as a P-message is received from the host each 12-second frame. For position types one and three (i.e., aircraft and surface ships, respectively), the PQ is decremented by one each frame that a P-message is not received from the host and is reset to the initialized value when a P-message is again received. For position type two (i.e., ground stations) the PQ remains constant.

F7.3.3 System Time and Quality. This parameter contains the current value of system time and the estimated accuracy of the time value.

F7.3.3.1 Time Uncertainty. Time Uncertainty is a Class 1 Terminal initialization parameter used to facilitate synchronization. Time Uncertainty specifies the maximum expected error in the operator’s estimate of JTIDS/MIDS network time in 6-second increments. Normal terminals use this value to achieve net entry. The Master terminal ignores this entry.

F7.3.4 IJMS Reporting Unit (Normal Mode)/IJMS Non-Reporting Unit (Radio Silence) Designation. This parameter designates the method that an IU is to use to attain fine synchronization. Reporting Units use the Active method. Non-Reporting Units use the Passive method.

F7.3.5 Communications Management Assignments. This parameter designates the IU to function as the JTIDS/MIDS NTR/Master, Change Data Authority, Reporting Unit, or Non-Reporting Unit.

F7.3.6 Wingman Designation. This parameter allows designation of the IU as the Flight Leader or a Wingman.

F7.4 IJMS Network Entry. IJMS network entry is the process of establishing time synchronization among all IUs in a network. One IU is assigned as the JTIDS/MIDS NTR/Master whose task is to establish network time. All JTIDS/MIDS terminals synchronize to network time automatically based on the reception of messages directly from the NTR/Master or other synchronized terminals initialized to transmit the Net Entry message.

F7.4.1 Time Synchronization. After a JTIDS/MIDS terminal is properly initialized, net entry is essentially automatic provided that messages are transmitted on the net by either the NTR or another synchronized user within LOS. When a valid message is received, coarse time synchronization is established. Fine synchronization is achieved by two methods

a. Active Synchronization. After receiving suitable position reports, the synchronizing terminal transmits an RTT message addressed to the terminal that transmitted the highest time quality position report. The addressed terminal replies in the same time slot, and from this a time refinement process begins using RTTs until the terminal becomes a full net member with the ability to transmit.

b. Passive Synchronization. Successive position reports from any other terminal and from these reports their distances are calculated. System time can be found by taking into account the propagation delay. A time refinement process then takes place in a similar manner as for active synchronization.

F7.4.2 JTIDS/MIDS NTR/Master. The IJMS network is established by the JTIDS/MIDS NTR/Master. The JTIDS/MIDS NTR/Master is the first IU to transmit on the network. There is only one NTR/Master in a network. The JTIDS/MIDS NTR/Master is initialized with cryptokeys and time during the initialization process. The JTIDS/MIDS NTR/Master's transmit time slots are

assigned during terminal initialization. Once time slots are assigned and the terminal is placed in a transmit mode, messages may be sent, thus establishing the network.

F7.4.3 Non-NTR/Master IU Entry. The JTIDS/MIDS NTR/Master begins the synchronization process with the transmission of Net Entry messages on the network. Other JTIDS/MIDS terminals that are attempting to join the network receive these messages. The operator must enter time as accurately as possible. Each IU then automatically achieves coarse synchronization to the timing of the Initial Entry message transmitted by the JTIDS/MIDS NTR/Master, an active relay terminal, or terminal initialized to transmit the Net Entry message. The Initial Entry message is never relayed. After achieving coarse synchronization and prior to transmitting operational data messages, the terminal must achieve fine synchronization. Fine synchronization is achieved and maintained automatically. The entire synchronization process can be accomplished while the terminal being synchronized is in the Radio Silence mode. Terminals initialized to transmit Initial Entry messages do so only after achieving fine synchronization. Once fine synchronization is achieved, the terminal automatically begins transmitting and receiving data on the network.

> NOTE: Class 1 Terminals can only transmit an IJMS Net Entry message. Class 2 Bilingual Terminals may transmit a Link 16 Initial Entry message or the Link 16 Initial Entry message and IJMS Net Entry message, alternately.

F7.4.4 Crypto Initialization Process. The Class 1 Terminal has only two cryptovariable locations in the SDU, whereas the Class 2 Terminal has eight. Additionally, both memory locations of the Class 1 Terminal must be loaded before it will operate.

F7.5 Network Control. See Appendix D.

F7.5.1 Network Maintenance Functions. See Appendix D.

F7.5.2 JTIDS/MIDS Network Management Station. The JTIDS/MIDS Network Management Station shall monitor the assigned JTIDS/MIDS NTR/Master and be responsible for maintaining sufficient terminals to support net entry. Additionally, the JTIDS/MIDS Network Management Station/Master shall assume, delegate, or make provisions for the assignment of any functions such as IJMS Change Data Authority that are associated with the network. The monitoring of relays requires JTIDS/MIDS Network Management Station actions. Usually a JTIDS/MIDS Network Management Station Standby is

designated at pre-mission planning. Only the CJTF or ICO can assign another IU to function as JTIDS/MIDS Network Management Station.

F7.5.3 JTIDS/MIDS NTR/Master. Once a synchronized IJMS network is established, maintenance of synchronization is automatic. Even with the loss of the JTIDS/MIDS NTR/Master, the time value in terminals already in fine synchronization permits continued communication for up to three hours. However, without a NTR/Master, terminals wishing to enter or re-enter the network are not able to synchronize. Therefore, a replacement NTR/Master must be activated. Care must be taken to ensure that only one NTR/Master is active. When directing transfer of the NTR/Master function from one IU to another, the JTIDS/MIDS Network Management Station shall ensure that each IU complies with the activation or deactivation assignment. An IU designated as the NTR/Master transmits Initial Entry messages automatically. Positive operator action is required to prevent transmission of those messages. If the operator selects other than the normal transmit mode while designated NTR/Master, an alert is generated.

F7.6 Subscriber Functions. See Appendix D.

F7.7 Data Registration. See Appendix D.

NOTE: The Class 1 Terminal does not perform JTIDS/MIDS RELNAV.

F7.8 Cryptonet Compromise. See Appendix D.

F7.9 Entering IJMS Operations. A C2 IU enters the IJMS Network according to the following procedures:

a. The C2 IU that is planning to enter the network shall contact the JTIDS/MIDS Network Management Station as far in advance as possible and inform him of the following:

(1) Reason for entry.

(2) Time/date of entry.

(3) Anticipated length of time of participation.

(4) Request OPTASK LINK information.

b. The JTIDS/MIDS Network Management Station shall then determine the impact on the interface and determine the approval or modification of the request for entry and inform the requesting C2 IU of the decision.

c. If approved or approved with modifications, the JTIDS/MIDS Network Management Station or ICO shall provide the C2 IU with the OPTASK LINK and an effective date/time that coincides with the unit's entry.

F7.10 Terminating IJMS Operations. A C2 IU exits the IJMS network in one of two ways: either a normal "planned" exit, or an unscheduled exit.

F7.10.1 Normal Network Exit. The following procedure will be used for a normal, planned exit from an IJMS network.

a. The C2 IU that is planning to depart the network shall contact the JTIDS/MIDS Network Management Station on the DCN as far in advance as possible and inform the JTIDS/MIDS Network Management Station of the following:

(1) Reason for departure.

(2) Time/Date of departure.

(3) Anticipated length of time of non-participation.

(4) Identification of functions currently performed for the integrity of the network (i.e., NTR/Master, Change Data Authority, Relay, etc.).

(5) Desire to maintain/release time slots assigned.

b. The JTIDS/MIDS Network Management Station shall then determine the impact on the interface and determine the approval or modification of the request and departure and inform the requesting unit of the decision.

c. If approved or approved with modifications, the JTIDS/MIDS Network Management Station shall reassign to other IUs those interface functions being performed by the exiting unit with an effective date/time that coincides with the unit's departure.

d. At the designated time, the departing C2 IU shall cease JTIDS/MIDS transmissions.

F7.10.2 Unscheduled Network Exit. The following procedure will be used if an unscheduled exit from the net occurs:

a. The JTIDS/MIDS Network Management Station shall attempt to contact the departing C2 IU to determine the following:

(1) Reason for departure.

(2) Estimated time/date of re-entry.

b. The JTIDS/MIDS Network Management Station shall then determine the impact on the interface and reassign to other IUs those interface functions necessary to maintain the IJMS network and inform all participants of the departure of the unit.

F7.11 IJMS Management Codes

a. Codes used in voice communications to manage Link technical operations are contained in Tables K-1 and K-4. Table K-1 provides Brevity Words from APP 7/MPP 7. Table K-4 provides Link Management Codes for all Links.

b. Link Management Codes (Table K-4). The three-Letter Codes shall be used for brevity and clarity only. These codes are unchanging and provide no security when transmitted over clear radio circuits. Any data that require security protection must be encrypted as specified by the Link 16 Manager or ICO.

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APPENDIX H TO ENCLOSURE A

ATDL-1 ESTABLISHMENT AND MAINTENANCE

NOTE: This Appendix is organized into three sections. Section 1 describes the Operational Characteristics of ATDL-1. Section 2 describes the Technical Characteristics of ATDL-1 and Section 3 describes the Planning and Operation of ATDL-1.

Section 1 - Operational Characteristics of ATDL-1

H1. General Description. ATDL-1 is a dedicated, point-to-point, duplex, digital data link using serial transmission frame characteristics and standard message formats at a basic speed of 1200 bps with an alternate rate of 600 bps and an optional rate of 2400 or 4800 bps (as available) to exchange real time tactical data between a C2 land unit and a SAM system, or between multiple SAM systems. Units that exchange data to the rest of the interface via ATDL-1 are designated Supporting Units (SUs).

H2. Communications Medium. ATDL-1 can be transmitted over landlines (wire or fiber-optic cable), single-channel radios, or multi-channel radio. Multi-channel radios may be established within LOS, use troposcatter techniques for over the horizon communications, or employ satellite communications. Both ends of the ATDL-1 link must use a compatible communications system. There are two basic communications systems employed by US forces, the DC digital form and the quasi-analog form.

a. The Marine Corps TAOC, Air and Missile Defense Planning and Control System (AMDPCS), Patriot Information Coordination and Control (ICC), and the Air Force Control and Reporting Center (CRC) use the quasi-analog transmission design that use the TD 1089 or TD 1316 modems.

b. ADA C2 systems operate using a quasi-analog form. Transmission and reception of ATDL-1 data, however is accomplished using DC Digital form and bulk encryption. The conversion is accomplished using an ADI to convert analog signals to digital signals (or visa versa) for transmission and receipt over the MSE net. Data transmissions are bulk encrypted by the MSE. Army ADA units directly interfaced with Air Force or Marine Corps C2 facilities will provide the necessary communications equipment for both ends of the ATDL-1 link. Bulk encryption will be provided by MSE. No point-to-point (line) encryption devices will be provided by NATO or Allied agencies. Where MSE connectivity cannot be established with Army ADA C2 systems due to unit locations or distance between units, radio communications equipment and

encryption devices must be provided by the Air Force or Marine Corps, or when available Army Signal units.

H3. Communications Architecture. SAM units that use ATDL-1 can be linked together to form a chain (Round Robin) or use a single forwarding unit as a hub with multiple units tied through the hub. The Round Robin mode permits data to be circulated within three Hawk Batteries using ATDL-1 formatted messages. It is used only in the absence of higher echelons. In the normal mode, ATDL-1 communications requires a separate, dedicated link between each supporting unit that simultaneously transmits and receives data on two channels, one dedicated transmit and one dedicated receive line. When data messages are not being transmitted, a continuous standby signal is transmitted by each unit to maintain time synchronization.

H4. Data Encryption. ATDL-1 is normally operated in the secure mode using encryption devices provided by the tactical unit. The configuration of encryption devices at both ends of the ATDL-1 links must be compatible. Configuration of encryption devices may be accomplished by means of "strapping" (physical) or "initialization" (electrical). The configuration means used is dependent on the TDS configuration. When MSE communications is used to provide the ATDL-1 link, secure mode operations is accomplished through bulk encryption of data transmissions by the MSE nodes. When ATDL-1 is transmitted over landlines (wire or fiber optic cable), single-channel radios, or multi-channel radios, the KG-30 (analog) or KG-84 (digital) single channel data encryption devices are used. Both the KG-30 and KG-84 use two key cards, one for transmitted data and one for received data. Encryption keys for the KG-30, KG-84, and KG-94A/KG-194A are loaded with the KYK-13 or KOI-18 devices.

> NOTE: NATO or Allied ADA C2 units provide the equipment necessary for data compatibility with Air Force or Marine Corps C2 facilities.

H5. Data Rates. ATDL-1 can be transmitted at the basic rate of 1200 bps with an alternate rate of 600 bps and an optional rate of 2400 or 4800 bps (as available). If the quasi-analog transmission scheme is used the audio signals will be modulated using FSK. See Section 2 of this Appendix for detailed technical requirements for each ATDL-1 data rate.

H6. Coordinate Reference Convention. ATDL-1 units exchange positional information on units, tracks, strobes, and points by transmitting an X and Y coordinate measured from the unit's SCC. A unit's location is reported to other IUs by transmitting its X and Y coordinates measured from the DLRP. All

positional information received from that unit is displayed in relation to the SCC.

H7. Transmission Structure.

a. ATDL-1 Test Message. Once the ATDL-1 link has been initialized a Test Message is transmitted. The continuing operational status of the link depends upon the exchange of the Test Message. This is a special message that is transmitted on a periodic basis by both ATDL-1 TDSs. Failure to receive this message for a specific period of time causes the ATDL-1 link to lose its Operational status. When the link status drops to less than Operational, all data exchange ceases except for the Idle Pattern (No Information Signal) and the Test Message.

b. No Information Signal. Once the link is established and no information is to be transmitted, the system will automatically assume an idling condition. This idle signal consists of alternating marks and spaces (1 0 1 0) and is continuously transmitted by each unit on the ATDL-1 link. This signal permits the two modems to remain in time synchronization and is interrupted only for the transmission of a data message, termination of the link by operator action, or equipment malfunction. The modem will indicate when a good idle pattern is received. This standby signal, or idle pattern, always starts with a one (1) and ends with a one (1) to distinguish it from the beginning of a start code.

c. ATDL-1 Data Message. ATDL-1 uses an 81-bit message frame that consists of:

(1) Start group - Nine bits all set to zero (0).

(2) Data Group - Seven data groups of 9 bits each immediately following the Start Group with the first bit of each Data Group set to one (1) and the next eight bits consisting of the B series message.

(3) Check Group - One check group completes each transmission frame and comprises a fixed bit set to one (1) followed by 8 check bits.

(a) Contiguous Data Message Grouping. The B-Series message transmit rules in MIL-STD-6013A for ATDL-1 require the transmission of multiple message sets. These message sets are transmitted as contiguous sets with no requirement for an idle pattern to be transmitted between messages. In a contiguous set the messages are transmitted back to back with no time delay between sets. Contiguous messages sets occur with the message

start codes immediately following the last bit of the previous message's Check Group. It is therefore possible to have extended interruptions of the No Information Signal (Idle pattern).

(b) Non-continuous Data Message. A non-continuous message set is a group of multiple messages separated by the insertion of a No Information Signal rather than transmitting messages back to back. When a No Information Signal is inserted between messages, the No Information Signal always starts with a bit set to one (1) and ends with a bit set to one (1).

H8. ATDL-1 Unit Address.

a. Each unit reporting on the ATDL-1 link is assigned a unique Station Address. This address or TN is assigned in the OPTASK LINK message and consists of two alpha characters that represent the station address and a three digit octal number, 000 through 777_8. The first alpha character can be “A” to “N”, “P” and “Q”. The second alpha character can be from “A” to “H”. A unit operating on multiple ATDL-1 links will use the same address for all links. A supporting fire unit will be assigned a TN by its reporting unit.

b. Restrictions. The Address AA000 is used to indicate No Statement/Unknown. “AA” and “QH” are illegal values for use as Station Addresses. If the address of the directly tied unit changes the data link will require reinitialization.

c. Units operating on a single ATDL-1 link but supporting the multi-link interface are designated Supporting Units, C2 units operating on multiple links (ATDL-1 and Link 11B) are designated FRU, and units operating on Link 11, and/or Link 11B, and ATDL-1 are designated FPU. For an FPU a single two-digit address is used in place of the normal three-digit address. The ATDL-1 address used by an FRU or FPU is required to be two alpha characters and three octal digits.

H9. ATDL-1 Track Numbers. An ATDL-1 TN consists of two alphabetical characters and three octal digits. An ATDL-1 TN derives its two alphabetical characters from the Station Address of the unit initiating the track and a unique three digit octal number derived from the TN block assigned to the unit. The Hawk BCP/PCP reserve TNs XY001 through XY006 for the following specific use, where “X” represents the values “A” to “N”, “P” and “Q” and “Y” represents the values “A” to “H”:

a. XY001 and XY002 are reserved to report Hawk Fire Sections.

b. XY003 through XY004 are used to report engaged ECM emitters.

c. XY005 through XY006 are used to report center bearings of HPI sector scan or center bearing of the LASHE engagement zone.

(1) The unique address “AA000” is used to indicate No Statement/Unknown.

(2) The unique address “QH” is used only as a General Address. “QH” is illegal for use as a station address.

H10. ATDL-1 Operation.

a. ATDL-1 Link Initialization.

(1) FTD Mode. Once an ATDL-1 link has been designated for use by the operator it is physically activated. Upon activation the ATDL-1 Standby Signal is transmitted along with the periodic Test Message. The Test Message contains the data link address of the transmitting unit that provides a capability to perform a loop-back check of the communications path, data path and encryption path. The Full Data Transmit mode provides for the automatic reporting of all tracks and information as soon as the link is Operational.

(2) LTD Mode. When an ATDL-1 unit requests to initialize its ATDL-1 link it may be directed to enter in the LTD mode as a means of resolving Dual Designations prior to activating its FTD mode. Only one unit shall be in the LTD mode for a single link. This allows the reception of track reports but inhibits the transmission of local air tracks until an operator or system action is taken to switch to the FTD mode. The unit in the LTD mode shall begin transmitting its surveillance tracks after the operator has determined that all necessary correlations are complete, or a maximum time limit has elapsed since the transition to an Operational link state.

b. Loop-back Check. ATDL-1 loop-back is performed by patching the Transmit output of the ATDL-1 modem into the Receive input of the ATDL-1 modem. When the ATDL-1 link is activated in the loop-back configuration the modem receives its own signal, the ATDL-1 link is activated and the Test Messages are transmitted by the TDS. The TDS recognizes its data link address contained in the Test Message and displays to the operator the status of the loop-back condition. Loop-back can be performed at various points throughout the ATDL-1 link and include establishing loop-back at the systems own modem, or switching the cable connection at the other end of the ATDL-1

link, i.e., at the remote TDS. This provides a positive means of isolating system problems.

c. Link Initialization. Once valid Test Messages are received at both TDSs, automatic link initialization occurs. When the required information elements have been exchanged the link becomes Operational and data messages are transmitted by both TDSs. Failure to receive an Test Message for a specified time period will cause the link to be removed from the Operational status until a valid Test Message is received that initiates the automatic link reinitialization. The Test Message is essential for maintaining an Operational ATDL-1 link.

d. Link States. ATDL-1 has two link states, Normal and Round Robin.

H11. System Employment. ATDL-1 is employed by Army, Marine Corps, Air Force, NATO and Allied C2 units and Army, Marine Corps, NATO, and Allied SAM Units.

Section 2 - Technical Characteristics of ATDL-1

H12. Data Signal Rates. ATDL-1 can be transmitted at the basic rate of 1200 bps with an alternate rate of 600 bps and an optional rate of 2400 or 4800 bps (as available). If the quasi-analog transmission scheme, is used the audio signals will be modulated using FSK. The characteristics of ATDL-1 modems are defined in the current edition of MIL-STD-188-110.

a. Basic Characteristics for 1200 bps. For the data signaling rate of 1200 bps, phase continuous FSK shall be used with a center frequency of 1700 Hz, a mark frequency of 1300 Hz, and a Space (0) frequency of 2100 Hz IAW MIL-STD-6013A.

b. Basic Characteristics for 2400 bps. For the data signaling rate of 2400 bps, Quadrature Phase Shift Keying (QPSK) shall be used with a carrier frequency of 1800 Hz IAW MIL-STD-188-200, resulting in a modulation rate of 1200 bps in the VF channel interface.

c. Basic Characteristics for 600 bps. For the data signaling rate of 600 bps, phase continuous FSK shall be used with a center frequency of 1500 Hz, a mark frequency of 1300 Hz, and a Space (0) frequency of 1700 Hz IAW MIL-STD-6013A.

d. Basic Characteristics for 4800 bps. TBD

H13. Transmission Speed Tolerance. The speed tolerance of the transmitted signal shall be +/- 1 part in 100,000. Receivers shall be able to accept speed variations of +/- 0.5 percent.

H14. Circuit Layout. In general ATDL-1 is a point-to-point circuit. Local exchanges should be bypassed wherever possible. Four-wire circuits will be used throughout. The prescribed use of the communications facilities along any route should include access to a two-way voice channel for maintenance purposes.

a. Impedance. Output and input impedance of the data transmission system on the line side will be standardized at 600 ohms +/- 10 percent balanced and resistive at 800 Hz. There will be no ground connection.

b. Transmitter Output Level. The signal output from the data terminal to the transmission system shall not exceed 0 dBm. Also, the signal level at a zero signal test point shall not exceed -10 dBm.

c. Receiver Input Level. The receiver shall accept input levels from 0 to -40 dBm. When necessary, receivers shall be provided with a variable attenuator covering the range of 0 to 15 dBm in -1 dBm steps.

d. Output Attenuator. Data transmitters shall be provided with a separate variable attenuator covering the range 0 to 20 dBm in -1 dBm steps.

H15. Switched Multi-channel Communications Subsystems.

a. Tactical Subsystem Type I is a multi-channel transmission subsystem using FDM equipment and FM wideband LOS or tropospheric scatter radio links or radio relay to cover distances up to 180 miles (290 km). The FDM equipment provides nominal 5 kHz VF channels and has been designed to operate with the quasi-analog signal level of -13 dBm0 and a test tone level of -10 dBm0 at the 4-wire input and output terminal of each VF channel and with a 0 TLP at these terminals.

b. Tactical Subsystem Type II is a multi-channel transmission subsystem using TDM/PCM equipment and wideband LOS, tropospheric scatter or satellite radio links or radio relay links, cable links with repeaters transmitting digital signals over distances of up to 180 miles (300 km). The TDM/PCM equipment provides nominal 4 kHz VF channels and has been designed to operate with a quasi-analog signal level of -6 dBm0 and a test tone level of -3 dBm0 at the 4-wire input and output terminals of each VF channel and with a -4 TLP at these terminals. For transmitting data in digital form over

the Type II tactical subsystem two types of equipment are employed, TDDM and the HSSDB. The TDDM is capable of accepting up to 24 digital telegraph or data signals and combining these signals to a 32 kbps bit stream that is fed into the HSSDB. For digital signals, the HSSDB automatically bypasses the analog-to-digital/digital-to-analog converters in the TDM/PCM equipment and provides direct action into the digital bit stream of the TDM/PCM link. As this equipment becomes available, it is recommended that data signals not be converted into quasi-analog signals and transmitted through a TDM/PCM VF channel, but rather be transmitted as digital signals through the TDM link.

c. Tactical Subsystem Type III is a multi-channel transmission subsystem using FDM equipment and FM wideband LOS or tropospheric scatter radio link or radio relay links. The subsystem had been designed for much longer distances (1100 miles) than the tactical subsystem Types I and II. The FDC equipment provides nominal 4 kHz VF channels and has been designed to operate with a quasi-analog signal level of -13 dBm0 and a test tone level of -10 dBm0 at the 4-wire input and output terminals of each VF channel and with a 0 TLP at the terminals.

d. Tactical Subsystem Type IV is a multi-channel TDM transmission subsystem under development that will employ CVSD modulation as the analog-to-digital conversion method and digital wideband line of sight, tropospheric scatter, and satellite radio links. The subsystem will have the capability to interface with existing nominal 4 kHz VF channels and will also have the capability to interconnect ATDL-1 terminal subsystems operating with digital signals at 1200 bps and 2400 bps over a digital channel. Access over digital channels will be the primary and preferred method of transmission in lieu of converting digital signals into quasi-analog signals for transmissions over analog channels.

e. For additional technical information see Military Standard (MIL-STD) MIL-STD 188-114, MIL-STD 188-200, and MIL-STD 188-212 that define the technical communications requirements for ATDL-1.

Section 3 - Planning and Operation of ATDL-1

H16. Coordination Communications.

a. Under tactical conditions initial communications between two ATDL-1 units is normally established on single channel tactical voice radios. These radios provide a means of engineering the communications path, i.e., aligning the directional antennas of the data radios used for ATDL-1 communications. Once multi-channel circuits are established, the ATDL-1 units begin the

coordination function that confirms the OPTASK LINK data in preparation for link initialization, coordinate link initialization over the voice circuits, and monitor the tactical situation.

b. Voice circuits between ATDL-1 units include both engineering and tactical voice circuits.

H17. Data Communications. ATDL-1 communications are normally transmitted over tactical radios. If multi-channel radio is used a directional antenna is normally employed, that is aimed at the receiving antenna whether LOS, reflected off the troposphere, or relayed by an orbiting satellite, ATDL-1 circuits are normally engineered by communications personnel. ATDL-1 when using multi-channel radios or multiplexing to provide a duplex circuit for data exchange, provides additional channels that are normally available on the data radios for voice communications between the directly tied units. Once "directional" communications is established between two units, a voice channel is used to coordinate the initialization of data communications.

H18. Tactical Data System. While the directional communications are being established the tactical data system is initialized with the OPTASK LINK data and any unique system data required to establish data link communication and conduct operations. At this time a system may perform internal loop-back checks to verify connectivity between the tactical data system, encryption equipment, and modems. Once the tactical communications are established, the unit is ready to perform an end around loop-back, that is a loop-back check of the entire communications path by patching the modem of the remote unit and receiving their own signal back at their own site. Each unit can perform this end around loop-back check to adjust system levels and evaluate system performance.

H19. Link Initialization. Once ATDL-1 data communications are established, the encryption device is "prepped" which synchronizes the time signal between the units. When the link is activated, the input/output channel of the TDS is initialized which transmits the initial sequence of messages. The successful exchange of these messages triggers the transmission of track reports that initializes the two-way exchange of data between units. Track data will now be exchanged between the systems depending on the whether the systems are in the FTD or LTD Mode. Only one unit shall be in the LTD Mode for a single link. The two-way data exchange is maintained as long as valid Test Messages are exchanged.

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APPENDIX I TO ENCLOSURE A

LINK 1 ESTABLISHMENT AND MAINTENANCE

Section 1 - Operational Characteristics of Link 1

I1. General Description. Link 1 is a point-to-point, duplex, non-encrypted, digital data link for the automatic exchange of track and strobe data, combined with link and data management messages between ground based ASACS-elements (e.g. CRC's and CAOC), specific units (TACS/MCE) and data link buffers (SSSB, CSI). Link 1 is operated at a basic speed of 1200 bps with alternate speeds of 600 and 2400 bps.

I2. Type of tracks. The following tracks are being exchanged by Link 1 between the different users of the Recognized Air Picture (RAP):

a. Ground Environment tracks (GE tracks): tracks that have received their last position-update by a Ground Site. These are either local or remote.

b. Airborne Early Warning tracks (AEW tracks): tracks that have received their last position-update by an AEW-platform. These are always remote;

c. GE/AEW tracks. These tracks are used as "Track Pairs" for registration purposes and are updated by both the ground sites and AEW.

d. E-3A tracks. The track of an active E-3A, usually correlated with the received P-1 message on IJMS.

I3. Link Messages. The following link messages are supported by Link 1 in the NATO Air Defense Ground Environment (NADGE):

a. S0 – Test Message. Used to test the channel used to exchange Link 1 data. The S0 is, on average, transmitted every 10 seconds.

b. S3 – IFF/SIF Message. Used to transmit the IFF/SIF Mode 1, 2 and 3 on a specific track. This message is always associated with a S4 Basic Track Data Message.

c. S4 – Basic Track Data Message. Used to report the basic positional data of a track. The S4 is either associated with a S3 or a S5 message.

d. S5 – Expanded Track Data Message. Used in conjunction with a S4 (or S8) to report the additional data of a track. The initial transmission of a S4/S5 message combination initiates a new track at the receiving Link 1 site.

e. S6 – Strobe Message. Used to report strobes, based on interference or electronic counter (radar) measures. The S6 is always transmitted alone and never associated with any other S-message.

f. S8 – AEW Basic Track Data Message. Used to forward AEW-tracks, received on IJMS via Link 1 to another Link 1 capable site. Special Cross-tell Areas are needed to activate this forwarding capability. The implementation of the S8 message is, obviously, paramount (e.g. the CSI is not capable of receiving AEW-tracks via Link 1). The S8 Message basically has the same contents as the S4 message and is also associated with the S5 message.

g. S14 – Management Message. Used to control the exchange of track data on Link 1 and to manipulate the track data itself. For example, S14 messages can be transmitted to change the settings in the other site's Cross-tell Areas or to change track parameters like ID and NTN. S14 messages are generated either manually or automatically.

I4. Link Characteristics

I4.1 Communication mode. Link 1 supports duplex exchange of data between two users.

I4.2 Communications Medium. Link 1 is normally transmitted over land lines (telephone) but can be transmitted over multi-channel radio. Multi-channel radios may be established within line of sight, use troposcatter techniques for over the horizon communications, or employ satellite communications. Both ends of the link shall use a compatible communications system.

I4.3 Track Transmission Frame (TTF). Link 1 S-messages are transmitted in associated pairs in a TTF. A TTF holds 128 data- and (link) control bits. A TTF is filled with a combination of S-messages e.g. S4/S4, S3/S4, S5/S8, S0/S0 or a single S6. The type of S-messages and their Priority Level, with the

number of TTF's in the transmission queue are of direct influence on the length of the Track Transmission Cycle (TTC, paragraph I4.5)

I4.4 Priority Levels. The different S-messages (and their combinations) are transmitted according to a specific priority scheme called the Priority Levels as defined in table I-1. These determine in which order the messages are transmitted.

Table I-1. Link 1 Priority Levels

Priority Level	Message / Message Combination
1	S0/S0
2	Specific S14
3	S6
4	S4/S5, S3/S4, S5/S8 with High Priority*, specific S14
5	S4/S5, S3/S4, S5/S8 with Low Priority*

* The Low/High Priority is defined by the settings in the Cross-tell Areas by the operator

I4.5 Track Transmission Cycle (TTC) and Track Transmission Cycle Load. The exchange of Link 1 messages, by the use of TTFs, is carried out within the TTC. The TTC generally has an update rate of 10 seconds. Within this timeframe, about 92 TTFs can be transmitted. The TTFs contain S-messages according to the Priority Levels as described above. The number of S-messages in the queue to be transmitted determines the Load of the TTC. The following three Loads are possible:

a. No Load. In this case all outstanding S-messages can be transmitted in the 10 second TTC. After this period, the Cycle starts over again, always beginning with a S0/S0.

b. High Load. In this situation the S-messages with Priority Levels 1 to 4 have priority. If there are still TTFs left within the 10 second TTC (max of 92 TTF in 10 sec), these will be utilized for the transmission of messages with Priority Level 5. The High Load condition indicates that there are still messages in the queue left that need to be transmitted. The remaining messages in the queue are transmitted in the next TTC, provided no new messages with higher priority are added to the transmission queue.

c. Overload. In this condition, no more messages with Priority Level 5 are transmitted. To ensure the transmission of all other messages the TTC can and will be extended to a maximum of 12 seconds. A new S0/S0 combination is transmitted, indicating the start of a new TTC, filled with the rest of the Priority Level 4 or higher messages.

I4.6 Telling States. Telling States, as defined in Table I-2, are used to indicate the status of a track on Link 1. The Telling State, appropriate to the situation of each track, is presented to the operator. The implementation of Telling States is system-dependent. All NATO CRCs and CAOCs are capable of displaying Telling States for operator interpretation. The States are:

Table I-2. Link 1 Telling States

Telling State	Meaning
0	Track has never been exchanged and is not being exchanged
1	Track is not being exchanged anymore
2	Track fulfils the requirements to be exchange, but manual input prevents it, e.g. Stop Tell
3	Track is received from a Link 1 site and therefore remote
4	Track is exchanged by manual input, e.g. Force Tell
5	Track is exchanged automatically with High Priority
6	Track is exchanged automatically with Low Priority
7 (Only set by overlapping LVOI en RVOI, paragraph I 4.7)	AEW-track, received via IJMS is forwarded to a specific Link 1 site.

I4.7 Cross-tell Areas. The exchange of Link 1 track data is controlled by Cross-tell Areas. The following apply:

a. Area of Operational Interest (AOI). This is a rectangular, horizontally orientated area in which tracks can automatically be selected for transmission

(Out-Tell) to a specific Link 1 site. In order to transmit track data via Link 1, an AOI has to be activated by the transmitting unit. AOIs have to be inserted for each activated Link 1 channel. It is possible to exclude tracks from Out-Tell or to set the telling priority for Out-Tell, based on their specific ID e.g. FRIEND, PENDING, FAKER etc. The options are No Tell, High Tell and Low Tell, which, in general, correspond with the Telling States 0, 5 and 6.

b. Track Continuity Area (TCA). This is a rectangular area that lies perpendicular to the borders of the Track Production Area (TPA) of the Link 1 site (e.g. CRC). The TCA provides track continuity between adjacent CRC's and their respective TPAs. In theory, a TCA is a transmit-area, therefore each Link 1 site has to insert one for the benefit of its neighboring site. In practice, it appears to the user that the TCA is a transmit/receive area since both TCAs overlap each other.

c. Volume of Operational Interest (VOI). This Cross-tell Area is used for the reception of AEW-tracks from an AEW-platform. A VOI is a rectangular area that can be rotated. Furthermore, an altitude-layer can be inserted. Two specific types of VOI exists:

(1) Local VOI (LVOI). The LVOI is used for a site's own benefit for directly receiving AEW tracks via IJMS. Although this is not related to Link 1, the LVOI influences Telling State 7, in conjunction with a Remote VOI (RVOI).

(2) RVOI. The RVOI is used to forward AEW tracks via Link 1. A RVOI is inserted by an IJMS operating Link 1 unit (e.g. CRC) for the benefit of the receiving Link 1 site. This last site may, for operational/technical reasons, not be able to join the IJMS net. The RVOI is positioned over the area of interest of the receiving site. AEW tracks within the RVOI boundaries are only displayed at the receiving Link 1 site, not at the forwarding IJMS/Link 1 station. Telling State 7 is set at the forwarding site by the overlap of a LVOI with a RVOI.

d. AEW Target Area (ATA). The ATA is used to transmit GE-tracks from an IJMS operating ground site to the AEW platform. Although the ATA has no direct relation to Link 1, the different Telling States apply for the ground site.

I4.8 <u>NATO Track Numbers (NTN)</u>. Each track within the NADGE is allocated a NTN. NTN's consist of two alpha characters and three octal numbers. The alpha characters are assigned from A, E, G, H, J, K, L and M, and the three

digit octal numbers range from 000 through 777_8. Each Link 1 site is assigned a fixed alpha character combination, for example KM. The combination AA is reserved for use as Non-NATO Track Number (NNTN). These NNTNs are, by (NADGE) software functionality, automatically excluded from transmission. Also no buffer systems (e.g. SSSB, CSI) are capable of automatically forwarding NNTN tracks. The only exception to this rule is for tracks identified as Interceptor, which are always transmitted, even when outside the Cross-tell Area or altitude-layer. When a NNTN is transmitted, by manual input (Force Tell), the receiving site allocates a NTN from its own NTN block. For ease of reference to a track, the NTN shall be retained, even when crossing several TPAs.

I4.9 Air Surveillance and Control System Configuration (ASACSCON). Within NADGE, the CRCs and their respective CAOCs are connected to the CRCs directly adjacent to them. The configuration of the Cross-tell Area's (for each activated Link 1 channel) are in a pre-set arrangement, called an ASACSCON. In case of an outage of one of the CRC's, an alternative ASACSCON will be ordered by the CAOC, resulting in a reconfiguration of, not only the shape and size of TPAs, but also of Link 1 channels and their associated Cross-tell Area's. All current ASACSCONs are described in the Regional Command North Operating Manual 80-7 Vol III.

Section 2 - Technical Characteristics of Link 1

I5. Transmission Speed Tolerance. The transmission speed tolerance of the transmitted signal shall be +1 part in 100000. Receivers shall be capable of accepting speed variations of ± 0.5 percent.

I5.1 Modulator-Demodulator

I5.2 Transmission Mode. Frequency modulation with a synchronous transmission mode will be used.

I5.3 Data Signal Rates. Link 1 is operated at a basic speed of 1200 bps with an alternate speed of 600 bps and 2400 bps using DFSK with a synchronous transmission mode. PSK may be used by mutual agreement.

I5.4 Impedance. Output and input impedance of the data transmission system on the line side will be standardized at a nominal 600 ohms, balanced

and resistive at 800 Hz. The balance to ground shall be at least 48 dB. There will be no ground connection on the line side.

I5.5 Impedance Tolerance. Impedance tolerance is determined over the frequency band 300 to 3400 Hz by:

$$\text{Return loss} = 20 \log_{10} \frac{Z \pm 600 \text{ ohms}}{} \text{ dB greater or equal to 15 dB}$$

I5.6 Receiver Input Level. The receiver should accept input levels from 0 to -40 dB. Where necessary, receivers shall be provided with a variable attenuator covering the range of 0 to -25 dB in -5 dB steps.

I5.7 Output Attenuator. Data transmitters shall be provided with separate variable output attenuators covering the range 0 to -20 dB in -1 dB steps. This attenuator will conform to CCITT recommendations and be so arranged as to be accessible only by the component charged with implementing the long distance communications links.

I5.8 Output/Input Filters. For leased point-to-point circuits, it is recommended that the transmitters employ an output filer to reject frequencies above 3400 Hz. The total transmitted power above this frequency should be at least 40 dB below the steady state signal power. The receiver should employ a bandpass input filter. Use of both filters should contribute significantly to the differential group delay of the system.

I6. Switched Multi-channel Communications Subsystems

I6.1 Tactical Subsystem Type I. Tactical Subsystem Type I is a multi-channel transmission subsystem using FDM equipment and FM wideband LOS or tropospheric scatter radio links or radio relay to cover distances up to 180 miles (300 km). The FDM equipment provides nominal 5 kHz VF channels and has been designed to operate with the quasi-analogue signal level of -13 dBm0 and a test tone level of -10 dBm0 at the 4-wire input and output terminal of each VF channel and with a 0 TLP at these terminals.

I6.2 Tactical Subsystem Type II. Tactical Subsystem Type II is a multi-channel transmission subsystem using TDM/PCM equipment and wideband LOS, tropospheric scatter or satellite radio links or radio relay links, cable links with repeaters transmitting digital signals over distances of up to 180 miles (300

km). The TDM/PCM equipment provides nominal 4 kHz VF channels and has been designed to operate with a quasi-analogue signal level of -6 dBm0 and a test tone level of -3 dBm0 at the 4-wire input and output terminals of each VF channel and with a -4 TLP at these terminals. For transmitting data in digital form over the Type II tactical subsystem two types of equipment are employed, TDDM and the HSSDB. The TDDM is capable of accepting up to 24 digital telegraph or data signals and combining these signals to a 32 kbps bit stream that is fed into the HSSDB. For digital signals, the HSSDB automatically bypasses the analogue-to-digital/digital-to-analogue converters in the TDM/PCM equipment and provides direct action into the digital bit stream of the TDM/PCM link. As this equipment becomes available, it is recommended that data signals not be converted into quasi-analogue signals and transmitted through a TDM/PCM VF channel, but rather be transmitted as digital signals through the TDM link.

I6.3 Tactical Subsystem Type III. Tactical Subsystem Type III is a multi-channel transmission subsystem using FDM equipment and FM wideband LOS or tropospheric scatter radio link or radio relay links. The subsystem had been designed for much longer distances (1100 miles) than the tactical subsystem Types I and II. The FDC equipment provides nominal 4 kHz VF channels and has been designed to operate with a quasi-analogue signal level of -13 dBm0 and a test tone level of -10 dBm0 at the 4-wire input and output terminals of each VF channel and with a 0 TLP at the terminals.

Section 3 - Planning and Operation of Link 1

I7. OPTASK LINK Message. Information required to establish Link 1 communications between centers is distributed in the OPTASK LINK. For Link 1 use sets 12 through 23.

I8. Coordination Communications

a. Under tactical conditions initial communications between two Link 1 units is normally established on single channel tactical voice radios. These radios provide a means of engineering the communications path, i.e., aligning the directional antennas of the data radios used for Link 1 communications. Once a multi-channel circuit is established, the units coordinate over the voice circuits to monitor the tactical situation and begin the coordination function that confirms the OPTASK LINK data in preparation for link initialization.

b. Voice circuits between NATO centers include both engineering and tactical voice circuits.

I9. Data Communications. Link 1 communications is normally transmitted over landlines (telephone circuits). If multi-channel radio is used a directional antenna is normally employed, that is aimed at the receiving antenna whether LOS, bounced off the troposphere, or relayed by an orbiting satellite, Link 1 circuits are normally engineered by communications personnel. Link 1 when using multi-channel radios or multiplexing to provide a duplex circuit for data exchange, provides additional channels that are normally available on the data radios for voice communications between the directly tied NATO centers. Once communications are established between two units, voice coordination is used to initialize data communications.

I10. Tactical Data System. While the directional communications are being established the TDS is initialized with the OPTASK LINK data and any unique system data required to establish data link communication and conduct operations. At this time a system may perform internal loop-back checks to verify connectivity between the TDS, encryption equipment if used, and modems. Once the communications is established the unit is ready to perform an end around loop-back, that is a loop-back check of the entire communications path by patching the modem of the remote unit and receiving their own signal back at their own site. Each unit can perform this end around loop-back check to adjust system levels and evaluate system performance.

APPENDIX J TO ENCLOSURE A

DATA LINK INTERFACE OPERATOR FIDELITY DRILLS

J1. Introduction. The TDL Interface Operator Fidelity Drills are designed to: refine operator proficiency in initiating and recognizing TDL Interface data elements; refine operator skills in recognizing and resolving conditions that degrade the effectiveness of interface operations; exercise hardware and software components of the interface; and validate the fidelity of the operational interface. These drills are meant to support the training needs of a broad variety of units and missions that make up the TDL Interface community. Effective use of these drills requires deliberate preparation and coordination by training managers at participating units for each fidelity drill training session. These drills were designed for Link 11 and 11B. They may be used with Link 16, but do not reflect certain additional capabilities of the Link 16 message standard.

J1.1 Organization. Units may select the events or steps that they require for training their own system operators. Specific instructions for each set of Fidelity Drills are included at the applicable Tab. Tabs or events not applicable to the needs of the participants during a particular training session or operational exercise may be disregarded. The Fidelity Drills have been organized into eight Tabs, with each Tab containing several Events and Action Steps. The Tabs are as follows:

TAB A - Battle Management Fidelity Drills
TAB B - Air Track Data Management Fidelity Drills
TAB C - Surface Track Data Management Fidelity Drills
TAB D - Points Data Management Fidelity Drills
TAB E - Intelligence Track Management Fidelity Drills
TAB F - Data Link Filter Management Fidelity Drills
TAB G - Comprehensive Integration Fidelity Drills
TAB H - Simple Integration Fidelity Drills for CRC/CRE and TAOC/EWC Units

J1.2 Coordination and Execution. In Joint Operations or Exercises, the senior ICO will organize, coordinate, and direct the execution of Fidelity Drills prior to the operational activity or the start of the exercise. For local unit training, the unit ICO, senior air surveillance person or weapons control section person may direct their portions of the Fidelity Drills. Fidelity Drill coordination should be conducted on secured/covered nets or circuits. Units will be specified to participate in the events and take the actions listed. The unit specified to take

the actions will ensure the other units receive data and changes over the link prior to continuing with the next action.

TAB A - BATTLE MANAGEMENT ACTION FIDELITY DRILLS

J1.3 Description. Battle Management Action Fidelity Drills cover the command and alert actions used by Joint C41 Battle Managers, Weapons Controllers, Air Intercept Controllers, etc. These drills are designed for two interface units.

J1.4 Purpose. These Fidelity Drills develop and refine TDL Interface operator skills in initiating, recognizing and responding to Battle Management commands and alerts. Operators to be trained with these drills are those at the various TDL operational facilities responsible for the management and control of air defense fighters and weapons systems.

J1.5 Examples of Joint Operations Personnel to be Trained

Army	FDC/ICC TD/TDA
Navy	AIC
Air Force	SD, WAO, WD, ICT at CRC/CRE, and MCC, SD, WD, ASO at AWACS
Marine Corp	SWD, WC, MC at TAOC

J1.6 Execution. These Fidelity Drills will normally be executed under the direction of the senior TDL Interface element involved in the training session. Voice acknowledgment of all events/actions is required. The Area of Responsibility (AOR), Track Production Area (TPA), Sector Bullseye, or exercise airspace will be designated as the Fidelity Drill working area or center point for the quadrants depicted below. Live track data may be used instead of manually initiated tracks if appropriate to the joint training activity. Designated units will initiate tracks, points, or commands into the system, as directed by the Events/Action Steps, in the following manner:

TARGET	IDENTITY	QUADRANT		
One	Suspect	1	1	2
Two	Friend	2	3	4
Three	Unknown	3		
Four	Hostile	4		

TAB A - BATTLE MANAGEMENT ACTION FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

ONE

Al-l	One	Send ADW White, “Weapons Tight”.
	Two	Verbally Acknowledge.
Al-2	One	Send ADW Yellow, “Weapons Tight”.
	Two	Verbally Acknowledge.
Al-3	One	Send ADW Red, “Weapons Free”.
	Two	Verbally Acknowledge.
Al-4	One	Send “Scramble”*.
	Two	Send “WILCO”.

TWO

A2-1	One	Send “Out of Action”*.
	Two	Verbally Acknowledge “Out of Action”.
A2-2	Two	Send “Out of Action”*.
	One	Verbally Acknowledge “Out of Action”.
A2-3	One	Send “Ready/Available”*.
	Two	Verbally Acknowledge “Ready/Available”.
A2-4	Two	Send “Ready/Available”*.
	One	Verbally Acknowledge “Ready/Available”.
A2-5	Two	Send “Hot/Cold Missile Count”*.
	One	Verbally Acknowledge Exact “Missile Count” Sent.

NOTE: The AN/TYQ-23 does not have the actions depicted with asterisk(*).

THREE

A3-1	One	Send “Cover” on Target One.
	Two	Send “WILCO”.

TAB A - BATTLE MANAGEMENT ACTION FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

A3-2	Two	Send “Tracking”*.
	One	Verbally Acknowledge “Tracking”.
A3-3	One	Send “Engage” on Target One.
	Two	Send “CANTCO”.
A3-4	Two	Send “Engagement Broken”* on Target One.
	One	Verbally Acknowledge “Engagement Broken”.
A3-5	One	Send “Cease Engagement”.
	Two	Send “HAVCO”.

FOUR

A4-1	Two	Send “Tracking”* on Target Two.
	One	Send “Hold Fire” on Target Two.
	Two	Send “WILCO”.
A4-2	Two	Send “Engagement Broken”*.
	One	Verbally Acknowledge “Engagement Broken”.

FIVE

A5-1	One	Send “Investigate/Assign” on Target Three.
	Two	Send “WILCO” Pair on Target Three.
A5-2	One	Send “Cease Fire” on Target Three.
	Two	Send “WILCO”.
A5-3	One	Send “Engage Salvo” on Target Three.
	Two	Send “WILCO”.
A5-4	Two	Send “Firing/Engaging”* on Target Three.
	One	Verbally Acknowledge “Firing/Engaging”.
A5-5	Two	Send “Not Effective”*.
	One	Verbally Acknowledge “Not Effective”.

TAB A - BATTLE MANAGEMENT ACTION FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

A5-6	One	Send "Cease Engagement".
	Two	Send "WILCO" Break Pairing on Target Three.

NOTE: The AN/TYQ-23 does not have the actions depicted with asterisk(*).

SIX

A6-1	One	Send "Heads Up" on Target Four.
	Two	Send "WILCO".
A6-2	One	Send "Engage" on Target Four.
	Two	Send "WILCO".
A6-3	Two	Send "Tracking"* on Target Four.
	One	Verbally Acknowledge "Tracking".
A6-4	Two	Send "Firing/Engaging" on Target Four.
	One	Verbally Acknowledge "Firing/Engaging".
A6-5	Two	Send "Effective"*.
	One	Verbally Acknowledge "Effective".

NOTE: The AN/TYQ-23 does not have the actions depicted with asterisk(*).

TAB B - AIR TRACK DATA MANAGEMENT FIDELITY DRILLS

J2. Description. Air Track Data Management Fidelity Drills cover initiation and recognition of Air Track Data Elements used during TDL Interface operations. These drills are designed for two interface units, but may be adapted for multiple units. One unit must be designated as the Identification Authority.

J2.1 Purpose. These Fidelity Drills develop and refine TDL Interface operator skills in initiating and recognizing Air Track Data. Operators to be trained with these drills are those at the various TDL operational facilities responsible for the initiation and management of Air Track Data.

TAB B - AIR TRACK DATA MANAGEMENT FIDELITY DRILLS (continued)

J2.2 Examples of Joint Operations Personnel to be Trained.

Army	FDC/ICC TD, TDA.
Navy	Track Supervisor, Surveillance Operators.
Air Force	ASO, AST, ICT at CRC/CRE, and ASO, AST, AAST at AWACS.
Marine Corps	Interface Coordination/Track Data Cell at TACC; SID, SO at TAOC.

J2.3 Execution. These Fidelity Drills will normally be executed under the direction of the senior TDL Interface element involved in the training session. Voice acknowledgment of all events/actions is required. The Area of Responsibility (AOR), Track Production Area (TPA), Sector Bullseye, or exercise airspace will be designated as the Fidelity Drill working area or center point for the quadrants depicted below. Live track data may be used instead of manually initiated tracks if appropriate to the joint training activity. Designated units will initiate tracks/points into the system, as directed by the Events/Action Steps, in the following manner:

TARGET	IDENTITY	QUADRANT		
One	Suspect	1	1	2
Two	Friend	2		
Three	Unknown	3	3	4
Four	Hostile	4		

EVENT/STEP UNIT TARGET DATA ACTIONS

ONE

B1-l	One	Enter Target One Identity: “UNKNOWN/Evaluated - General”.
	Two	Acknowledge Target One Identity Change.
Bl-2	One	Enter Target One Identity: “UNKNOWN - Bomber”.
	Two	Acknowledge Target One Identity Change.
B1-3	One	Enter Target One Identity: “UNKNOWN - Fighter”.
	Two	Acknowledge Target One Identity Change.
B1-4	One	Enter Target One Identity: “UNKNOWN - AEW”.
	Two	Acknowledge Target One Identity Change.

TAB B - AIR TRACK DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT TARGET DATA ACTIONS

B1-5	One	Enter Target One Identity: "UNKNOWN - Helo/Transport".
	Two	Acknowledge Target One Identity Change.
Bl-6	One	Enter Target One Identity: "UNKNOWN - Missile Platform".
	Two	Acknowledge Target One Identity Change.

TWO

B2-1	Two	Enter Target Three Identity: "ASSUMED FRIEND - General".
	One	Acknowledge Target Three Identity Change.
B2-2	Two	Enter Target Three Identity: "ASSUMED FRIEND - Bomber".
	One	Acknowledge Target Three Identity Change.
B2-3	Two	Enter Target Three Identity: "ASSUMED FRIEND - Fighter".
	One	Acknowledge Target Three Identity Change.
B2-4	Two	Enter Target Three Identity: "ASSUMED FRIEND - AEW".
	One	Acknowledge Target Three Identity Change.
B2-5	Two	Enter Target Three Identity: "ASSUMED FRIEND - Helo/Transport".
	One	Acknowledge Target Three Identity Change.
B2-6	Two	Enter Target Three Identity: "ASSUMED FRIEND - Missile Platform".
	One	Acknowledge Target Three Identity Change.

THREE

B3-1	One	Enter Target One Identity: "Suspect - General".
	Two	Acknowledge Target One Identity Change.
B3-2	One	Enter Target One Identity: "Suspect - Bomber".
	Two	Acknowledge Target One Identity Change.
B3-3	One	Enter Target One Identity: "Suspect - Fighter".
	Two	Acknowledge Target One Identity Change.

TAB B - AIR TRACK DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT TARGET DATA ACTIONS

B3-4	One	Enter Target One Identity: "Suspect - AEW".
	Two	Acknowledge Target One Identity Change.
B3-5	One	Enter Target One Identity: "Suspect - Helo/Transport".
	Two	Acknowledge Target One Identity Change.
B3-6	One	Enter Target One Identity: "Suspect - Missile Platform".
	Two	Acknowledge Target One Identity Change.

FOUR

B4-1	Two	Enter Target Two Identity: "FRIEND - General".
	One	Acknowledge Target Two Identity Change.
B4-2	Two	Enter Target Two Identity: "NEUTRAL".
	One	Acknowledge Target Two Identity Change.
B4-3	Two	Enter Target Two Identity: "FRIEND - Non-Military".
	One	Acknowledge Target Two Identity Change.
B4-4	Two	Enter Target Two Identity: "FRIEND - Missile".
	One	Acknowledge Target Two Identity Change.
B4-5	Two	Enter Target Two Identity: "FRIEND - RTB".
	One	Acknowledge Target Two Identity Change.

FIVE

B5-1	One	Enter Target Two Identity: "FRIEND - Helo - General".
	Two	Acknowledge Target Two Identity Change.
B5-2	One	Enter Target Two Identity: "FRIEND - Helo - USW".
	Two	Acknowledge Target Two Identity Change.
B5-3	One	Enter Target Two Identity: "FRIEND - Helo - SAR".
	Two	Acknowledge Target Two Identity Change.
B5-4	One	Enter Target Two Identity: "FRIEND - Helo - Gunship".
	Two	Acknowledge Target Two Identity Change.

TAB B - AIR TRACK DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT TARGET DATA ACTIONS

B5-5	One	Enter Target Two Identity: "FRIEND - Helo - Recce".
	Two	Acknowledge Target Two Identity Change.
B5-6	One	Enter Target Two Identity: "FRIEND - Helo - Logistics".
	Two	Acknowledge Target Two Identity Change.
B5-7	One	Enter Target Two Identity: "FRIEND - Helo - Troop Lift".
	Two	Acknowledge Target Two Identity Change.
B5-8	One	Enter Target Two Identity: "FRIEND - Helo - MEDEVAC".
	Two	Acknowledge Target Two Identity Change.

SIX

B6-1	Two	Enter Target Four Identity: "HOSTILE - General".
	One	Acknowledge Target Four Identity Change.
B6-2	Two	Enter Target Four Identity: "HOSTILE - Missile".
	One	Acknowledge Target Four Identity Change.
B6-3	Two	Enter Target Four Identity: "HOSTILE - Bomber".
	One	Acknowledge Target Four Identity Change.
B6-4	Two	Enter Target Four Identity: "HOSTILE - Fighter".
	One	Acknowledge Target Four Identity Change.
B6-5	Two	Enter Target Four Identity: "HOSTILE - AEW".
	One	Acknowledge Target Four Identity Change.
B6-6	Two	Enter Target Four Identity: "HOSTILE - Helo/Transport".
	One	Acknowledge Target Four Identity Change.
B6-7	Two	Enter Target Four Identity: "HOSTILE - Missile Platform".
	One	Acknowledge Target Four Identity Change.

SEVEN

B7-1	One	Enter Target Two Identity: "FRIEND - AEW".
	Two	Acknowledge Target Two Identity Change.

TAB B - AIR TRACK DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT TARGET DATA ACTIONS

B7-2	One	Enter Target Two Identity: "FRIEND - SAR".
	Two	Acknowledge Target Two Identity Change.
B7-3	One	Enter Target Two Identity: "FRIEND - EW".
	Two	Acknowledge Target Two Identity Change.
B7-4	One	Enter Target Two Identity: "FRIEND - Recce".
	Two	Acknowledge Target Two Identity Change.
B7-5	One	Enter Target Two Identity: "FRIEND - FAKER Jammer".
	Two	Acknowledge Target Two Identity Change.
B7-6	One	Enter Target Two Identity: "FRIEND - FAKER".
	Two	Acknowledge Target Two Identity Change.
B7-7	One	Enter Target Two Identity: "JOKER".
	Two	Acknowledge Target Two Identity Change.

EIGHT

B8-1	Two	Enter Target Two Identity: "FRIEND - USW".
	One	Acknowledge Target Two Identity Change.
B8-2	Two	Enter Target Two Identity: "FRIEND - Tanker, General".
	One	Acknowledge Target Two Identity Change.
B8-3	Two	Enter Target Two Identity: "FRIEND - Tanker, Boom".
	One	Acknowledge Target Two Identity Change.
B8-4	Two	Enter Target Two Identity: "FRIEND - Tanker, Drogue".
	One	Acknowledge Target Two Identity Change.
B8-5	Two	Enter Target Two Identity: "FRIEND - CAS".
	One	Acknowledge Target Two Identity Change.
B8-6	Two	Enter Target Two Identity: "FRIEND - Logistics".
	One	Acknowledge Target Two Identity Change.

TAB B - AIR TRACK DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT TARGET DATA ACTIONS

B8-7	Two	Enter Target Two Identity: "FRIEND - Interdiction".
	One	Acknowledge Target Two Identity Change.

NINE

B9-1	One	Enter Target Two Identity: "FRIEND - Fighter, General".
	Two	Acknowledge Target Two Identity Change.
B9-2	One	Enter Target Two Identity: "FRIEND - Fighter, Unavailable".
	Two	Acknowledge Target Two Identity Change.
B9-3	One	Enter Target Two Identity: "FRIEND - Fighter, RESCAP".
	Two	Acknowledge Target Two Identity Change.
B9-4	One	Enter Target Two Identity: "FRIEND - Fighter, CAP".
	Two	Acknowledge Target Two Identity Change.
B9-5	One	Enter Target Two Identify: "FRIEND - Fighter, RTB".
	Two	Acknowledge Target Two Identity Change.

TEN

B10-1	One	Enter Target One Data:		
		Flight Size:	1 (One)	Mode I: 11
		Speed:	150	Mode II: 1010
		Heading:	090	Mode III: 1100
		Altitude:	5000	Mode IV: Not Interrogated
	Two	Acknowledge each change to the data elements.		
B10-2	Two	Enter Target Two Data:		
		Flight Size:	2 (Few)	Mode I: 22
		Speed:	250	Mode II: 2020
		Heading:	180	Mode III: 2200
		Altitude:	12000	Mode IV: Valid Response
	One	Acknowledge each change to the data elements.		

TAB B - AIR TRACK DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT TARGET DATA ACTIONS

B10-3	One	Enter Target Three Data:		
		Flight Size:	3 (Many)	Mode I: 33
		Speed:	350	Mode II: 3030
		Heading:	270	Mode III: 3300
		Altitude:	20000	Mode IV: No Response
	Two	Acknowledge each change to the data elements.		
B10-4	Two	Enter Target Four Data:		
		Flight Size:	1 (One)	Mode I: 44
		Speed:	450	Mode II: 4040
		Heading:	360	Mode III: 4400
		Altitude:	34000	Mode IV: Invalid Response
	One	Acknowledge each change to the data elements.		

TAB C - SURFACE TRACK DATA MANAGEMENT FIDELITY DRILLS

J3. Description. Surface Track Data Management Fidelity Drills cover the initiation and recognition of Surface Track Data elements used during TDL Interface Data Link Operations. These drills are designed for two interface units; one unit will be designated the senior unit.

J3.1 Purpose. These Fidelity Drills develop and refine TDL Interface operator skills in initiating and recognizing Surface Track Data. Operators to be trained in these drills are those at the various TDL operational facilities responsible for the initiation and management of Surface Track Data.

J3.2 Examples of Joint Operations Personnel to be Trained.

Navy	Track Supervisor, Surveillance Operators.
Air Force	ASO, AST, AAST at AWACS.
Marine Corps	Interface Coordination/Track Data Cell at TACC, SID, SO at TAOC.

J3.3 Execution. These Fidelity Drills will normally be executed under the direction of the senior TDL Interface element involved in the training session. Voice acknowledgment of all events/actions is required. The Area of Responsibility (AOR), Track Production Area (TPA), Sector Bullseye, or exercise airspace will be designated as the Fidelity Drill working area or center point for the quadrants depicted below. Live track data may be used instead of manually initiated tracks if appropriate to the joint training activity.

TAB C - SURFACE TRACK DATA MANAGEMENT FIDELITY DRILLS (continued)

Designated units will initiate tracks/points into the system, as directed by the Events/Action Steps, in the following manner:

TARGET	IDENTITY	QUADRANT		
One	Pending	1	1	2
Two	Pending	2		
Three	Pending	3	3	4
Four	Pending	4		

NOTE: The AN/I-YQ-23 does not have any of the following surface applications.

EVENT/STEP UNIT TARGET DATA ACTIONS

ONE

Cl-1	One	Enter Target One Identity: "UNKNOWN".
	Two	Acknowledge Target One Identity Change.
C1-2	One	Enter Target One Identity: "UNKNOWN - Aircraft Carrier".
	Two	Acknowledge Target One Identity Change.
C1-3	One	Enter Target One Identity: "UNKNOWN - Cruiser".
	Two	Acknowledge Target One Identity Change.
C1-4	One	Enter Target One Identity: "UNKNOWN - Fast Patrol Boat".
	Two	Acknowledge Target One Identity Change.
C1-5	One	Enter Target One Identity: "UNKNOWN - Amphibious".
	Two	Acknowledge Target One Identity Change.
C1-6	One	Enter Target One Identity: "UNKNOWN - Non-Military".
	Two	Acknowledge Target One Identity Change.
C1-7	One	Enter Target One Identity: "UNKNOWN - Intelligence Collector".
	Two	Acknowledge Target One Identity Change.

TAB C - SURFACE TRACK DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT TARGET DATA ACTIONS

TWO

C2-1	Two	Enter Target Three Identity: "ASSUMED FRIEND - General".
	One	Acknowledge Target Three Identity Change.
C2-2	Two	Enter Target Three Identity: "ASSUMED FRIEND - Aircraft Carrier".
	One	Acknowledge Target Three Identity Change.
C2-3	Two	Enter Target Three Identity: "ASSUMED FRIEND - Cruiser".
	One	Acknowledge Target Three Identity Change.
C2-4	Two	Enter Target Three Identity: "ASSUMED FRIEND - Fast Patrol Boat".
	One	Acknowledge Target Three Identity Change.
C2-5	Two	Enter Target Three Identity: "ASSUMED FRIEND - Amphibious".
	One	Acknowledge Target Three Identity Change.
C2-6	Two	Enter Target Three Identity: "ASSUMED FRIEND - Non-Military".
	One	Acknowledge Target Three Identity Change.
C2-7	Two	Enter Target Three Identity: "ASSUMED FRIEND - Intelligence Collector".
	One	Acknowledge Target Three Identity Change.

THREE

C3-1	One	Enter Target Three Identity: "SUSPECT-General".
	Two	Acknowledge Target Three Identity Change.
C3-2	One	Enter Target Three Identity: "SUSPECT - Aircraft Carrier".
	Two	Acknowledge Target Three Identity Change.
C3-3	One	Enter Target Three Identity: "SUSPECT - Cruiser".
	Two	Acknowledge Target Three Identity Change.

TAB C - SURFACE TRACK DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT TARGET DATA ACTIONS

C3-4	One	Enter Target Three Identity: "SUSPECT - Fast Patrol Boat".
	Two	Acknowledge Target Three Identity Change.
C3-5	One	Enter Target Three Identity: "SUSPECT - Amphibious".
	Two	Acknowledge Target Three Identity Change.
C3-6	One	Enter Target Three Identity: "SUSPECT - Non Military".
	Two	Acknowledge Target Three Identity Change.
C3-7	One	Enter Target Three Identity: "SUSPECT - Intelligence Collector".
	Two	Acknowledge Target Three Identity Change.

FOUR

C4-1	Two	Enter Target Two Identity: "FRIEND - General".
	One	Acknowledge Target Two Identity Change.
C4-2	Two	Enter Target Two Identity: "NEUTRAL".
	One	Acknowledge Target Two Identity Change.
C4-3	Two	Enter Target Two Identity: "FRIEND - Non Military".
	One	Acknowledge Target Two Identity Change.
C4-4	Two	Enter Target Two Identity: "FRIEND - Auxiliary".
	One	Acknowledge Target Two Identity Change.
C4-5	Two	Enter Target Two Identity: "FRIEND - Tanker".
	One	Acknowledge Target Two Identity Change.
C4-6	Two	Enter Target Two Identity: "FRIEND - Support".
	One	Acknowledge Target Two Identity Change.
C4-7	Two	Enter Target Two Identity: "FRIEND - Troop Ship".
	One	Acknowledge Target Two Identity Change.
C4-8	Two	Enter Target Two Identity: "FRIEND - Hospital Ship".
	One	Acknowledge Target Two Identity Change.

TAB C - SURFACE TRACK DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT TARGET DATA ACTIONS

FIVE

C5-1	One	Enter Target Four Identity: "HOSTILE - General".
	Two	Acknowledge Target Four Identity Change.
C5-2	One	Enter Target Four Identity: "HOSTILE - Aircraft Carrier".
	Two	Acknowledge Target Four Identity Change.
C5-3	One	Enter Target Four Identity: "HOSTILE - Cruiser".
	Two	Acknowledge Target Four Identity Change.
C5-4	One	Enter Target Four Identity: "HOSTILE - Fast Patrol Boat".
	Two	Acknowledge Target Four Identity Change.
C5-5	One	Enter Target Four Identity: "HOSTILE - Amphibious".
	Two	Acknowledge Target Four Identity Change.
C5-6	One	Enter Target Four Identity: "HOSTILE - Non Military".
	Two	Acknowledge Target Four Identity Change.
C5-7	One	Enter Target Four Identity: "HOSTILE Intelligence Collector".
	Two	Acknowledge Target Four Identity Change.

SIX

C6-1	One	Enter Target Two Identity: "FRIEND - Fast Patrol Boat".
	Two	Acknowledge Target Two Identity Change
C6-2	One	Enter Target Two Identity: "FRIEND - Amphibious".
	Two	Acknowledge Target Two Identity Change.
C6-3	One	Enter Target Two Identity: "FRIEND - Non Military".
	Two	Acknowledge Target Two Identity Change.
C6-4	One	Enter Target Two Identity: "FRIEND - Intelligence Collector".
	Two	Acknowledge Target Two Identity Change.

TAB C - SURFACE TRACK DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT TARGET DATA ACTIONS

SEVEN

C7-1	One	Enter Target Two Identity: "FRIEND - Aircraft Carrier".
	Two	Acknowledge Target Two Identity Change.
C7-2	One	Enter Target Two Identity: "FRIEND - Cruiser".
	Two	Acknowledge Target Two Identity Change.
C7-3	One	Enter Target Two Identity: "FRIEND - Destroyer".
	Two	Acknowledge Target Two Identity Change.
C7-4	One	Enter Target Two Identity: "FRIEND - Frigate"
	Two	Acknowledge Target Two Identity Change.
C7-5	One	Enter Target Two Identity: "FRIEND - Fast Patrol Boat".
	Two	Acknowledge Target Two Identity Change.

EIGHT

C8-l	Two	Enter Target Two Identity: "FRIEND - Amphibious".
	One	Acknowledge Target Two Identity Change.
C8-2	Two	Enter Target Two Identity: "FRIEND - Landing Platform".
	One	Acknowledge Target Two Identity Change.
C8-3	Two	Enter Target Two Identity: "FRIEND - Landing Ship".
	One	Acknowledge Target Two Identity Change.
C8-4	Two	Enter Target Two Identity: "FRIEND - Landing Craft".
	One	Acknowledge Target Two Identity Change.
C8-5	Two	Enter Target Two Identity: "FRIEND - Troop Ship".
	One	Acknowledge Target Two Identity Change.
C8-6	Two	Enter Target Two Identity: "FRIEND - LCC".
	One	Acknowledge Target Two Identity Change.
C8-7	One	Enter Target Two Identity: "FRIEND - LHA/LHD".
	Two	Acknowledge Target Two Identity Change.

TAB C - SURFACE TRACK DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT TARGET DATA ACTIONS

NINE

C9-1 One Enter Target One Data:

Size:	1	Mode I: 10
Velocity:	10	Mode II: 1111
		Mode III: 1010
		Mode IV: Not Interrogated

Two Acknowledge each change to the data elements.

C9-2 Two Enter Target Two Data:

Size:	2	Mode I: 20
Velocity:	20	Mode II: 2222
		Mode III: 2020
		Mode IV: Valid Response

One Acknowledge each change to the data elements.

C9-3 One Enter Target Three Data:

Size:	3	Mode I: 30
Velocity:	30	Mode II: 3333
		Mode III: 3030
		Mode IV: No Response

Two Acknowledge each change to the data elements.

C9-4 Two Enter Target Four Data:

Size:	1	Mode I: 40
Velocity:	40	Mode II: 4444
		Mode II: 4444
		Mode III: 4040
		Mode IV: Invalid Response

One Acknowledge each change to the data elements.

TAB D - POINTS DATA MANAGEMENT FIDELITY DRILLS

J4. Description. Points Data Management Fidelity Drills cover the initiation and recognition of Points Data used during TDL Interface Data Link Operations. These drills were designed for two interface units; one must be designated as the senior unit.

TAB D - POINTS DATA MANAGEMENT FIDELITY DRILLS (continued)

J4.1 Purpose. These Fidelity Drills develop and refine TDL Interface operator skills in initiating and recognizing Points Data. Operators to be trained with these drills are those at the various TDL operational facilities responsible for the initiation and management of Points Data.

J4.2 Examples Of Joint Operations Personnel To Be Trained.

Army	FDC/ICC TD, TDA.
Navy AIC	Track Supervisor, Surveillance Operators.
Air Force	ASO, AST, WD, ICO at CRC/CRE, and WD, ASO, AST, AAST at AWACS.
Marine Corps	SWD, SID, STD, SO, AIC, TATC at TAOC.

J4.3 Execution. These Fidelity Drills will normally be executed under the direction of the senior TDL Interface element involved in the training session. Voice acknowledgment of all events/actions is required. The Area of Responsibility (AOR), Track Production Area (TPA), Sector Bullseye, or exercise airspace will be designated as the Fidelity Drill working area or center point for the quadrants depicted below. Designated units will initiate points into the system, as directed by the Events/Action Steps, in the following manner:

POINT	QUADRANT		
One	1	1	2
Two	2	3	4
Three	3		
Four	4		

EVENT/STEP UNIT ACTIONS

ONE

Dl-1	One	Initiate a Pointer in Quadrant One.
	Two	Acknowledge and Delete Pointer in Quadrant One.
Dl-2	One	Initiate a Pointer in Quadrant Two.
	Two	Acknowledge and Delete Pointer in Quadrant Two.
D1-3	One	Initiate a Pointer in Quadrant Three.
	Two	Acknowledge and Delete Pointer in Quadrant Three.

TAB D - POINTS DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

Dl-4	One	Initiate a Pointer in Quadrant Four.
	Two	Acknowledge and Delete Pointer in Quadrant Four.

NOTE: Recommend operators use different available operator positions for the pointer in order to test the systems.

TWO

D2-1	One	Initiate at Point One: "ECM FIX".
	Two	Acknowledge at Point One.
D2-2	One	Initiate at Point Three: "Air Base".
	Two	Acknowledge at Point Three.
D2-3	One	Initiate at Point Four: "SAM Site".
	Two	Acknowledge at Point Four.
D2-4	One	Initiate at Point One: "DASC".
	Two	Acknowledge at Point One.
D2-5	One	Initiate at Point Two: "FACP" (Now "CRE")*.
	Two	Acknowledge at Point Two.
D2-6	One	Initiate at Point Three: "AMDPCS"*.
	Two	Acknowledge at Point Three.

NOTE: The AN/TYQ-23 does not have applications depicted by asterisk (*).

THREE

D3-1	Two	Initiate at Point One: "ECM Fix".
	One	Acknowledge at Point One.
D3-2	Two	Initiate at Point Two: "Hazard - Ground Zero".
	One	Acknowledge at Point Two.
D3-3	Two	Initiate at Point Three: "CAP station".
	One	Acknowledge at Point Three.

TAB D - POINTS DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

D3-4	Two	Initiate at Point Four: "AEW Station".
	One	Acknowledge at Point Four.
D3-5	Two	Initiate at Point One: "Strike IP".
	One	Acknowledge at Point One.
D3-6	Two	Initiate at Point Two: "Emergency - Downed Aircraft".
	One	Acknowledge at Point Two.
D3-7	Two	Initiate at Point Three: "Emergency - Man in Water/Bailout".
	One	Acknowledge at Point Three.
D3-8	Two	Initiate at Point Four: "Emergency - Distressed Vessel".
	One	Acknowledge at Point Four.

FOUR

D4-1	One	Initiate at Point One: "ECM Fix".
	Two	Acknowledge at Point One.
D4-2	One	Initiate at Point Two: "Air Station".
	Two	Acknowledge at Point Two.
D4-3	One	Initiate at Point Three: "CAP Station".
	Two	Acknowledge at Point Three.
D4-4	One	Initiate at Point Four: "Strike IP".
	Two	Acknowledge at Point Four.
D4-5	One	Initiate at Point One: "TACAN".
	Two	Acknowledge at Point One.
D4-6	One	Initiate at Point Two: "Emergency - General"
	Two	Acknowledge at Point Two.
D4-7	One	Initiate at Point Three: "Emergency - Downed Aircraft".
	Two	Acknowledge at Point Three.

TAB D - POINTS DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

D4-8	One	Initiate at Point Four: "Emergency - Man in Water" (Alternate: Emergency - "Bailout").
	Two	Acknowledge at Point Four.
D4-9	One	Initiate at Point Two: "Emergency - Distressed Vessel".
	Two	Acknowledge at Point Two.
D4-10	One	Initiate at Point Three: "Air Base".
	Two	Acknowledge at Point Three.
D4-11	One	Initiate at Point Four: "SAM Site".
	Two	Acknowledge at Point Four.

FIVE

D5-1	One	Initiate at Point One: "ECM Fix".
	Two	Acknowledge at Point One.
D5-2	One	Initiate at Point Two: "Reference Point - General".
	Two	Acknowledge at Point Two.
D5-3	One	Initiate at Point One: "Station - CAP".
	Two	Acknowledge at Point One.
D5-4	One	Initiate at Point One: "Station - Air".
	Two	Acknowledge at Point One.
D5-5	One	Initiate at Point Two: "Strike IP".
	Two	Acknowledge at Point Two
D5-6	One	Initiate at Point Three: "TACAN".
	Two	Acknowledge at Point Three.
D5-7	One	Initiate at Point Four: "Emergency - General".
	Two	Acknowledge at Point Four.
D5-8	One	Initiate at Point One: "Support Unit".
	Two	Acknowledge at Point One.

TAB D - POINTS DATA MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

D5-9	One	Initiate at Point Two: "Air Base".
	Two	Acknowledge at Point Two.
D5-10	One	Initiate at Point Three: "SAM Site".
	Two	Acknowledge at Point Three.

TAB E – INTELLIGENCE TRACK MANAGEMENT FIDELITY DRILLS

J5. Description. Intelligence Track Management Fidelity Drills cover recognition of Special Information Systems (SIS) or Electronic Warfare/Intelligence (EW/I) data appended to tracks/points transmitted during TDL operations. This drill was designed for multiple interface units within a netted system. ASIS unit will be designated to lead this drill.

J5.1 Purpose. These drills provide TDL interface operators and intelligence personnel with experience in recognizing SIS/TDL EW/I data, and practice in using it in decision making for offensive/defensive tactical air, land, and sea operations.

J5.2 Examples of Joint Operations/Intelligence Personnel to be Trained

Army	FDC/ICC TD, FTC/TDC.
Navy	AIC, TAO, Intelligence staff.
Air Force	SD, WAO, WD, ICT, FTC/TDC, at CRC/CRE; MCC, SD, WD, ASO, AAST at AWACS; intelligence staff, and SIS unit operators.
Marine Corps	SID, SO, EPO, at the TAOC, plus intelligence staff.

J5.3 Execution. These drills will be conducted on a secure Voice Product Net (VPN), and executed under the direction of the SIS unit operator who is acting as NCS on the VPN. These drills are to be proceeded by a classified OPTASK LINK, or separate message, containing "Theater Defined Values" for the exercise or operation being conducted. Operator/systems managers will refer to this message when configuring their equipment, and use it and any necessary guidance to decipher the alphanumerics associated with the SIS/TDL EW/I appended data. Theater Defined Values will be generated, in accordance with Joint Pub 6 Series for any weapons system, platform, or an activity that can be expected to participate in the exercise/operation. The SIS

TAB E – INTELLIGENCE TRACK MANAGEMENT FIDELITY DRILLS (continued)

unit leading the drill may also include sample Tactical Report (TACREP) information, via the VPN, to enhance the training value. Participating Units will include their unit intelligence personnel in the Fidelity Drill training session in order to increase the value of this coordinated activity in joint operations. Note that SIS VPN or data link information is highly perishable time-sensitive information principally intended for tactical users and battle managers and not for intelligence briefings. The lead SIS unit will direct, either by message or via VPN, track initiation by individual units within their respective AORs, and subsequently append EW/I data to the track(s). Tracking/controlling units are to give feedback on the VPN regarding what they have received and what they interpret it to mean. SIS units are to assist with data breakout and, in the event of non-receipt, troubleshooting the data link. The SIS unit is also to initiate Points, append EW/I to them, and aid operators in interpreting and troubleshooting.

TAB F – DATA LINK FILTER MANAGEMENT FIDELITY DRILLS

J6. Description. Data Link Filter Management Fidelity Drills cover initiation and recognition of Data Link Filters used during TDL Interface Operations. These Drills are designed for multiple interface units within a netted system.

J6.1 Purpose. These Fidelity Drills develop and refine TDL interface operators skills in initiating Data Link Filters, understanding filter management responsibilities, and the awareness of the results to the unit and joint system when filters are in use. Operators to be trained are those at the TDL operational facilities responsible for data link interfaces and filter management.

J6.2 Examples of Joint Operations/Intelligence Personnel to be Trained

Army	FDC/ICC TD, FTC/TDC.
Navy	TIC, AIC.
Air Force	WAO, ICO/ICT, at CRC/CRE, and ASO at AWACS.
Marine Corps	SID, SO, SCC, DLC.

J6.3 Execution. These Fidelity Drills will normally be executed under the direction of the senior ICO involved in the training session. Voice acknowledgement of all events/actions is required. The Area of Responsibility (AOR), Track Production Area (TPA), Sector Bullseye, or exercise airspace will be designated as the Fidelity Drill working area or center point for the tracks.

TAB F – DATA LINK FILTER MANAGEMENT FIDELITY DRILLS (continued)

depicted below. Manually initiated tracks should be used for these drills. Designated units will initiate the tracks and activate filters as directed by the Events/Action Steps. This drill may require tracks to be established TPA's.

TGT	IDENTITY	BEARING/RANGE FROM OWN SITE	TGT	IDENTITY	BEARING/RANGE FROM OWN SITE
1	HOSTILE	090/15	8	FRIEND GENERAL	330/30
2	HOSTILE	090/40	9	ATTACK	270/15
3	SUSPECT	045/15	10	ATTACK	270/30
4	SUSPECT	045/30	11	PENDING	240/15
5	ASSUMED FRIENDLY	360/15	12	PENDING	240/30
6	ASSUMED FRIENDLY	360/30	13	UNKNOWN	180/15
7	FRIEND GENERAL	330/15	14	UNKNOWN	180/30

EVENT/STEP UNIT ACTIONS

F-1	All	Create GEO Filter (Area In/Alt In: 0-99) using Bearing/Range out to 25 nm from own site, and activate in the Transmit/ Receive mode.
	ICO	Confirm that every site has all inner tracks filtered out except HOSTILE.
F-2	All	Force Tell Target Three.
	ICO	Confirm tracks are passing through the links.
F-3	All	Change existing GEO Filters to make Filter (Area Out).
	ICO	Confirm with all sites that tracks are being filtered.
F-4	All	Activate Identity Exempt filter for FRIEND – General, ASSUMED FRIEND, and PENDING, previous filters stay in effect.
	ICO	Confirm with units that exempted tracks are being passed through filters.
F-5	All	Deactivate the GEO Filters. Change Identity Filter to INHIBIT ASSUMED FRIEND, PENDING, and FRIEND.
F-6	All	Deactivate all Filters.

TAB F – DATA LINK FILTER MANAGEMENT FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

F-7	All	Activate Forward Filters for Link 11B Participants.
	ICO	Query units affected to ensure Filter works.

TAB G - COMPREHENSIVE INTEGRATION FIDELITY DRILLS

J7. Description. These Comprehensive Integration Fidelity Drills contain all elements of Data Link Integration Procedures and are written in general terms so as to be applicable for use by all TDL interface units. These drills were designed for two interface units, but may adapted for use by an integrated system; one unit must be designated as the senior unit.

J7.1 Purpose. These Fidelity Drills develop and refine TDL Interface operator skills in the Integration Procedures. Operators to be trained with these drills are both technicians and system operators at various TDL operational facilities who are responsible for the tactical employment of the TDL Interfaces.

J7.2 Examples of Joint Operations Personnel to be Trained

Army	FDC/ICC TD, TDA.
Navy	AIC, Track Supervisor, Surveillance Operators.
Air Force	ASO, AST, WD, ICO at CRC/CRE, and WD, ASO, AST, AAST at AWACS.
Marine Corps	AIC, AWC, MC, at TAOC.

J7.3 Execution. These Fidelity Drills will normally be executed under the direction of the senior TDL Interface element involved in the training session; Unit One is designated the senior element. Voice acknowledgment of all Event actions is required. The Fidelity Drill working area or center point for the quadrants depicted below is centered over each participating unit. In a system context, the ICO may designate several units to perform as “Unit Two” in this Integration Fidelity Drill.

POINT	QUADRANT		
One	1	1	2
Two	2	3	4
Three	3		
Four	4		

TAB G - COMPREHENSIVE INTEGRATION FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

ONE

G1-1	One	Send “Weapons Tight” and “ADW White”.
	Two	Verify receipt and acknowledge.
G1-2	One	Send “Weapons Tight” and “ADW Yellow”.
	Two	Verify receipt and acknowledge.
G1-3	One	Send “Weapons Tight” and “ADW Red”.
	Two	Verify receipt and acknowledge.
G1-4	One	Send “Weapons Free and ADW Red”.
	Two	Verify receipt and acknowledge.

NOTE: Unit One accompanies execution of each step of Event One with a verbal transmission of “Status Sent” Unit Two acknowledgment of each receipt of Weapons Control Status Air Defense Warning should be limited to a verbal “Roger” for each verified change receive. Receipt of incorrect status or warning, or no receipt of expected status or warning, should be signaled by a verbal “Negative”.

TWO

G2-1	One	Initiate Track One: Located in Units Two's Quadrant One. Range: 40 km from Unit Two's SCC. Identity: UNKNOWN
	Two	Report Range and Azimuth on Track One. Transmit a Pointer at Track One location.
	One	Verify Pointer location and acknowledge. Delete Pointer.
G2-2	One	Initiate Track Two: Located in Unit Two's Quadrant Two. Range: 60 km from Unit Two's SCC. Identity: FRIEND
	Two	Report Range and Azimuth on Track Two. Transmit a Pointer at Track Two location.

TAB G - COMPREHENSIVE INTEGRATION FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

	One	Verify Pointer location and acknowledge. Delete Pointer.
G2-3	One	Initiate Track Three: Located in Unit Two's Quadrant Three. Range: 40 km from Unit Two's SCC. Identity: UNKNOWN
	Two	Report Range and Azimuth on Track Three. Transmit a Pointer at Track Three location.
	One	Verify Pointer location and acknowledge. Delete Pointer.
G2-4	One	Initiate Track Four: Located in Unit Two's Quadrant Four. Range: 70 km from Unit Two's SCC. Identity: HOSTILE.
	Two	Report Range and Azimuth on Track Four. Transmit a Pointer at Track Four location.
	One	Verify Pointer location and acknowledge. Delete Pointer. Delete Track Four.

THREE

G3-1	Two	Initiate Track Five: Located in Quadrant Two. Range: 30-50km Altitude: 25000 Speed: 150 knots Heading: Southwest Identity: UNKNOWN
	One	Verify Track Five data and acknowledge. Transmit a Pointer on Track Five location.
	Two	Verify Pointer location and acknowledge. Delete Pointer.

TAB G - COMPREHENSIVE INTEGRATION FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

G3-2	Two	Initiate Sim PU or Interceptor (as required). Enter PU/Interceptor Missile/Weapons & Fuel) data (as required).
	One	Acknowledge receipt of Sim PU/Interceptor. Verbally report PU/Interceptor Missiles/Weapons (Fuel) status. Transmit a Pointer at PU/Interceptor location.
	Two	Verify Pointer location and acknowledge. Delete Pointer.
G3-3	One	Change Track Five Identity to “HOSTILE”. Send “Engage” on Track Five.
	Two	Acknowledge “Engage”. Send “WILCO”. Pair on Track Five.
	One	Verify Engagement Marker on Track Five.
	Two	Send FU/Interceptor Status “Tracking/Weapon Assigned”.
	One	Verify FU/Interceptor Status.
G3-4	Two	On Track Five; send in order: Flight Size 1 (One), Flight Size 2 (Few), Flight Size 3 (Many).
	One	Acknowledge receipt of each of the flight size changes.
G3-5	Two	On Track Five, send FU/Interceptor “Firing”.
	One	Acknowledge Receipt of “Firing”. Send “Hold Fire” on Track Five.
	Two	Send “Engagement Broken” on Track Five.
	One	Acknowledge receipt of “Engagement Broken”.

TAB G - COMPREHENSIVE INTEGRATION FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

FOUR

G4-1	One	Initiate Track Six: Located in Unit Two's Quadrant One. Range: 50-70 km from Unit Two Altitude: 12000 Speed: 250 knots Heading: Southeast Identity: UNKNOWN
	Two	Verify Track Six data and Acknowledge. Transmit a Pointer at Track Six location.
	One	Verify Pointer location and acknowledge. Delete Pointer Change Track Six Identity to "Suspect".
	Two	Acknowledge receipt of Track Six identity change.
G4-2	Two	Initiate Track Seven: located in Unit Two's Quadrant Four. Range: 50-70 km Altitude: 10000. Speed: 350 knots Heading: Southeast Identity: HOSTILE
	One	Verify Track Seven data and acknowledge. Transmit Pointer of Track Seven location.
	Two	Verify Pointer location and acknowledge. Delete Pointer.
G4-3	One	Send "Engage" (or "Engage Ripple") on Track Seven.
	Two	Simulate engagement of Track Seven. Pair on Track Seven.
	Two	Send "Tracking". Send "Firing".
	One	Verify receipt of "Tracking" and "Firing". Send "Cease Engagement" on Track Seven.
	Two	Verify receipt of "Cease Engagement". Send "WILCO".
	One	Send "Investigate/Assign" (or "Engage Salvo") on Track Six.

TAB G - COMPREHENSIVE INTEGRATION FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

	Two	Verify receipt of Secondary Assignment. Send "WILCO". Send "Effective" on Track Seven. Drop pairing on Track Seven. Drop Track Seven.
	One	Verify receipt of "Effective".
	Two	Simulate Engagement on Track Six. Pair Track Six and Send "Tracking".
	One	Verify receipt of "Tracking". Send "Cease Engagement".
	Two	Verify receipt of "Cease Engagement". Send "Engagement Broken".
	One	Verify Receipt of "Engagement Broken". Drop Track Six

FIVE

G5-1	Two	Initiate "Jam Strobe" in Quadrant Three. Send "Tracking".
	One	Verify receipt of "Jam Strobe". Send "Engage" on "Jam Strobe".
	Two	Send "CANTCO".
	One	Verify receipt of "CANTCO". Send "Cease Engagement".
	Two	Verify receipt of "Cease Engagement". Drop "Jam Strobe".

SIX

G6-1	One	Configure system for live radar data.
	Two	Configure system for live radar data.

TAB G - COMPREHENSIVE INTEGRATION FIDELITY DRILLS (continued)

EVENT/STEP UNIT ACTIONS

One Select a target of opportunity, Change Identity to "HOSTILE".
Send "Engage".

Two Verify receipt of "HOSTILE" and "Engage".
Send "WILCO".
Verify system correlation with local radar video.
Lock on Target if FU/Interceptor is available.
Send Pointer on Target if no FU/Interceptor is available.
Report: Altitude, Speed and Heading.

One Verify correct target is being tracked.
Verify Altitude, Speed and Heading.
Send "Cease Engagement".

Two Verify receipt of "Cease Engagement". Break lock on target.

TAB H - SIMPLE INTEGRATION FIDELITY DRILLS FOR CRC/CRE AND TAOC/EWC UNITS

J8. Description. These Simple Integration Fidelity Drills contain the basic steps to confirm working data links, registration and Systems for the CRC/CRE and TAOC/EWC units. They were designed for two units but could be used in an integrated system with one unit designated as the senior unit in charge.

J8.1 Purpose. These Simple Fidelity Drills help to develop and train the basic TDL interface operator skills at the CRC/CRE and TAOC/EWC units.

J8.2 Examples of Operations Personnel to be Trained

Air Force	CRC/CRE, All.
Marine Corps	TAOC/EW/C, All.

J8.3 Execution. Once an objective (i.e., pointer, point, etc.,) is verified by both systems, press on to the next objective. Both ends must work together to make this fidelity drill work properly. The key to a successful fidelity drill is to communicate and coordinate.

TAB H - SIMPLE INTEGRATION FIDELITY DRILLS FOR CRC/CRE AND TAOC/EWC UNITS (continued)

EVENT/STEP UNIT ACTIONS

ONE

H-1 All Ensure Link 11/11B is established.

TWO

H-2 All Set range at 200 NM.

All Ensure distant end is in view.

All System Display (FFS), Select map, and pointer (All) only.

THREE

H-3 Send a weapons pointer on top of distant end site.
Verify pointer over your site.

Drop pointer.

Was it successful (Yes/No)? If no, take corrective action.

FOUR

H-4 Select all points and map only on the system display.

FIVE

H-5 Initiate the following 4 points:
Emergency (Downed Aircraft).
Station/Air (CAP).
Hazard (Ground Zero).
S/HOSTILE (Airbase).

Drop points initiated.

Was it successful (Yes/No)? If no, take corrective action.

TAB H - SIMPLE INTEGRATION FIDELITY DRILLS FOR CRC/CRE AND TAOC/EWC UNITS (continued)

EVENT/STEP UNIT ACTIONS

SIX

H-6 Select all Air Track Categories On system display initiate 10 Rate Aided Tracks around own site.

Select Surveillance FFS and change the ID's to the following with Change Data Order.

UNKNOWN	-Evaluated
	-Assume Friend
	-Assume Enemy
HOSTILE	-Jammer
	-General
FRIEND	-General
	-Helo
	-Special Mission
	-Strike Support
	-Interceptor/Fighter

Verify distant end tracks and Change Data Orders.

Was it successful (Yes/No)? If no, take corrective action.

SEVEN

H-7 Change OWN site Alert Condition via ATIWPNS FFS and Alert Condition WS.

Verify OWN site Alert Condition.

Was it successful (Yes/No)? If no, take corrective action.

EIGHT

H-8 Select Data Link Control FFS and Weapons Free VFS.

TAB H - SIMPLE INTEGRATION FIDELITY DRILLS FOR CRC/CRE AND TAOC/EWC UNITS (continued)

EVENT/STEP UNIT ACTIONS

Select DISTANT END PU.

Verify OWN site Alert Condition.

Was it successful (Yes/No)? If no, take corrective action.

NINE

H-9 Select Data Link Control FFS.

Perform the following by hooking the track only:
Engage.
Cease Engage.
Cease Fire.
Cover.

Perform the following by hooking the track, then a distant end PU:
Investigate/Assign.
Hold Fire.
Heads Up.
Salvo.

Perform the following by hooking the track, then an airbase RTB.

Verify distant end list order/tracks by WILCO (FFS) the first five; the last five verify the responses.

Was it successful (Yes/No)? If no, take corrective action.

TEN

H-10 Perform the following by hooking a distant end track via Data Link Control FFS.
Select Force Tell.

Verify own track that distant end changed.

TAB H - SIMPLE INTEGRATION FIDELITY DRILLS FOR CRC/CRE AND TAOC/EWC UNITS (continued)

EVENT/STEP UNIT ACTIONS

Was it successful (Yes/No)? If no, take corrective action.

ELEVEN

H-11 Perform the following by hooking a distant end track via Surveillance FFS.

Select Emergency Force Tell.

Verify own track that distant end changed.

Was it successful (Yes/No)? If no, take corrective action.

TWELVE

H-12 Drop all tracks.

APPENDIX K TO ENCLOSURE A

LINK MANAGEMENT CODES

K1. Link Management Codes. Link Management Codes are brevity words or letters used for voice coordination of link management actions on covered or uncovered voice nets. Table K-1 provides Brevity Words from APP 7/MPP 7. Table K-2 provides the List of Indicators, Table K-3 provides the List of Subjects, and Table K-4 provides the Link Management Codes for all links. Procedures for specification and use of Link Management Codes are described in Appendix C and D. The ICO should specify any exceptions to the procedures in the OPTASK LINK in the 1MANCODE set.

K2. Three Letter Codes. The three-Letter Codes are to be used for brevity and clarity only. These codes are unchanging and provide no security when transmitted over clear radio circuits. Any data that require security protection must be encrypted as specified by the Link Manager or ICO.

K3. Link Management Code String. The Link Management Code consists of three letters and may be amplified with one numeric and/or a proword.

proword	1st letter	2nd letter	3rd letter	numeric	proword
proword*	Indicator*	subject	descriptor	amplifier*	proword*

(* Only when required.)

K4. Prowords. Prowords are words easily used and easily understood by all nations. Prowords are not included in this document; they are listed in APP 1. A proword may be a prefix or a suffix to the code string.

K4.1 List of Prowords. The following words are recognized as prowords to go with NATO Link Management Codes:

- Request
- Interrogative
- Confirm
- Confirmed
- Cancel
- Cancelled
- Set
- Disregard
- Approved
- Not approved
- Negative
- Positive
- Execute
- Executed
- Stand by
- HAVCO
- WILCO
- CANTCO
- Ready
- Verify
- Take
- I want
- I hold
- Switch
- Line ...
- Freak ...
- Desig ...
- Tack ...
- Time ...
- Minutes

This list is not comprehensive. See also APP 1.

K5. Indicator. Table K-2 provides the list of indicators. The indicator is used when specified in the OPTASK Link message for National Codes and or experimental or temporary status code. The indicator defines and is only to be used as follows:

a. The link for which the code is applicable.

b. The experimental or temporary status of the code.

c. National Codes. These codes may be used, subject to originators' approval, by other than the originating nation or command. National Codes are not included herein. Therefore, nations would require coordination outside this document to obtain and use other nation's codes. U.S. National Codes (Indicator U) have been developed.

d. Subject. The subject defines the main functional area addressed by the code. Each indicator may have a list of subjects. The subjects for data link management are listed in Table K-3 .

e. Descriptor. The descriptor defines a specific part of the subject or main functional area.

f. Amplifier. The amplifier subdivides or amplifies the secondary root.

Table K-1. (U) Link Brevity Codes

Codeword	Meaning
Agnes	Tactical Data System Keyset Control.
Alligator	Link 11.
Anteater	An automatic tracking equipment using IFF rather than radar as its input.
Beaver	Link 14.
Clean	Broadcast is encrypted. May be used as a report or order and must be followed by a frequency or station designator.
Dirty	Link is not encrypted. May be used as a report or order and must be followed by a frequency or station designator.
Elfin	Link 22. A secure nodeless data link which utilizes the NILE communications Equipment (NCE), and protocols, conventions and fixed word message formats defined by STANAG 5522.
Gridlock (-)	All units are to prepare for a general gridlock on the track or tracks indicated.
Gridlock Positive/ Negative	Satisfactory gridlock has/has not been achieved.
Hook Locker	The term meaning the unit specified has been entered as a participant on Link 11 but is not active on the link. (The PU symbol appears in a separate location known as the “hook locker” for systems so programmed.)
Mongoose	The collective term used when specifying more than one of the tactical data links (Link 11, Link 11B, Link 16 and/or Link 22).
Octopus	Tactical Data System Computer.
Phase	Send a 1000 MHz modulation on both sidebands of the HF radio frequency carrier for 1 minute beginning in (...) minutes for frequency locking and radio receiver tuning purposes.
Ping Pong	Exchange of Link 11 information. Used in conjunction with an adjective to describe the status of Link 11 operations.
Prelude	Data Link Reference Point.
R Squared	Reporting responsibility.
Ronson	The unit addressed is to carry out an individual gridlock with the GRU or the designated PU.
Silent	Broadcast station is not transmitting data. May also be used as an order and must be followed by a frequency or station designator. If possible it should be followed by an estimated time of return to the air.
Synchro	Carry out a NET SYNC procedure for DTS clock synchronization purposes beginning in (...) minutes.

Talk	Broadcast station is transmitting data. May also be used as an order. May be modified by pro words Clean or Dirty and must be followed by a frequency station designator.
Timber	Link 16 A secure, jam resistant nodeless data link which utilizes the Multifunctional Information Distribution System (MIDS), and the protocols, conventions and fixed word formats defined by STANAG 5516.
Tattoo	A personal identifier (PI) Code.
Tune	Send a continuous signal on the central radio frequency for 30 seconds, beginning in (...) minutes for radio receiver frequency tuning purposes.
Zipcode	Automatic computer controlled point-to-point digital data link between units equipped with computerized tactical data systems (Link 11B).
NOTES: 1. These codewords are to be followed by ALLIGATOR (for Link 11), Timber (for Link 16), and Elfin (for Link 22) to avoid ambiguity with other links. 2. These codewords may be used as statements or orders (by the NCS) or requests (by other PUs/JUs or receiving units). They may be preceded by a station designation in case of ambiguity.	

Table K-2. Indicators for NATO Link Management Codes

INDICATOR	USE		
	Data Link	Experimental/ Temporary	National
A	11 (Alligator)	-	-
B	14 (Beaver)	-	-
C	-	-	Canada
D	-	-	Denmark
E	22 (Elfin)	-	-
F	-	-	France
G	-	-	Germany
H	-	-	The Netherlands
I	-	-	Italy
J	IJMS (Jamboree)	-	-
K	-	-	United Kingdom
L	-	-	Luxembourg
M	Multi-link (Mongoose)	-	-
N	-	-	Norway
O	-	-	Belgium
P	-	-	Portugal
Q	-	-	Iceland
R	-	-	Greece
S	-	-	Spain
T	16 (Timber)	-	-
U	-	-	United States
V	-	-	Turkey
W	-	-	Stanavforlant/ Stanavformed
X	-	Reserved	
Y	-	Reserved Major NATO Exercise	
Z	11B (Zipcode)	-	-

Table K-3. List of Subjects for Link Management Codes

1.	JU/PU/RU Terminal Address	-A
2.	Breakdown/Assistance	-B
3.	Crypto	-C
4.	Data Exchange	-D
5.	Net Establishment	-E
6.	Filter	-F
7.	Geo-Positioning/Update	-G
8.	Satellite	-K
9.	Link Monitoring System	-L
10.	Net Mode/Work	-N
11.	Transmission Orders	-0
12.	Picture Compilation/Track Management	-P
13.	Radio/Communications	-R
14.	Station Mode	-S
15.	Data Terminal	-T
16.	Gateway/SSB operations	-U
17.	Warning/Conflicts	-W
18.	Link Exercises	-X
19.	Weapon Assignment	-Y
20.	Electronic Warfare	-Z

Table K-4. Link Management Codes

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
	A			Subject: JU/PU/RU/NU Address or Terminal Address.
A	A	A		Switch (Add) dummy TN between all addresses.
A	A	B		Address .... not activated.
A	A	C		PU .... set is window.
M	A	D		(Call sign ....) IU nr. (is ....).
T	A	E		Change Terminal address to day .... (at time ....).
E	A	M		MASN number of c/s .... is ....
M	A	O		Do not receive Data (from IU/Callsign ....).
E	A	T		Terminal (NILE) address of c/s .... is ....
E	A	U		(call sign ....) Dedicated Assignment slot is ....
T	A	V		Hold your PPLI/not your CDS.
	B			**Subject: Breakdown/Assistance**
M	B	A		Assistance - I require your Link Technician on this circuit (on Line No ....).
M	B	B		Capacity alert (System ....).
M	B	C	1	Load – Tape/cassette designator ....
M	B	C	2	Load – Patch ....(Load following patch).
M	B	C	3	Request active IUs....
M	B	D		Breakdown - System.
M	B	D	1	System breakdown, wait (approximately .... minutes).
M	B	E		Reload operational program.
M	B	E	1	Reloading operational program.
M	B	F		Operational – System.
M	B	G		Have program casualty.
M	B	G	1	Have Data Terminal Set (DTS) casualty.
M	B	H		Reloading my command and control processor (C2P)/data link processor (DLP).
	C			**Subject: Crypto**
-	C	A		KG 40 mode.
A	C	A	1	KG 40 mode - A1. (Switch KG 40A to Crypto mode A1.)
A	C	A	2	KG 40 mode - A2. (Switch KG 40A to Crypto mode A2.)
A	C	A	3	KG 40 mode - B. (Switch KG 40A to Crypto mode B.)
A	C	A	4	KG 40 mode – Plain text. (Switch KG 40A to plain text.)
A	C	A	5	KG 40 mode – POFA. (Switch KG 40A to POFA test.)

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
Z	C	A	6	KG-30 mode.
Z	C	A	7	KG-84A mode.
Z	C	A	8	KG-84C mode.
Z	C	A	9	KG-27/KG-197 mode (bulk encryption).
-	C	B		Keymat.
M	C	B	1	Keymat – Day .... set.
M	C	B	2	Keymat – Period extended (until time ....).
M	C	B	3	Keymat – change to day.
M	C	B	4	Keymat – edition .... in force.
M	C	B	5	Keymat - not held.
M	C	B	6	Keymat – compromised.
M	C	E	*	Breakdown – Crypto equipment.
M	C	E	1	Check Crypto device breakdown.
A	C	F	1	AKAI 17 - (c/s) your line number is ....
A	C	F	2	AKAI 6 - (c/s) your line number is ....
M	C	G		Crypto net (No. ....).
M	C	H	1	Cryptovariable Logical Label (CVLL) - (Designator/short title ..).
M	C	H	2	Cryptovariable Logical Label (CVLL) – Transec (No. ....).
M	C	H	3	Cryptovariable Logical Label (CVLL) – Msec (No. ....).
M	C	H	4	Cryptovariable Logical Label (CVLL) – Unique (No. ....).
M	C	M	1	(Re) initialize with Crypto Integrity Mode On.
M	C	M	2	(Re) initialize with Crypto Integrity Mode Off.
T	C	N		Received SDU alarm.
	D			**Subject: Data Exchange**
-	D	A		Quality of Data.
M	D	A	1	Quality of Data – good (from IU/Callsign ....). (Am receiving good data (from IU/Callsign ....).
M	D	A	2	Quality of Data – intermittent (from IU ....).
M	D	A	3	Quality of Data – no receipt (from IU ....).
M	D	A	4	Receiving signal, no data.
M	D	A	5	Not receiving signal.
-	D	B		Error data.
A	D	B	1	Error data – receiving Data Error (from PU ....).
A	D	B	2	Error data – (Am) Transmitting Data Error.
A	D	B	3	Error code – Receiving code error (from PU ....).

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
A	D	B	4	Error code- (Am) Transmitting code error.
A	D	B	5	Transmit Control Codes only.
M	D	B	6	High error rate indication (from IU No. ....).
-	D	C		Codes/Call Up.
A	D	C	1	Codes-(Am) Receiving control codes only (from PU ....).
A	D	C	2	Codes – Transmitting stop code.
A	D	C	3	Codes – (Am) Missing stop code.
A	D	C	4	Call up –(Am) Missing call up/Hold you inactive.
A	D	C	5	Call up – Rx permanent miss call from (PU ....).
-	D	D		Data.
A	D	D	1	Data – Transmit M.1 only.
A	D	D	2	Data – Transmit M.1 + data.
-	D	E		TDS (computer) breakdown.
M	D	E	1*	TDS breakdown.
T	D	E	2	Link 16/DAPG breakdown/not connected.
T	D	F		Reception J0.0 message.
T	D	G	1	(JU No. ....) response to interrogation messages.
T	D	G	2	(JU No. ....) indication of Conditional Radio Silence (MUM).
T	D	G	3	(JU No. ....) indication Polling.
T	D	G	4	(JU No. ....) fine synchronization.
T	D	H	1	Packing – Standard.
T	D	H	2	Packed 2 – single pulse.
T	D	H	3	Packed 2 – double pulse.
T	D	H	4	Packed 4.
	E			**<u>Subject: Net Establishment</u>**
M	E	A		Enter the net.
T	E	A	1	JTIDS Network is ....
M	E	B		Leave the net.
M	E	B	1	Request permission to leave net.
M	E	C		Net set-up IAW. (Optask .... /Table ....).
T	E	D	1	Initialize as primary user.
T	E	D	2	Initialize as secondary user.
E	E	D	3	Execute Short Initialization.
E	E	D	4	Execute Channel Probing.
T	E	E		Initial Entry JU.
E	E	E	1	Execute Late Entry.

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
A	E	F		Close down Link 11 net.
T	E	F	1	Close down Link 16 net.
E	E	F	2	Close down Link 22 Super Network.
E	E	F	3	Close down Link 22 Network.
M	E	G		Time check.
-	E	H		PU.
A	E	H	1	Enter PU ....
A	E	H	2	Delete PU ....
A	E	H	3	Recycle PU ....
Z	E	I		Activate LTD mode.
Z	E	J		Activate FTD mode.
M	E	I		Data Forwarding Unit is Callsign ....
T	E	J		Net Time Reference is Callsign ....
T	E	K		Start/Reset Net Entry.
	F			**Subject: Filter**
-	F	A		Filter settings.
M	F	A	1	Filter settings - TX and RX. (May be followed by filter description and amplifiers, e.g. AFA 2-B50-C2-C3-D I -E3) (see OPTASK Link).
M	F	A	2	Filter settings - TX.
M	F	A	3	Filter settings - RX.
M	F	A	4	Filter in defined area.
M	F	A	5	Filter outside defined area.
M	F	A	6	Close all transmit filters.
M	F	B		Range – .... DM (own unit: range = 0).
-	F	C		Category.
M	F	C	1	Category – All.
M	F	C	2	Category – Air.
M	F	C	3	Category – Surface.
M	F	C	4	Category – Subsurface.
M	F	C	5	Category – Land/Ground.
M	F	C	6	Category – Space.
M	F	C	7	Category – Points.
M	F	C	8	Category – EW.
M	F	C	9	Category – Sonobuoy.
-	F	D		Identity.

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
M	F	D	1	Identity – All.
M	F	D	2	Identity – Unknown.
M	F	D	3	Identity – Assumed friend.
M	F	D	4	Identity – Friend.
M	F	D	5	Identity – Neutral.
M	F	D	6	Identity – Suspect.
M	F	D	7	Identity – Hostile.
M	F	D	8	Identity – Pending.
-	F	E		Area/Sector.
M	F	E	1	Area - Coordinates are ....
M	F	E	2	Sector - (Origin ....). (Bearing lines .... Range inner/outer ...).
M	F	E	3	Area/Sector – as stated in ....
M	F	E	4	TPA cardinal sector .... FM CV/CVN .... NM.
M	F	E	5	TPA start BRG .... stop BRG .... out to .... NM fm CV/CVN.
M	F	F	1	Simulated tracks.
	G			**<u>Subject: Geo-Positioning/Updating</u>**
A	G	A		DLRP.
A	G	A	1*	DLRP - in force .... [lat/long or name].
A	G	A	2*	DLRP – shift to .... [lat/long or name] (at time ....).
A	G	A	3*	DLRP - next is .... [lat/long or name] (at time ....).
-	G	B		Gridlock
A	G	B	1	GRIDLOCK – GRU is ....
A	G	B	2*	GRIDLOCK – on TN .... (Carry out gridlock on TN ....)
A	G	B	3*	GRIDLOCK – Hold (c/s ....) in good gridlock.
M	G	B	4*	– Reference Unit.
M	G	B	5*	GRID – Correction (on TN ....)(Method).
A	G	C		PADS.
A	G	C	1	PADS - Zero.
A	G	C	2	Verify Rel Grid.
A	G	C	3	Shipboard Gridlock System (SGS) (STARWARS) is up.
A	G	C	4	Shipboard Gridlock System (SGS) (STARWARS) is down.
A	G	D		Enable SGS with Callsign.... as GRU.
A	G	E		Perform(ing) STBY on....
A	G	F		Request to enter NET/in Gridlock, w/no duals).
	K			**Subject: Satellite**
M	K	A		Gateway unit is....

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
M	K	A	1	Designated unit act as satellite gateway.
M	K	B		Select Digital Mode only.
M	K	C		Select Audio Mode only.
M	K	D		Select Mixed Mode.
A	K	E		Select Extended Time Out for PU/Callsign.
M	K	F		I am not receiving Satellite data.
M	K	G		I am receiving intermittent Satellite data.
M	K	H		I am receiving good Satellite data.
M	K	I		Configure for Satellite Ops.
M	K	J		Confirm offset is....
M	K	K		Confirm WSC-3 Mode select PSK 2400.
A	K	L		Select normal time out for PU c/s ....
M	K	M		Uplink Freq is desig ....
M	K	O		Downlink Freq is desig ....
M	K	P		Configure for TDMA OPS (DAMA).
M	K	Q		Configure for non-TDMA OPS (non-DAMA).
A	K	R		Confirm Link 11 Keymat in use is:
A	K	R	1	AKAT A5517.
A	K	R	2	ASAT A5517.
A	K	R	3	CCT A16.
A	K	R	4	USKAT A5503.
A	K	R	5	A5520.
A	K	R	6	USKAT 5520.
A	K	R	7	AKAT A5511.
	L			**Subject: Link Monitoring System**
A	L	A		S/N Ratio. Request S/N ratio for PU/RU.
A	L	A	1	PU/RU .... has good S/N ratio or (S/N ratio is ....).
A	L	A	2	PU/RU .... has low S/N ratio.
A	L	A	3	PU/RU .... has transmitter level set too high.
A	L	A	4	PU/RU .... has transmitter power set too low.
A	L	A	5	Set your power to High.
A	L	A	6	Set your power to Low.
A	L	A	7	My transmit mode is Normal.
A	L	A	8	My transmit mode is Voice only.
A	L	A	9	My transmit mode is in EMCON.
A	L	B		Bit Error Rate Request bit error rate for PU/RU ....

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
A	L	B	1	PU/RU .... has high bit error rate.
A	L	B	2	PU/RU .... has normal bit error rate based on S/N ratio.
A	L	B	3	PU/RU .... bit error rate is ....
A	L	C		Radio Frequency Error - Request radio frequency error for PU ....
A	L	C	1	PU .... has large radio frequency error.
A	L	C	2	PU .... radio frequency is accurate.
A	L	C	3	Request carrier suppression test on PU ....
A	L	C	4	PU .... carrier suppression is (good)(poor).
A	L	D		Tone Level-Request relative tone levels for PU ....
A	L	D	1	PU .... relative tone levels are correct.
A	L	D	2	PU .... tone levels are out of calibration.
A	L	D	3	PU .... have/has low power.
A	L	D	4	PU .... tone # .... is (high/low).
A	L	D	5	PU .... has (high/low) frequency rolloff.
A	L	E		Phase Error - PU .... has large phase errors.
A	L	E	1	(USB) or (LSB) has large phase errors.
A	L	I		Net Hang-up – Request status of net hang-up.
A	L	I	1	Net hangs up when PU .... transmits.
A	L	I	2	Net hangs up occasionally when PU .... transmits.
A	L	I	3	Net hang-up is random.
A	L	I	4	Net hang-up is due to NCS receive errors.
A	L	J		Jammed – Net is jammed.
A	L	J	1	USB is jammed.
A	L	J	2	LSB is jammed.
A	L	K		NCS (Dual) - Two units acting as NCS simultaneously.
A	L	K	1	NCS has PU .... entered twice.
A	L	K	2	NCS fails to re-poll non-responding PUs.
A	L	K	3	NCS not polling PU ....
A	L	K	4	NCS is polling dummy PUs ....
A	L	K	5	NCS polling these inactive PUs (....), (....), (....), (....).
A	L	L		PU Response – Request report non-responding PUs.
A	L	L	1	PU .... not responding.
A	L	L	2	PU .... responding with no data frames.
A	L	L	3	PU .... responding with single data frame.
A	L	L	4	PU .... responding intermittently.

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
A	L	L	5	Several PUs not responding.
A	L	L	6	PU .... responding, NCS not receiving.
A	L	L	7	Dual Response – Unit .... responding to two different addresses.
A	L	M		Transmission Part of transmission from PU .... is lost.
A	L	N		Broadcast – No data received in broadcast mode.
A	L	P		Interface CPU and Data Terminal Set (DTS) not communicating.
	N			**Subject: Net Mode/Work**
A	N	A		Roll Call. Switch to Roll Call.
A	N	A	1	Roll Call – Full Roll Call.
A	N	A	2	Roll Call – Partial Roll Call.
A	N	A	3	Roll Call – Roll Call broadcast.
A	N	A	4	Transmit Broadcast (buffers – every .... minutes).
A	N	A	5	Silence - Use of SBC authorized.
A	N	A	6	Silence - Use of SBC not authorized.
A	N	A	7	Request Permission to enter the Link.
A	N	A	8	Permission granted.
A	N	B		Transmit Short Broadcast (every.... minutes).
T	N	D		Network (PG No. ..../Description ....).
E	N	D	1	MASN (nr..../participant....).
T	N	E		Needline (PG No. ..../Description ....).
T	N	F		Net Operation.
T	N	F	1	Net Operation – Single net.
T	N	F	2	Multinet Operation Coordinated/Stacked Net.
T	N	F	3	Multinet Operation Non-coordinated.
T	N	G		Network limitations.
T	N	G	1	Network limitations – Protection 1 (Exercise).
T	N	G	2	Network limitations – Protection 2 (Full IPF).
T	N	G	3	Network limitations – Protection 0 (Combat).
T	N	G	4	Select Net Entry Control.
T	N	G	5	IPF Reset.
T	N	G	6	Received IPF failure alarm.
M	N	H	1	TDMA Mode-Fixed.
M	N	H	2	TDMA Mode – Dynamic, fixed slot length.
M	N	H	3	TDMA Mode – Dynamic, variable slot length.

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
M	N	I		SPC Fragmentation Rate.
	O			**Subject: Transmission Orders**
M	O	A		Transmit - .... (datum, air track, bearing, etc.).
M	O	B	*	Cease reporting (TN ....)(CAT ....)(Ident ....).
M	O	C		Drop track ....
	P			**Subject: Picture Compilation/Track Management**
M	P	A	*	R2 - (for TN ....).
M	P	A	2	Take R2 for TN .... Report when ready.
M	P	A	3	Am holding reporting responsibility for TN ....
M	P	B		Force Track Coordinator (c/s ....).
-	P	D		Verify.
M	P	D	1*	Verify - ID for TN ....
M	P	D	2*	Verify – Environment/Category for TN ....
M	P	D	3*	Verify - IFF/SIF for TN ....
-	P	E		Correlation
M	P	E	1	Correlate TN .... with TN ....
M	P	E	2	Correlation not possible - (TN ....) [track assigned].
M	P	F		Pointer – Transmit to TN ....(or IU/Callsign).
M	P	F	1	Pointer - (c/s IU) indicates.
M	P	G		TN .... is Force TN ....
-	P	H		DI Code.
M	P	H	1	Assign DI code for TN ....
M	P	H	2	Verify DI code for TN ....
M	P	I	1	Auto ID is up.
M	P	I	2	Auto ID is down.
M	P	J	1	Variable TQ/Set Variable TQ to ....
M	P	J	2	Inhibit all IFF doctrine around CV/CVN Marshall.
M	P	J	3	Inhibit all IFF challenge doctrine (AEGIS).
M	P	J	4	Reset IFF challenge doctrine (AEGIS).
	R			**Subject: Radio/Communications**
M	R	A		Voice Frequency.
M	R	A	1*	Voice Frequency - (Line/Frequency/Number ....).
M	R	A	2*	Voice Frequency – UHF (Line/Frequency ....).
M	R	A	3*	Voice Frequency - HF (Line/Frequency ....).
M	R	A	4*	Voice Frequency – Secure Voice.
M	R	B		Data Frequency.

	LINK MGMT CODES			MEANING: (….) : Indicates optional transmission. …. : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
M	R	B	1*	Data Frequency - (Line/Frequency/Number ….).
M	R	B	2*	Data Frequency – UHF (Line/Frequency ….).
M	R	B	3*	Data Frequency – HF (Line/Frequency ….).
A	R	C		Sideband selection.
A	R	C	1	Sideband selection – Double Sideband/Auto Diversity. (Switch to Auto/Diversity.)
A	R	C	2	Sideband selection – Upper Sideband. (Switch to Lower Sideband.)
A	R	C	3	Sideband selection – Lower Sideband.
E	R	C	4	Data Frequency Hopset.
E	R	C	5	Data Frequency Hopset UHF (Line/Frequency/Number).
E	R	C	6	Data Frequency Hopset HF (Line/Frequency/Number).
-	R	D		Transceiver.
M	R	D	1	Transceiver – max. power. (Net, A, B, J, E.)
M	R	D	2	Transceiver – min. power. (Net, A, B, J, E.)
M	R	D	3	Transceiver – switch to voice.
M	R	D	4	Transceiver – switch to data.
M	R	D	5	Transceiver – switch to CW.
-	R	E		Breakdown.
M	R	E	1*	Breakdown – Radio equipment.
M	R	E	2*	Breakdown - UHF equipment.
M	R	E	3*	Breakdown - HF equipment. (Transmitter or receiver.)
M	R	E	4	Breakdown – UHF Fixed Frequency Radio equipment.
M	R	E	5	Breakdown – HF Fixed Frequency Radio equipment.
E	R	E	6	Breakdown – UHF Hopping Radio equipment.
E	R	E	7	Breakdown – HF Hopping Radio set.
M	R	F		Communications Mode (….).
E	R	F	1	Media Setting Number (….).
-	*R*	*G*		Pulse.
T	*R*	*G*	*1*	Pulse – single.
T	R	G	2	Pulse – double.
T	R	G	3	Pulse – first.
E	R	G	4	Modulation (TBD).
T	R	H	1	Normal range mode.
T	R	H	2	Extended range mode.
A	R	I		Frequency Lock on freq …. (at time ….).

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
A	R	J		Shift Frequency to desig ....
A	R	K		Do not receive you on desig ....
M	R	L		Am calling your on desig ....
M	R	M		Control Net is ....
M	R	N		Voice Net 1 is ....
M	R	O		Voice Net 2 is ....
A	R	P	1	Link configuration single HF/UHF Frequency.
A	R	P	2	HF/UHF Multi-Frequency.
A	R	P	3	HF or UHF Re-Key.
A	R	P	4	UHF Autocat relay.
A	R	P	5	Set DTS in Single Tone Mode.
A	R	Q	1	UHF/HF MFL: UHF/HF-Alfa frequency is (CRT Desig...).
A	R	Q	2	UHF/HF MFL: UHF/HF-Bravo frequency is (CRT Desig...).
A	R	R	1	UHF Autocat uplink Frequency is (CKT Desig ....).
A	R	R	2	UHF Autocat downlink Frequency is (CKT Desig ....).
	S			**<u>Subject: Station Mode</u>**
A	S	A		DNCS (c/s ....). (Act as Net Control Station.)
E	S	A	1	Super Network Management Unit (SNMU).
T	*S*	*A*	*2*	Network Control Station/Network Manager Station.
E	*S*	*A*	*3*	Network Management Unit (NMU).
T	S	A	4	Polling Control Station.
A	S	B		Picket active. (Act as Picket.)
M	S	B	1	Unit reporting – Normal Mode.
M	S	B	2	Unit not reporting – Conditional Radio Silence.
T	S	B	3	Unit not fully reporting – Polling Mode.
T	S	B	4	Unit not fully reporting – Limited Status.
E	S	B	5	Unit not Reporting – Engineering Mode.
A	S	B	6	Picket passive.
A	S	C	*	Broadcasting Unit. Switch to Broadcast.
A	S	C	1	Use Short Broadcast Mode.
M	S	D		Silent. (Switch to radio silence.)
M	S	D	1	Unit not Reporting – Listen Only Mode.
M	S	D	2	Unit not reporting – Inactive.
M	*S*	*F*		(Select) Network Time Reference.
T	S	G		Position Reference.
T	S	H		Navigation Controller is Callsign ....

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
A	S	I		Nav Reset.
A	S	J		Assume Nav Controller.
	T			**Subject: Data Terminal**
M	T	A		Start/repeat net synch.
M	T	A	1	Synchronization – successful.
T	T	A	2	Synchronization – coarse.
T	T	A	3	Synchronization – fine passive.
T	T	A	4	Synchronization – fine active.
T	T	A	5	Synchronization (State of) (c/s ..../JU ....).
A	T	A	6	Net Sync – intermittent (from c/s ....).
T	T	A	7	My sync status is pending.
T	T	A	8	My sync status is coarse sync.
T	T	A	9	My sync status is fine sync.
A	T	A	10	Net Sync unsuccessful.
A	T	A	11	Net Sync successful.
E	T	A	12	Synchronization - TBD.
E	T	A	13	Synchronization - TBD.
E	T	A	14	Synchronization - TBD.
A	T	B		Net Test.
A	T	B	1	Net Test – successful.
M	T	B	2	Terminal test mode (....).
M	T	B	3	Test – successful.
A	T	B	4	Net Test - unsuccessful.
-	T	C		Data Rate.
A	T	C	1	Data Rate - 13/9 (2250).
A	T	C	2	Data Rate – 22/9 (1364/9.09).
A	T	C	3	Data Rate – 22/18 (1364/18.18).
Z	T	C	4	Data Rate - 6(600).
Z	T	C	5	Data Rate - 12(1200).
Z	T	C	6	Data Rate - 24(2400).
Z	T	C	7	Data Rate - 48(4800).
Z	T	C	8	Data Rate - 96(9600).
-	T	D		Timing Mode.
A	T	D	1	Timing Mode – corrected. (Switch to corrected timing).
A	T	D	2	Timing Mode – stored. (Switch to stored timing).
M	T	E	*	Breakdown - Data Terminal.

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
M	T	E	1	Terminal Initialization.
E	*T*	*E*	*2*	Signal Processing Controller.
-	T	F		Doppler.
A	T	F	1	Doppler on. (Switch Doppler on).
A	T	F	2	Doppler off. (Switch Doppler off).
M	*T*	*G*	*1*	System Time Adjustment (add .... mins and/or .... secs).
M	T	G	2	System time adjustment (subtract .... mins and/or .... secs).
-	T	H		Voice group.
T	T	H	1	Voice group Alfa.
T	T	H	2	Voice group Bravo.
T	T	I	1	Error-coded FTM.
T	T	I	2	Non-error coded FTM.
M	T	J	1	Time Slot - Primary setting.
M	T	J	2	Time Slot - Alternate setting.
M	T	K	1	Time Slot - Minimum configuration.
M	T	K	2	Time Slot - Standard value.
M	T	K	3	Time Slot - IAW Table ....
M	T	K	4	Time Slot - Initial slot.
M	T	K	5	Time Slot – Recurrence rate.
M	T	K	6	Time Slot – Set.
T	T	L	1	Time Slot - Net entry.
T	T	L	2	Time Slot – Radio relay.
T	T	L	3	Time Slot - Relay UME.
E	T	L	4	Priority Interrupt Slot (TBD).
E	T	L	5	Priority Interrupt Slot (TBD).
E	T	L	6	Priority Interrupt Slot (TBD).
-	T	M		Relay.
T	T	M	1	Radio relay - Paired slot.
T	T	M	2	Radio relay – Repromulgation.
T	T	M	3	Radio relay – Addressed.
T	T	M	4	Radio relay mode – Conditional.
T	T	M	5	Radio relay mode – Unconditional.
T	T	M	6	Radio relay mode – Suspended.
T	T	M	7	Relay function - Main Net.
T	T	M	8	Relay function - Voice (A/B).
T	T	M	9	Relay function – Control.

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
T	T	M	10	Relay function – Zoom.
T	T	M	11	Relay function - Directed (1-63).
T	T	M	12	Relay function – Participation Group (4-511).
T	T	O		Access Mode.
T	T	O	1	Access Mode – Dedicated.
T	T	O	2	Access Mode - Dedicated Time Slot Reuse.
T	T	O	3	Access Mode - Time Slot Reallocation.
T	T	O	4	Access Mode – Contention.
T	T	O	5	Access Mode - Call up.
M	T	O	6	My operating mode is Link 11 only.
M	T	O	7	My operating mode is Link 16 only.
M	T	O	8	My operating mode is Link 22 only.
M	T	O	9	My operating mode is data forwarder (Link....).
A	T	P		Waveform/Modulation Type.
A	T	P	1	Conventional Link 11 waveform (CLEW)/Kineplex.
A	T	P	2	Single tone Link 11 Waveform (SLEW).
	U			**Subject: Gateway/SSSB Operations**
M	U	A		Gateway on the net.
M	U	B		SSSB on the net.
M	U	C		Receive tracks - (TN ....) from SSSB.
M	U	D		Receive tracks - (TN ....) from gateway.
M	U	E		Transmit tracks (TN ....) to gateway/SSSB.
	W			**Subject: Warning /Conflicts**
M	W	A		Emergency/Force Tell – general (for TN ....).
M	W	B		Jamming on Link.
M	W	B	1	Jamming on Link – Noise/pulse, etc.
M	W	B	2	Jamming on Link – Fake Data.
-	W	C		ID Conflict.
M	W	C	1	ID conflict - exists (for TN ....).
M	W	C	2	ID conflict - initiate (for TN ....).
M	W	C	3	ID conflict - solve (for TN ....).
M	W	D		ENV/CAT conflict – exists (for TN ....).
M	W	D	1	ENV/CAT conflict – initiate (for TN ....).
M	W	D	2	ENV/CAT conflict – solve (for TN ....).
M	*W*	*E*		EW info conflict - exists (for TN ....).
M	W	E	1	EW info conflict – initiate (for TN ....).

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
M	W	E	2	EW info conflict - solve (for TN ....).
-	W	F		Track Number Conflict.
M	W	F	1	Track number conflict – Dual Designation (TN ....).
M	W	F	2	Track number conflict – Duplicate tracks (TN ....).
-	W	G		IFF/SIF Conflict.
M	W	G	1	IFF/SIF conflict – exists (for TN ....).
M	W	G	2	IFF/SIF conflict – solve (for TN ....).
	X			**Subject: Link Exercises**
M	X	A		Link exercise - (exercise designator ....).
M	X	B		Start - (exercise designator ....).
M	X	C		Terminate - (exercise designator ....).
M	X	D		Next - (exercise designator ....).
	Y			**Subject: Weapon Assignments**
-	Y	A		Assign Weapon.
M	Y	A	1	Assign Weapon – general (to TN ....).
M	Y	A	2	Assign Weapon – Guns (to TN ....).
M	Y	A	3	Assign Weapon – SAM (to TN ....).
M	Y	A	4	Assign Weapon – SAMSR (to TN ....).
M	Y	A	5	Assign Weapon – SSM/ASM (to TN ....).
M	Y	A	6	Assign Weapon – Torpedo (to TN ....).
M	Y	A	7	Assign Weapon – Fighter (to TN ....).
M	Y	A	8	Received engagement/weapon assignment data on TN ....
	Z			**Subject: Electronic Warfare**
-	Z	A		ESM (ES) Data.
M	Z	A	1	ESM (ES) Data - Data (TN ....).
M	Z	A	2	ESM (ES) Data - Receive Data (TN ....).
-	Z	B		ESM (ES) Bearing
M	Z	B	1	ESM (ES) Bearing – (TN ....).
M	Z	B	2	ESM (ES) Bearing - Received Bearing (TN ....).
-	Z	C		ESM (ES) FIX.
M	Z	C	1	ESM (ES) Fix – Received Fix (TN ....).
-	Z	D		ECM (EA) DATA.
M	Z	D	1	ECM (EA) Data - Data (TN ....).
M	Z	D	2	ECM (EA) Data – Received Data (TN ....).
M	Z	D	3	ECM (EA) Bearing - (TN ....).
M	Z	D	4	ECM (EA) Bearing – Received Bearing (TN ....).

	LINK MGMT CODES			MEANING: (....) : Indicates optional transmission. .... : Indicates mandatory transmission.
Ind[1].	Subj.	Desc	Amp	
	A	Z		Spare.
	B	W		Spare.
	B	X		Spare.
	B	Y		Spare.
	B	Z		Spare.
	C	X		Spare.

NOTES: ***** indicates the following:
When voice reports are necessary to support the data link information exchange, the APP-1 voice reporting procedures must be used[2].

[1] When the first letter (Indicator) is an "M", it designates the code as being applicable to multiple data links. The operator has the option to substitute the "M" code for a code of a specific Link.

[2]NATO Standard Voice Reporting Procedures are contained in the following publications; Navy APP1, Air APP1 or equivalent (i.e., Pub 32/34/35001, Annex C).

ENCLOSURE B

REFERENCES

References:

a. MIL-STD-6011, “Tactical Data Link (TDL) 11/11B Message Standard”

b. MIL-STD-6004, “Tactical Digital Information Link (TADIL) C Message Standard”

c. MIL-STD-6013, “Army Tactical Data Link-1 Message Standard”

d. MIL-STD-6016, “Tactical Data Link (TDL) 16 Message Standard”

e. Variable Message Format (VMF) Technical Interface Design Plan - Test Edition

f. North Atlantic Treaty Organization (NATO) Allied Data Systems Interoperability Agency (ADSIA) Data Link Working Group (DLWG) Document D/4 (IJMS D/4)

g. MIL-STD-188-220A, “Interoperability Standard for Digital Message Transfer Device (DMTD) Subsystems”

h. Allied Data Processing Publication 11 (ADatP-11), “Standard Operating Procedures for NATO Link 11”

i. Allied Data Processing Publication 16 (ADatP-16), “Standard Operating Procedures for NATO Link 16”

j. Allied Data Processing Publication 33 (ADatP-33), “NATO Multi-Link Standard Operating Procedures for Tactical Data Systems”

k. Allied Data Processing Publication 4 (ADatP-4), “Standard Operating Procedures for NATO Link 4”

l. MIL-STD-188-203-1A, “Subsystem Design and Engineering Standards for TADIL A”

m. MIL-STD-188-212, “Subsystem Design and Engineering Standards for TADIL B”

n. MIL-STD-188-110, MIL-STD-188-114, MIL-STD-188-200, and MIL-STD-188-203-2 define the technical communications requirements for TADIL B.

o. MIL-STD-188-203-3, “Subsystem Design and Engineering Standards for TADIL C”

p. JTIDS System Segment Specification

q. STANAG 4175 (MIDS)

r. JIEO Circular 3010

s. CJCSI 6610.01, “Tactical Digital Information Link Standardization Policy and Procedures”

t. MIL-STD-6040, “Joint U.S. Message Formatting Program”

u. CJCSI 6232.01, “Deconflicting JTIDS/Link 16 Operations”

v. CJCSM 3115.01, “Joint Data Networks Operations Manual”

w. Network Design Catalog

x. STANAG 1241, NATO Standard Identity Description Structure for Tactical Use

y. STANAG 5501, Tactical Data Exchange - Link 1 Point-to-Point.

z. STANAG 5601, Standards for Interface of Data Links 1, 11, 11B, and 14 through a Buffer.

aa. ADatP-2, NATO Glossary of Automatic Data Processing (ADP) Terms and Definitions

bb. AAP-6, NATO Glossary of Terms and Definitions

cc. ADatP-12, Standard Operating Procedures for the Ship-Shore-Ship Buffer (NC).

dd. ADatP-31, Standard Operating Procedures for Link 1 (NC).

ee. AEGX-101-FD Aegis Crosstell Procedures (C). "Detailed Procedures and Transmission Rules"

ff. SACEUR SUPPLAN 10001D "NATINAD", NATO Integrated Air Defense (NC).

gg. MCM 35-70 Ship/Shore/Ship Facilities for the Exchange of Air Defense Information (NC).

hh. SHAPE 1250.13/SHOPDP/78 Tri-MNC Operational Requirement for the Land Maritime Exchange of Air Surveillance Information Ship-Shore-Ship Buffer (NC).

ii. SHAPE 1250.13.02/SHOPDP/81 Tri-MNC Operational/Requirement for the Land Maritime Exchange of Air Surveillance Information (NC).

jj. SHAPE 6547.04.01/SHOPDS/81 Tri-MNC Operational/Requirement for NATO Ship-Shore-Ship Buffer (NC).

kk. Tri-MNC Concept of Operations for the Land Maritime Exchange of Air Surveillance Information SSSB, 1251.05/SHORF/91 (NC).

ll. International Telephone and Telegraph Consultative Committee (CCITT)

mm. OS-404: 2 Link 4A Operational Specification

nn. Security Classification Guide: PATRIOT Air Defense Missile System-Program Number 1X464307D212

oo. Security Classification Guide: FAAD C21 System Less Sensor-Program Number 1T46471D126

pp. Security Classification Guide: FAAD Ground Based Sensor-Program Number 1T46471D126

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GLOSSARY

This Glossary provides acronyms and the definitions used in the JMTOP or likely to be encountered in interface operations.

PART I--ABBREVIATIONS AND ACRONYMS

AAA*	anti-aircraft artillery
AADC	area air defense commander
AADP*	Area Air Defense Plan
AAW	anti-air warfare
ABCCC	Airborne Battlefield Command and Control Center
ACA	Airspace Control Authority
ACDS*	Advanced Combat Direction System (formerly NTDS)
ACLS*	Automatic Carrier Landing System
ACO	airspace control order
ACP	airspace control plan
ACR	air control revision
ACT	activity
ACT AMP*	activity amplification
ADA	air defense artillery
ADatP*	Allied Data Processing Publication
ADCCN*	Air Defense Command and Control Net
ADCP*	Air Defense Communications Platform
ADI*	Air Defense Interface
ADIZ	Air Defense Identification Zone
ADSI*	Air Defense System Integrator (USA, USN, USAF, USMC)
ADSIA	Allied Data Systems Interoperability Agency
ADW	air defense warning
AEGIS*	airborne early warning ground integration segment
AEW	airborne early warning
AFC*	area frequency coordinators
AFNDF*	Air Force Network Design Facility
AGC*	automatic gain control
AGM*	air-to-ground missile
AI	air interdiction
AIM*	air intercept missile
AJ	anti-jam

AM	amplitude modulation
AMDPCS*	Air and Missile Defense Planning and Control System
AMRAAM	Advanced Medium Range Air-to-Air Missile
AOC	Air Operations Center
AOI	area of interest
AOP*	area of probability
AOR	area of responsibility
ARNG	Army National Guard
ASACS	Air Surveillance and Control System
ASIT*	Adaptable Surface Interface Terminal
ASM*	air-to-surface missile
ASO*	air support operations
ASW	anti-submarine warfare
ATA*	Airborne Early Warning Target Area
ATCRBS*	Air Traffic Control Radar Beacon System
ATDL-1	Army Tactical Data Link-1
ATO	air tasking order
AUTOCAT*	Automatic Communications Relay
AW*	air warfare
AWACS	Airborne Warning and Control System
BAI	battlefield air interdiction
BCP*	battery command post
BIT	built-in test
bps	bits per second
BRG/RNG*	bearing and range
C2	command and control
C2 IU*	command and control interface unit
C2 JU*	command and control JTIDS/MIDS unit
C2P*	command and control processor (USN)
C4I	command, control, communications, computers, and intelligence
CANTCO*	cannot comply
CANTPRO*	cannot process
CAP	Combat Air Patrol
CARS*	Contingency Airborne Reconnaissance System
CAS	close air support
CASS*	Command Activated Sonar System
CCITT	International Telephone and Telegraph Consultative Committee

CCS*	combat control system
CCU*	current controlling IU
CDO*	change data order
CERTSUB*	certain submarine
CG	guided missile cruiser
CIU*	concurrent interface unit
CJTF	commander, joint task force
CLEW*	Conventional Link Eleven Waveform
CM*	crypto manager
COMSEC	communications security
CONOPS	concept of operations
CPD*	crypto period designator
CRC	Control and Reporting Center
CRE*	control and reporting equipment
CSDTS*	common shipboard data terminal set
CTN*	common track number
CV	aircraft carrier
CVLL*	cryptovariable logical label
CVM*	cryptovariable mode
CVSD	continuously variable slope delta
CZ*	convergence zone
dB	decibel
dBm	power level and decibels referenced to one milliwatt
DC	direct current
DCN*	Data Link Coordination Net
DDG	guided missile destroyer
DFSK*	differential frequency shift keying
DI*	discrete identifier
DLCS*	Data Link Communications System
DLRP*	data link reference point
DLWG*	data link working group
DME	distance measuring equipment
DMTD*	digital message transfer device
DNCS	data net control station
DOD	Department of Defense
DP*	standard double pulse
DRMA*	data registration monitoring and adjustment
DRRU*	data registration reference unit
DSN	Defense Switched Network

DTS*	data terminal set
DUR*	data update request
DURRI*	data update request by request indicator
DX*	data extraction
EA	electronic attack
EDAC*	hamming error detection and correction
EEC*	emitter evaluation confidence
EEI	essential elements of information
EHF	extremely high frequency
ELDI*	EW local discrete identifier
ELINT	electronic intelligence
EMC	electromagnetic compatibility
EMCON	electronic emission control
EN*	emitter number
ENI*	emitter number indicator
EO	electro-optic
EOB	electronic order of battle
EP*	estimated position
EP	electronic protection
EPL*	ELINT parameter limits
ER*	extended range
ERR*	enhanced repromulgation relay
ERV*	EA countermeasures resistant voice
ES	electronic warfare support
ESM	electronic warfare support measures
ETI*	Modem Exchange Terminal Initialization Program
ETR*	external time reference
EW	electronic warfare
EWC	electronic warfare coordinator
EWDF*	electronic warfare data forwarding
EWDFA*	EW Data Forwarding to Link 11
EWDFJ*	EW Data Forwarding to Link 16
FAAD*	forward area air defense
FAC	forward air controller
FCS*	fire control system
FDL*	fighter data link
FDM	frequency division multiplex
FEZ	fighter engagement zone
FFG	guided missile frigate

FINEX*	finish of the exercise
FJU*	Forwarding JTIDS/MIDS Unit
FJUA*	Forwarding JTIDS/MIDS Unit Link 11
FJUAB*	Forwarding JTIDS/MIDS Unit Link 11/11B
FJUB*	Forwarding JTIDS/MIDS Unit Link 11B
FM	frequency modulation
FOC*	farthest-on-circle
FORSCOM	United States Army Forces Command
FPU*	forwarding participating unit
FRU*	forwarding reporting unit
FSCL	fire support coordination line
FSK	frequency shift keying
FTC	force track coordinator
FTD*	full transmission of data
FTP*	file transfer protocol
FWDA*	friendly weapon danger area
GAAC *	geographic area assignment coordinator
GCI	ground control intercept
GPS	Global Positioning System
GRU*	gridlock reference unit
HARM	High Speed Anti-Radiation Missile
HAVCO*	have complied
HC*	altitude correction
HF	high frequency
HFDF	high frequency direction finder (or finding)
HIMEZ	high altitude missile engagement zone
HSSDB	high speed serial data buffer
HULTEC*	hull-to-emitter correlation
HUR*	high update rate
Hz	hertz
I/O	input/output
IAW	in accordance with
ICC*	information coordination and control
ICNI*	integrated communications, navigation, and identification
ICO*	interface control officer
ICU	interface control unit
ID	identity
ID AMP*	identity amplification
IEJU*	initial entry JTIDS/MIDS Unit

IFF	identification friend or foe
IFF/SIF	identification friend or foe/selective identification feature
IJMS*	interim JTIDS message specification
ILDI*	intelligence local discrete identifier
IMC	instrument meteorological conditions
IP	initial point
IPF*	interference protection feature
IR	infrared
IU*	interface unit
JCS	Joint Chiefs of Staff
JFC	joint force commander
JICO*	joint interface control officer
JIEO	Joint Information Engineering Organization
JMTOP*	joint multi-TDL operating procedures
JNDF*	joint network design facility
JNDL*	joint network design library
JNDT*	joint network design team
JNL*	JTIDS Network Library
JRSL*	jammer received signal level
JSTARS	Joint Surveillance Target Attack Radar System
JTAA*	joint tactical action area
JTAGS*	joint tactical ground station
JTAO	joint tactical air operations
JTF	joint task force
JTIDS	Joint Tactical Information Distribution System
JU*	JTIDS/MIDS Unit
JUDATA*	provides data pertaining to units on the net
KG	key generator
kHz	kilohertz
km	kilometer
LAAD*	low altitude air defense (USMC)
LAMPS	Light Airborne Multipurpose System
LASHE*	Low Altitude Simulated Hawk Engagement
LATC*	latitude correction
LDI*	local discrete identifier
LHA	amphibious assault ship (helicopters)
LHD	amphibious assault ship (multipurpose)
LLA*	limiting lines of approach
LLLTV*	low light level television

LOB*	line-of-bearing
LOFAR*	low frequency analysis and recording
LOMEZ	low altitude missile engagement zone
LONC *	longitude correction
LORAN	long range navigation
LOS	line-of-sight
LPUDATA*	link participating unit data
LRI*	limited range intercept
LRUDATA*	link reporting unit data
LTD*	limited transmission of data
MAD*	magnetic anomaly detection
MATCALS*	Marine Air Traffic Control and Landing System
MC*	mission correlator
MCE*	modular control equipment
MEZ	missile engagement zone
MFL*	multi-frequency TADIL technique
MHz	megahertz
MI*	message indicator
MIDS*	Multifunctional Information Distribution System
MOF*	method of fire
MR*	(1) machine receipt
	(2) medium range
ms	millisecond
MSCS*	Multiple Source Correlation System
MSE	mobile subscriber equipment
MSEC*	message security
MSS*	Mission Support System
MTF	message text format
NADGE*	NATO air defense ground environment
NAS*	National Airspace System
NAT/ALL*	nationality and/or alliance
NATO	North Atlantic Treaty Organization
NC*	navigation controller
NCS	Net Control Station
NCT*	net cycle time
NCTSI*	Navy Center for Tactical Systems Interoperability
NCU*	new controlling IU
NDF*	network design facility
NDL*	network design load

NDR*	network design requests
NEDB*	NATO emitter data base
NETMGR*	network manager
NIPRNET*	Non-secure Internet Protocol Routing Network
nm	nautical mile
nonC2JU*	non command and control JTIDS/MIDS unit
NOTACK*	no attack
NPG*	network participation group
NPS*	network participation status
NRT*	non-real-time track
NSA	National Security Agency
NTN*	NATO Track Number
NTR*	network time reference
OCC*	operational contingency constraint
OPCON	operational control
OPLAN	operational plan(s)
OPORD	operational order(s)
OPSEC	operations security
OPTASK LINK*	operational tasking data links
OTAR*	over-the-air rekeying
OTH-DCT*	over-the-horizon detection, classification, and targeting
P2DP*	Packed-2 Double Pulse
P2SP*	Packed-2 Single Pulse
PCM	pulse code modulation
PEC*	platform evaluation confidence
PG*	participation group
PGC*	participation group community
PIM*	position and intended movement
PK*	probability of kill
PN*	platform number
POC	point of contact
POFA*	programmed operational and functional analysis
POSSUB*	possible submarine
PPLI*	precise participant location and identification
PR*	position reference
PRF*	pulse repetition frequency
PRI AMP*	primary identity amplification
PROBSUB*	probable submarine
PROC *	Puerto Rican Operations Center

PRU*	primary user
PSK	phase shift keying
PU*	participating unit
PVM*	partitioned variable mode
Q_{pg}	geodetic position quality
QPSK	quadrature phase frequency shift keying
R^{2*}	reporting responsibility
R^2IU*	reporting responsibility interface unit
RADIC*	rapidly deployable command and control
RADIL*	Region Operations Control Center/Airborne Warning and Control System Digital Interface Link
RAOC/SAOC*	Region Air Operations Center/Sector Air Operations Center
RDF	radio direction finder (or finding)
RELNAV*	relative navigation
RF	radio frequency
RFI*	radio frequency interference
RICO*	regional ICO
RO*	range only
ROE	rules of engagement
RQ*	reception quality
RRN*	recurrence rate number
RSC*	radio set control
RTB	return to base
RTT*	round trip timing
RU*	reporting unit
S/A*	Service/agency
SA*	situational awareness
SAA*	submarine action area
SAM	surface-to-air missile
SAR	search and rescue
SATCOM	satellite communications
SAU*	surface action unit
SCC*	System Coordinate Center
SDU*	secure data unit
SEAD	suppression of enemy air defenses
SECNC	secondary navigation controller
SFJU*	standby forwarding JTIDS/MIDS unit
SGSA*	submarine generated support area
SHF	super high frequency

SHORADEZ	short range air defense engagement zone
SIC*	subject identifier code
SICO*	sector ICO
SIF	selective identification feature
SIGINT	signals intelligence
SIM*	submarine position and intended movement
SINCGARS	Single Channel Ground-Air Radio System
SIPRNET*	Secret Internet Protocol Router Network
SIS	Special Information System
SLEW*	Single Tone Link Eleven Waveform
SNR*	signal-to-noise ratio
SOCA*	support submarine operation coordinating authority
SOM*	system operator's manual
SONAR*	sound navigation & ranging
SOTA	SIGINT operational tasking authority
SPA*	submarine patrol area
SPECTRK*	special track
SPI*	special processing indicator
SPINS	special instructions
SRN*	system reference number
SSM	surface-to-surface missile
SSN	nuclear powered submarine
SSSB*	ship shore ship buffer
STANAG*	standardization agreement
STBYNETMGR*	standby network manager
STDL*	submarine tactical data link
STIR*	System TDL Interoperability Report
SU*	supporting unit
SUWC*	surface warfare commander
TACAIR	tactical air
TACAN	tactical air navigation
TACC	Tactical Air Command Center
TACOPDAT*	tactical operational data
TACREP*	tactical report
TADIL	Tactical Digital Information Link
TADIL A*	Tactical Digital Information Link A (Link 11)
TADIL B*	Tactical Digital Information Link B (Link 11B)
TADIL C*	Tactical Digital Information Link C (Link 4A)
TADIL J*	Tactical Digital Information Link J (Link 16)

TAOC	Tactical Air Operations Center
TASMO*	tactical air support for maritime operations
TBD	to be determined
TBM*	theater ballistic missile
TBMCS*	Theater Battle Management Core Systems
TBMD	theater ballistic missile defense
TDC*	track data coordinator
TDDM*	time division digital multiplexer
TDM	time division multiplexer
TDM/PCM*	time division multiplexing/pulse code modulation
TDMA	time division multiple access
TDL	tactical data link
TDS*	tactical data system
TERPES	Tactical Electronic Reconnaissance Processing and Evaluation System (USMC)
THAAD*	theater high altitude area defense
TIBS	Tactical Information Broadcast Service
TIDP*	technical interface design plan
TIN*	track index number
TLP	transmission level point
TMA*	target motion analysis
TMD*	theater missile defense
TN*	track number
TOA*	time of arrival
TPA*	track production area
TQ*	track quality
TRANSEC	transmission security
TRAP	Tactical Related Applications Broadcast System
TSB*	time slot block
TSDF*	time slot duty factor
TSN*	track supervision net
TSR*	time slot reallocation
TV*	television
UHF	ultra high frequency
UHFDF*	ultra high frequency direction finder (or finding)
UME*	unformatted message element
US*	United States
USA	United States Army
USAF	United States Air Force

USMC	United States Marine Corps
USMTF	United States message text format
USN	United States Navy
USW	under sea warfare
USWC*	under sea warfare commander
VCO*	variable control oscillator
VF	voice frequency
VHF	very high frequency
VMC	visual meteorological conditions
VMF*	variable message format
VPN*	voice product net
WC*	weapons coordination
WILCO*	will comply

PART II--DEFINITIONS

acknowledge*. The act of notifying a unit transmitting a message that the message has been received as a valid message.

active synchronization*. A procedure used by a JTIDS/MIDS terminal to effect and maintain fine synchronization with system time based on the Round-Trip-Timing (RTT) process.

address*. A number applied to an Interface Unit to associate information and directives with interface units or tracks for both digital and voice communications.

airborne early warning (AEW) station*. A point at which AEW aircraft are or will be orbiting or maneuvering.

air surveillance. The systematic area observation of air space by electronic, visual or other means, primarily for the purpose of identifying and determining the movements of aircraft and missiles, friendly and enemy, in the air space under observation.

airborne early warning. The detection of enemy air or surface units by radar or other equipment carried in an airborne vehicle, and the transmitting of a warning to friendly units.

area (General)*. A general nonhazard area that must be amplified via voice or predetermined procedures.

area of probability*. An area in which there is a 95 percent probability that a particular contact is located, or an area in which the presence of one or more contact is suspected.

area of responsibility

(1) The geographic area associated with a combatant command within which a combatant commander has authority to plan and conduct operations.

(2) In naval usage, a predefined area of enemy terrain for which supporting ships are responsible for covering by fire on known targets or targets of opportunity and my observation.

association*. The automatic or manual establishment of a relationship between two or more tracks when the information on them is deemed to pertain to the same contact.

ASSUMED FRIEND*. A track assumed to be a friend because of its characteristics, behavior, or origin.

bailout point*. An emergency point that indicates the expected location of a person in the water or on land as a result of ejecting from an aircraft.

bit*. A binary digit. In the binary system of numbering, each digit can have only one of two values (0 or 1).

brief contact (USW)*. A contact that was not held long enough to generate course and speed information.

buffer zone*. A line beyond which friendly aircraft usually do not fly in peacetime.

CANTCO*. Originator of this response cannot comply with order. This is a manually generated response by an operator who has received the order and has determined that the order cannot/will not be carried out.

CANTPRO*. Originator of this response cannot process the order. This is an automatic computer generated response and the operator need not be aware that any order has been received or that the CANTPRO response has been generated. Implies order could be considered if passed by other means; e.g., voice.

category*. The environment in which the associated track is operating; i.e., air, surface, subsurface, land, or space.

close air support. Air action by fixed-and rotary-wing aircraft against hostile targets which are in close proximity to friendly forces and which require

detailed integration of each air mission with the fire and movement of those forces. Also called CAS.

coarse synchronization*. The state of synchronization with system time that allows a terminal to receive and process messages and to achieve fine synchronization. (System Segment Specification for JTIDS Class 2 Terminal)

combat air patrol. An aircraft patrol provided over an objective area, over the force protected, over the critical area of a combat zone, or over an air defense area, for the purpose of intercepting and destroying hostile aircraft before they reach their target.

combat air patrol (CAP) station*. A point at which CAP aircraft are or will be orbiting or maneuvering.

command. An order given by a commander; that is, the will of the commander expressed for the purpose of bringing about a particular action.

command and control. The exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of his mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission.

command and control interface unit (C2 IU)*. Any JU, PU, or RU except a nonC2 JU.

command and control JTIDS unit (C2 JU)*. A JTIDS/MIDS unit with command and control capability.

command and control processor*. A computer that performs the data link communications and data forwarding functions in a USN ship.

common track*. A track for which two or more interface units hold locally derived positional information.

compatibility. Capability of two or more items or components of equipment or material to exist or function in the same system or environment without mutual interference.

concurrent interface unit (CIU)*. An IU that is conducting concurrent transmission of the same data on two or more data links but not forwarding between them.

contention access mode*. A transmit access mode in which a given time slot block is assigned to more than one JU. Each JU will transmit at a specified rate in the time slot block by selecting time slots for transmission pseudo-randomly.

control*. The near-real-time direction of weapons systems and supporting platforms for the accomplishment of assigned missions.

correlation*. The determination that a system track or local sensor track data report represents the same object or point as another track and/or the process of combining two such tracks/data under one track number.

corridor*. A line describing the center line (if one line) or boundary (if two lines) of a route designated for travel by friendly aircraft.

danger area.

(1)* A specified area above, below, or within which there may be potential danger. (DOD, NATO)

(2) In air traffic control, an airspace of defined dimensions within which activities dangerous to the flight of aircraft may exist at specified times.

data extraction (DX)*. A capability of some TDS programs to perform an on-line extraction of data from the TDS for purposes of post-operation reduction and analysis.

data forwarding*. The process of receiving data on one data link and outputting the data in the proper format and protocol of another data link.

data link. The means of connecting one location to another for the purpose of transmitting and receiving data. See also Tactical Digital Information Link.

data link reference point (DLRP)*. A fixed geographic reference point specified by appropriate authority from which a PU/RU can calculate the relative position of own unit and local tracks (the DLRP is the X-Y grid origin of the data link Interface).

data mile (DM). A standard unit of distance - 6000 feet.

data net control station (DNCS)*. A Link 11 station which, through switch selection on the data terminal set, acts as the interrogating station in the roll call mode of operation.

data silent mode*. A mode of JTIDS/MIDS terminal operation where the terminal receives but does not transmit fixed word format or variable message format messages.

data source*. A unit to which data can be addressed and from which data can be identified as to source; e.g., all IUs.

datum*. The last known or best estimated position of a submarine after contact has been lost.

decorrelation*.

(1) The determination that locally held track data for a given track number does not represent the same object or point as a track data being received in a remote track report for the same track number.

(2) The process of establishing a new track number for a local track when a remote track report with the same track number as the local track is determined to represent a different object.

dedicated access mode*. A JTIDS/MIDS transmit access mode in which time slots are assigned to an individual JU for that JU's exclusive use.

default net*. The JTIDS/MIDS net that the terminal will transmit or receive in the absence of an input directing otherwise.

disposition center. A reference point designated as the center of a prescribed arrangement of stations to be occupied by the several formations and single ships of a fleet or major subdivisions of a fleet for any purpose, such as cruising, approach, maintaining contact, or battle. A prescribed arrangement of all the tactical units composing a flight or group of aircraft.

drop track. In air intercept, the unit having reporting responsibility for a particular track is dropping that track and will no longer report it. Other units holding an interest in that track may continue to report it.

dual designation*. The same track being reported by two or more IUs using two or more different track numbers.

duplicate track numbers*. The same track number used by two or more IUs for two or more different tracks.

electronic attack decoy (hazard point)*. A point at which a device is located that produces false targets (i.e., target generation, chaff, and confusion deflector).

electronic protection*. See electronic warfare.

electronic warfare. Any military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. Also called EW.

The three major subdivisions within electronic warfare are: electronic attack, electronic protection, and electronic warfare support.

(1) Electronic attack*. That division of electronic warfare involving the use of electromagnetic or directed energy to attack personnel, facilities, or equipment with the intent of degrading, neutralizing, or destroying enemy combat capability. Also called EA. EA includes 1) actions taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum, such as jamming and electromagnetic deception, and 2) employment of weapons that use either electromagnetic or directed energy as their primary destructive mechanism (lasers, radio frequency weapons, particle beams).

(2) Electronic protection*. That division of electronic warfare involving actions taken to protect personnel, facilities, and equipment from any effects of friendly or enemy employment of electronic warfare that degrade, neutralize, or destroy friendly combat capability. Also called EP.

(3) Electronic warfare support. That division of electronic warfare involving actions tasked by, or under direct control of, and operational commander to search for, intercept, identify, and locate sources of intentional and unintentional radiated electromagnetic energy for the purpose of immediate threat recognition. Thus, electronic warfare support provides information required for immediate decisions involving electronic warfare operations and other tactical actions such as threat avoidance, targeting, and homing. Also called ES. Electronic warfare support data can be used to produce signals intelligence (SIGINT), both communications intelligence (COMINT), and electronic intelligence (ELINT).

electronic warfare support*. See electronic warfare.

emergency point (General)*. A point marking the location of potential or ongoing Search and Rescue (SAR) operations.

engagement status*. The current relationship between a weapon system and a target or the reason for change of a relationship previously reported.

environment/category*. The environment in which the associated track is operating; e.g., air, space, surface, subsurface.

epoch*. A JTIDS/MIDS TDMA 12.8-minute time interval consisting of 98304 time slot intervals, each of 7.8125 milliseconds duration. The time slots in each epoch are organized into three sets (A, B, or C) of 32768 time slots each. There are 112.5 epochs in a 24-hour period. (Derived from System Segment Specification for JTIDS Class 2 Terminal)

EXERCISE ASSUMED FRIEND*. A friendly track acting as other than a friendly and identified as Assumed Friend for exercise purposes.

EXERCISE HOSTILE*. See Faker.

EXERCISE NEUTRAL*. A friendly track acting as other than a friendly and identified as Neutral for exercise purposes.

EXERCISE SUSPECT*. See Joker.

EXERCISE TRACK*. A “live” friendly track which has had certain information such as identity, armament, aircraft type etc., changed for “exercise” purposes. Exercise tracks may be used for operator training, testing the exchange of link data, or combat system testing.

EXERCISE UNKNOWN*. A friendly track acting as other than a friendly and identified as Unknown for exercise purposes.

extended range*. The longer of two range options for a JTIDS/MIDS terminal, providing a line-of-sight range capability of 0 to 500 nautical miles with respect to the allocated propagation for message transmission. (Derived from System Segment Specification for JTIDS Class 2 Terminal)

FAKER. A friendly aircraft simulating a hostile in an air defense exercise.

fighter engagement zone*. See weapon engagement zone.

filter*. A process of inhibiting data from transmission on a data link and/or inhibiting data received on a data link from entry into a unit data base.

fine synchronization*. The state of synchronization with system time that allows a JTIDS/MIDS terminal to transmit messages. A terminal may utilize a passive or active synchronization procedure to achieve fine synchronization. (System Segment Specification for JTIDS Class 2 Terminal)

fix. A position determined from terrestrial, electronic, or astronomical data.

fix (USW)*. A correlated position of a submarine derived from two or more sensor inputs.

fix (EA)*. A point used to indicate the probable position of a jamming source.

force tell*. The process whereby data that are being inhibited by a filter are allowed to be transmitted or received.

formation center*. A reference point indicating a position designated as the center of an ordered arrangement of units, normally the geometric center. It is the point of origin of a formation axis.

Forwarding JTIDS Unit (FJU)*. A JU that translates and forwards data among units using J-series messages and M-series messages. An FJU can function in one of the configurations defined for FJUA, FJUB, and FJUAB.

Forwarding JTIDS Unit A (FJUA)*. A JU communicating on both Link 11 and Link 16 while forwarding information between Link 11 and Link 16 participants.

Forwarding JTIDS Unit AB (FJUAB)*. A JU communicating on Link 16, Link 11, and Link 11B while forwarding information among Link 16, Link 11, and Link 11B participants.

Forwarding JTIDS Unit B (FJUB)*. A JU communicating on both Link 11B and Link 16 while forwarding information between Link 11B and Link 16 participants.

forwarding participating unit (FPU)*. A PU that is forwarding data between Link 11 and one or more RUs.

forwarding reporting unit (FRU)*. An RU that is forwarding data between two or more RUs.

free text message*. Bit-oriented messages whose information bits may be used to represent digitized voice, teletype and other forms of free text information. (System Segment Specification for JTIDS Class 2 Terminal)

FRIEND*. A track belonging to a declared friendly nation.

geodetic position quality (GPQ)*. A measure of the quality of a JTIDS/MIDS terminal's geodetic position reported in the terminal's Position and Status Reports. Geodetic Position Quality is reported as an integer from 0-15 where the higher numbers correspond to the higher qualities; i.e., lower errors in position. (System Segment Specification for JTIDS Class 2 Terminal)

gridlock*. A procedure for determining data registration corrective values (pads) by comparing remote tracks received from a designated Gridlock Reference Unit (GRU) to local data.

Ground Zero. A hazard point on the surface of the Earth at, or directly below or above, the center of a planned or actual nuclear detonation.

handover. The passing of control authority of an aircraft from one control agency to another control agency. Handover action may be accomplished between control agencies of separate Services when conducting joint operations or between control agencies within a single command and control system. Handover action is complete when the receiving controller acknowledges assumption of control authority.

hazard area*. A general area representing a condition which jeopardizes safety, the specific type of which must be amplified via voice or predetermined procedures.
hazard point*. A point representing an object or condition which jeopardizes safety.

Hostile*. A track declared to belong to any opposing nation, party, group or entity, which by virtue of its behavior or information collected on it such as characteristics, origin, or nationality contributes to the threat to friendly forces.

identification, friend, or foe. A system using electromagnetic transmissions to which equipment carried by friendly forces automatically responds, for example, by emitting pulses, thereby distinguishing themselves from enemy forces. Also called IFF.

impact point*. The real or expected point that a device has or will penetrate or contact a surface.

initial entry*. The procedure by which a subscriber JTIDS/MIDS terminal becomes a system participant initially and may achieve coarse synchronization with system time. (System Segment Specification for JTIDS Class 2 Terminal)

Initial Entry JTIDS Unit (IEJU)*. Any JTIDS/MIDS unit that transmits the Initial Entry message in the appropriate time slot.

initial point. A well-defined point, easily distinguishable visually and/or electronically, used as a starting point for the bomb run to the target. See Target Approach Point.

intelligence.

(1)* The product resulting from the collection, processing, integration, analysis, evaluation, and interpretation of available information concerning foreign countries or areas.

(2) Information and knowledge about an adversary obtained through observation, investigation, analysis, or understanding.

interface*. A boundary or point common to two or more similar or dissimilar command and control systems, subsystems, or other entities against which or at which necessary information flow takes place.

interface operating procedures (IOP)*. A document used to provide a functional understanding of data exchange on a data link and to describe operator initiated actions and their effect on the exchange of data.

interface unit (IU). A generic term that applies to JTIDS/MIDS Units (JUs), Participating Units (PUs), and Reporting Units (RUs) providing information on the interface. The term "C2 IU" includes PUs, RUs, and C2 JUs, but not nonC^2JUs.

interleaving*. A pattern of orienting the data symbols of a message for transmission, applicable to Modes 1 and 2. A fixed interleaving pattern is used for Mode 4. (System Segment Specification for JTIDS Class 2 Terminal)

interoperability.

(1)* The ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use the services exchanged to enable them to operate effectively together.

(2) The condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services

can be exchanged directly and satisfactorily between them and/or their users. The degree of interoperability should be defined when referring to specific cases.

jam strobe*. A line projecting from a jammed radar on the approximate azimuth of the jamming source.

jitter*. A pseudorandom time period for varying the start of a JTIDS/MIDS pulse. Gives JTIDS/MIDS additional resistance to jamming.

joint. Connotes activities, operations, organizations, etc., in which elements of two or more Military Departments participate.

joint force commander. A general term applied to a combatant commander, subunified commander, or joint task force commander authorized to exercise combatant command (command authority) or operational control over a joint force. Also called JFC.

Joint Tactical Information Distribution System (JTIDS)*. A joint-Service system which provides an Integrated Communications, Navigation, and Identification (ICNI) capability. The JTIDS provides a reliable, secure, jam-resistant, high-capacity, ICNI capability through the use of direct-sequence, spread-spectrum, frequency-hopping, and error detection and correction techniques.

JOKER. A friendly track acting as other than a friendly and identified as Suspect for exercise purposes.

JTIDS/MIDS Net*. One of 128 time-division structures comprising a JTIDS/MIDS network. Each net consists of a continuous stream of time intervals (time slots) with 98304 time slots per 12.8-minute epoch, during which digital data whose signal characteristics are determined by a cryptographic variable in conjunction with a unique net number are distributed.

JTIDS/MIDS Network*. The JTIDS/MIDS structure having a total usable capacity of 98304 time slots per epoch per net and 128 nets. All nets are synchronized so that each time slot of each net is time-coincident with the corresponding time slot (same set and number) of every other net. The signal

characteristics of all data distributed within a specified multinetted structure are determined by a cryptographic variable in conjunction with a set of net numbers that define the structure.

JTIDS/MIDS Relay*. An automatic function of the JTIDS/MIDS terminal that provides retransmission of received information to extend the range beyond line of sight.

JTIDS/MIDS Unit (JU)*. A unit communicating directly on Link 16.

JU response time*. The time from new information availability at the JU to the transmission of the information on the link. This is defined for each message in the MIL-STD-6016.

KILO*. A friendly track of special interest to the air defense system; e.g., special mission, etc.

limiting line of approach (LLA) (USW)*. A mathematically calculated limit, relative to the force, within which an attacking submarine must be in order that it can reach the torpedo danger zone (TDZ). The TDZ is an area which the submarine must enter in order to be within maximum effective torpedo firing range.

line (General)*. A general line that must be amplified by voice or predetermined procedures.

Link 14*. Link 14 is a one-way teletype link which provides computer-controlled broadcasts by units equipped with tactical data systems (TDSs) to other units. It is not considered a DATA Link per se, because it does not provide data in real time. Rather, its data provides only general situational awareness to the non-TDS units that do not contribute data to the tactical Interface.

local track*. A track established within an interface unit based on locally entered positional information. Amplifying data associated with the track may be derived locally, from supporting units, or from data links.

locally derived data*. Data derived from local sensors.

locally held data*. Data items established within an IU's database. Such data may be either locally or remotely derived.

machine receipt (MR)*. A message automatically transmitted by an IU's computer in response to a message sent from another IU indicating receipt.

Marshall Point*. A reference point used to assemble, hold, or organize troops, aircraft, or ships for a mission.

message. Any thought or idea expressed briefly in a plain, coded, or secret language, prepared in a form suitable for transmission by any means of communications.

message standard*. A set of protocols consisting of rules, procedures, formats, data element definitions or other conventions for information exchange and related interactions agreed upon between cooperating systems to ensure interoperability.

mine*. A hazard point at which a mine(s) is located.

missile launch point*. A hazard point indicating the position from which a missile has been or will be launched.

Mode 1 Communications*. Mode 1 JTIDS/MIDS transmissions consist of a sequence of wide-band transmission symbol packets (single-pulse, 13-microsecond packets and double-pulse, 26-microsecond packets), the pulses of which are formed by continuous phase shift modulation (CPSM) of the carrier frequency. The signal processing required to transform base-band data to the JTIDS/MIDS signal waveforms for transmission includes base-band data encryption, forward error correction encoding, error detection encoding, cyclic code shift keying (CCSK) encoding, data symbol interleaving, and the selection of a variable start time.

Mode 2 Communications*. Mode 2 JTIDS/MIDS transmissions are identical to Mode 1, except that Mode 2 operates in the narrow-band mode.

Mode 4 Communications*. Mode 4 JTIDS/MIDS transmissions have signal waveform characteristics identical to Mode 2, except that Mode 4 does not employ base-band data encryption signal processing.

navigation controller (NC)*. The Navigation Controller establishes the origin and North orientation of the U, V relative grid for the JTIDS/MIDS Relative Navigation function. (System Segment Specification for JTIDS Class 2 Terminal)

Needline Participation Group (PG)*. A unique list of netted subscribers compiled without regard to the specific messages they exchange with each other. This list is a means of transmitting any message to a common set of users.

net control station (NCS)*. A communications station designed to control traffic and enforce circuit discipline within a given net.

net cycle time (NCT)*. The time required for one Link 11 net cycle; i.e., for all PUs to be polled at least once in the
Link 11 roll call mode.

net number*. A seven-bit code that identifies each net as a decimal number (0 through 127). (System Segment Specification for JTIDS Class 2 Terminal)

net sync*. A LINK 11 net mode of operation for synchronizing all stations on the link.

net*. See “JTIDS Net.”

network*. See “JTIDS Network.”

network management function*. An action or activity affecting the relationships, actions, or activities of the various elements of the network.

Network Participation Group (NPG)*. A unique list of applicable LINK 16 messages used to support an agreed-upon technical function without regard to subscriber identities. This list is a means of transmitting a common set of Link 16 messages to all interested users.

network time reference (NTR)*. A subscriber JTIDS/MIDS terminal that is assigned as the reference for system time for each synchronized netted system. The NTR terminal's clock time is never updated by system information

and is the reference to which all other terminals synchronize their own clocks. There is only one NTR.

NEUTRAL*. A track whose characteristics, behavior, origin, or nationality indicate that it is neither supporting nor opposing friendly forces.

Non Command and Control JTIDS Unit (nonC2JU)*. A JU without command and control capability.

normal mode*. The standard mode of terminal operation with respect to the receipt and transmission of messages. (System Segment Specification for JTIDS Class 2 Terminal)

normal range*. The shorter of two range options for a JTIDS/MIDS terminal, providing a line-of-sight coverage capability of 0-300 nautical miles with respect to the allocated propagation for message transmission. (Derived from System Segment Specification for JTIDS Class 2 Terminal)

NOTACK Area (USW)*. A directive by/request to a friendly submarine to establish an area in which no air or surface launched USW weapon may be employed.

order. An oral, written or signal communication that conveys instructions from a superior to a subordinate. In a broad sense, the terms “order” and “command” are synonymous. However, an order implies discretion as to the details of execution whereas a command does not.

pairing*. The establishment of an operational relationship (other than an engagement) between a friendly track and another track or point.

participating unit (PU)*. A unit communicating directly on Link 11.

participation group community (PGC)*. The set of JUST assigned to participate as transmitters and/or receivers in the corresponding participation group.

passive synchronization*. A procedure used by a terminal to effect and maintain fine synchronization with system time by passive observations of Position and Status messages transmitted by other terminals. The

synchronizing terminal is not required to transmit any information. (System Segment Specification for JTIDS Class 2 Terminal)

PENDING*. A track which has not been subjected to the identification process.

picket*. A switch setting on a Link 11 Data Terminal Set. A PU in the picket mode responds to interrogation by the DNCS.

picket station*. A point where an aircraft or ship is stationed outside a formation or geographic area as a rescue or warning unit.

polling mode*. A mode of JTIDS/MIDS terminal operation whereby the terminal can receive messages but does not transmit any fixed format messages except to transmit automatic message acknowledgments, RTT Interrogations, or other messages in response to special interrogations. (System Segment Specification for JTIDS Class 2 Terminal)

position reference (PR)*. One or more JUs designated as a network reference. Such a JU has maintained a geodetic position accuracy of 50 feet, one sigma (standard deviation) over a long period of time.

position and intended movement (PIM)*. A reference point or points established by the officer in tactical command at a given time and a forecast of the course(s) and speed(s) expected to be made good over the ground. PIMs are established to assist the return of aircraft, to aid outlying surface units in maintaining their stations, and for rendezvous purposes.

primary user*. A subscriber JTIDS/MIDS terminal that utilizes the active synchronization (RTT) procedure and serves as a high-quality source for synchronization by the general Relative Navigation community. (System Segment Specification for JTIDS Class 2 Terminal)

purge*. Removal from data base in response to local system criteria or operator action.

radio relaying*. A function for extending radio coverage based on time delay relaying where a message received during one time slot is subsequently retransmitted in another time slot. (System Segment Specification for JTIDS Class 2 Terminal)

receipt/ compliance*. The acknowledgment of a message and/or an indication of intent to respond to a message either by machine acknowledgment or operator action.

receive block*. A time slot block assigned for message reception.

reception quality (RQ)*. A number from 0 through 7 which represents the quality of data reception from a particular IU by a particular IU. 0 represents no reception and 7 represents perfect reception.

recurrence rate number (RRN)*. An integer R, which is less than or equal to 15 and greater than or equal to 0 where 2^R, is the recurrence rate of the block assignment.

recurrence rate*. The total number of full slots per epoch assigned (or deleted) in a single time block assignment, specified as an integer, R = 0 to 15, where 2 = the number of time slots. (System Segment Specification for JTIDS Class 2 Terminal)

reference point (General)*. A general nonhazard reference point that must be amplified by voice or predetermined procedure.

relative navigation (RELNAV)*. A procedure used by a JTIDS/MIDS terminal to determine its position and velocity in a common reference coordinate system by passive observations of Position and Status messages transmitted by other terminals. (System Segment Specification for JTIDS Class 2 Terminal)

relay*. An automatic function of the JTIDS/MIDS terminal that provides retransmission of received information to extend the range beyond line of sight.

remote data*. Data that are derived from data link reports from another unit.

remote track*. A track established within an interface unit based upon positional information derived from a data link report or reports. Amplifying data associated with the track may be derived locally, from supporting units, or from data links.

rendezvous point*. A point for a prearranged meeting at a given time from which to begin an action or phase of an operation, or to which to return after an operation.

reporting responsibility (R^2)*. The requirement for the IU with the best positional data on a track to transmit track data on the interface.

reporting unit (RU)*. A unit communicating directly on Link 11B.

repromulgation*. The rebroadcast of a specified message or messages. The repromulgation request field specifies the number of times the message should be relayed and the time slot in which it is to be broadcast.

restricted area*. A specific area designated by the area airspace management authority for which flight is restricted without prior approval, or an area (land, sea, or air) in which there are special restrictive measures employed to prevent or minimize interference between friendly forces.

round-trip timing (RTT)*. The process used by a JTIDS/MIDS terminal to directly determine the offset between its clock and that of another JTIDS/MIDS terminal. This is used to achieve and maintain fine synchronization and to improve the terminal's time quality. This process involves the exchange of RTT Interrogation and Reply messages.

RTT message*. A short, 35-bit message used by the Active synchronization method, either an RTT Interrogation message or RTT Reply message. (System Segment Specification for JTIDS Class 2 Terminal)

search and rescue (SAR). The use of aircraft, surface craft, submarines, specialized rescue teams and equipment to search for and rescue personnel in distress on land or at sea. Also called SAR.

search area*. An area where a search is being or will be conducted. Normally associated with a SAR mission.

search center (USW)*. The geographically fixed origin or reference point of an USW search when established at a point other than datum.

secondary user*. The general category for the majority of JTIDS/MIDS subscriber terminals. Secondary user terminals generally utilize the Passive synchronization procedures for synchronizing in the Relative Navigation community. (System Segment Specification for JTIDS Class 2 Terminal) Secondary users may use RTT messages when improved time quality is needed to maintain position quality.

selective identification feature*. A capability which, when added to the basic identification friend or foe system, provides the means to transmit, receive, and display selected coded replies.

stacked net*. The coordinated use of specific blocks of time slots on different nets in a JTIDS/MIDS network by different communities of users.

station (Air)*. A general point used to describe a station in the air that must be amplified by voice or predetermined procedures.

station (General)*. A general point used to describe a non-air station that must be amplified by voice or predetermined procedures.

subscriber*. A participant in the use of the system, either actively (transmission of information) or passively (receiver of information only), or both. (System Segment Specification for JTIDS Class 2 Terminal)

subsurface surveillance*. The reporting of active or passive subsurface contact information to support the compilation of the general surveillance picture and the conduct of USW.

supporting unit (SU)*. A unit operating in support of a JU, a PU, or an RU which is providing data for the interface but which is not specifically identified as a data source.

SUSPECT*. A track which is potentially hostile because of its characteristics, behavior, origin, or nationality.

System Coordinate Center (SCC)*. The geographic position from which a PU or RU reports all positional data. The SCC is reported relative to the DLRP.

TACAN Station*. A point at which a TACAN is located. TACAN is an ultrahigh frequency electronic air navigation system which provides a continuous indication of bearing and distance (slant range) to a TACAN station, common components being used in distance and bearing determination.

Tactical Data System (TDS)*. An automated real-time computer system in which tactical data are entered for storage, calculation, and/or display.

Tactical Data Link*. A Joint Staff approved, standardized communications link suitable for transmission of digital information. Current practice is to characterize a tactical data link (TDL) by its standardized message formats and transmission characteristics. data links interface two or more command and control or weapon systems via a single or multiple network architecture and multiple communication media for exchange of tactical information.

(1) Link 11. A secure, half-duplex, netted digital data link utilizing parallel transmission frame characteristics and standard message formats at either 1364 or 2250 bits per second. It is normally operated in a roll-call mode under control of a net control station to exchange digital information among airborne, land-based, and shipboard systems. NATO's equivalent is Link 11.

(2) Link 11B. A secure, full-duplex, point-to-point digital data link utilizing serial transmission frame characteristics and standard message formats at either 2400, 1200, or of 600 bits per second. It interconnects tactical air defense and air control units. NATO's equivalent is Link 11B.

(3) TADIL C. An unsecure, time-division digital data link utilizing serial transmission characteristics and standard message formats at 5000 bits per second from a controlling unit to controlled aircraft. Information exchange can be one-way (controlling unit to controlled aircraft) or two-way. NATO's equivalent is Link 4.

(4) Link 16. A secure, high capacity, jam-resistant, nodeless data link which uses the Joint Tactical Information Distribution System (JTIDS) transmission characteristics and the protocols, conventions, and fixed-length message formats defined by the MIL-STD-6016. NATO's equivalent is Link 16.

(5) Army Tactical Data Link 1 (ATDL-1). A secure full-duplex, point-to-point digital data link utilizing serial transmission frame characteristics and

standard message formats at a basic speed of 1200 bits per second. It interconnects tactical air control systems and Army or Marine surface-to-air missile systems.

(6) Interim JTIDS Message Specification (IJMS). A secure high capacity, jam-resistant, nodeless interim message specification that uses the MIL-STD-6016 transmission characteristics and the protocols, conventions, and fixed-length message formats defined by the IJMS. See also Data Link. The transmission characteristics and standards for the data links are set forth in the following documents:

Link 11 = MIL-STD-6011 and MIL-STD-188-203-1A.
Link 11B = MIL-STD-6011 and MIL-STD-188-212.
Link 4A = MIL-STD-6004 and MIL-STD-188-203-3.
Link 16 = MIL-STD-6016.
ATDL-1 = MIL-STD 6013
Link 1 = STANAG 5501

Link 16 Manager*. A C2 JU that is designated to employ the required tools to allocate, assign, and manage JTIDS/MIDS network resources.

Link 16 Message*. A functionally oriented, variable-length string of one or more 70-bit words in either fixed word format or variable message format.

target approach point. In air transport operations, a navigational check point over which the final turn into the drop zone/landing zone is made. See also Initial Point.

Technical Interface Design Plan (TIDP)*. An engineering implementation plan that specifies the technical standards required to achieve compatibility and interoperability as specified in the Technical Interface Concepts. The plan includes a comprehensive technical description of the operational interface, message implementation, methods, and rules for processing data between operational facilities and a final list of effective Service/Agency facilities/systems.

terminal (JTIDS)*. The integrated equipment comprised of hardware, firmware, and software elements used as the means for participating as a system subscriber (System Segment Specification for JTIDS Class 2 Terminal)

terminal response time*. The time from new information availability at the terminal to the transmission of the information on the link. This time is part of the JU response time.

test mode*. A mode of terminal operation whereby a terminal is required to transmit Test messages. (System Segment Specification for JTIDS Class 2 Terminal)

time (system)*. The time maintained by the terminal assigned as the Network Time Reference (NTR) to which all other participating terminals are synchronized. (System Segment Specification for JTIDS Class 2 Terminal)

time (terminal)*. The estimate of time derived by a terminal as a result of executing either the active or a passive synchronization procedure. (System Segment Specification for JTIDS Class 2 Terminal)

time quality (Q_t)*. A measure of the quality of a terminal's state of synchronization with system time reported in the terminal's Position and Status Report. Time Quality is reported as an integer from 0-15 where the higher numbers correspond to the higher levels of quality; i.e., lower errors in timing. (System Segment Specification for JTIDS Class 2 Terminal)

time slot*. A 7.8125-millisecond time interval during which Link 16 messages may be transmitted by a JTIDS/MIDS terminal. (System Segment Specification for JTIDS Class 2 Terminal)

time slot block*. A collection of time slots spaced uniformly in time over each epoch and belonging to a single time slot set. A block is defined by indexing time slot number (0 to 32767), set (A, B, or C), and a recurrence rate number (0 to 15).

time slot number*. A 17-bit code that identifies each full time slot, the code consisting of a 2-bit set field (set A, B, or C) and a 815-bit slot field representing the decimal numbers zero to 32767. (System Segment Specification for JTIDS Class 2 Terminal)

time slot pool*. One or more time slot blocks that can be used to satisfy a particular functional requirement or the total JTIDS/MIDS capacity that can be divided into pools to satisfy all functional requirements.

time slot reallocation*. A transmit access mode in which each Access Mode participant periodically assigns itself time slots from a shared pool of time slots. A participant assigns transmit time slots after transmitting a Time Slot Reallocation (TSR) message and receiving TSR message and receiving TSR messages from other participants.

time slot reuse*. A method to increase the JTIDS/MIDS network capacity by allowing more than one terminal to transmit in a single time slot on a single net number. This is appropriate for JUST in proximity to each other that have information to exchange; receivers will lock onto the message with the shortest time of arrival.

time slot assignment*. The designation to the JTIDS/MIDS terminal of the specific time slot blocks in which it will transmit or receive messages.

track.

(1)* A series of related contacts displayed on a plotting board.

(2)* To display or record the successive positions of a moving object.

(3)* To lock onto a point of radiation and obtain guidance therefrom.

(4)* To keep a gun properly aimed, or to point continuously a target-locating instrument at a moving target.

(5) The actual path of an aircraft above, or a ship on the surface of the Earth. The course is the path that is planned, the track is the path that is actually taken.

track number (TN)*. The unique numeric or alphanumeric octal identifier associated with a specific set of track data representing a vehicular object, point, line of bearing, fix, or area of probability.

track number pool*. A block of track number that is shared among designated Participating Units.

track quality (TQ)*. A numerical value assigned to a track computed from data related to the past tracking performance on the track, representing the accuracy of the track position.

transmit block*. A time slot block assigned for the transmission of messages.

TRAVELLER*. A Suspect Surface Track following a recognized traffic route.

UNKNOWN*. An evaluated track which has not been identified.

variable message format (VMF)*. A message structure using predefined fields of fixed length employing internal syntax and a header extension. The internal syntax specifies the presence, absence, and recurrence of fields as selected by the user.

weapon engagement zone (WEZ). In air defense, air space of defined dimensions within which the responsibility for engagement of air threats normally rests with a particular weapon system.

(1) fighter engagement zone (FEZ). In air defense, that airspace of defined dimensions within which the responsibility for engagement of air threats normally rests with fighter aircraft.

(2) high altitude missile engagement zone (HIMEZ). In air defense, that airspace of defined dimensions within which the responsibility for engagement of air threats normally rests with high-altitude surface-to-air missiles.

(3) low-altitude missile engagement zone (LOMEZ). In air defense, that airspace of defined dimensions within which the responsibility for engagement of air threats normally rests with low-to medium-altitude surface-to-air missiles.

(4) short-range air defense engagement zone (SHORADEZ). In air defense, that airspace of defined dimensions within which the responsibility for engagement of air threats normally rests with short-range air defense

weapons. It may be established within a low or high-altitude missile engagement zone.

(5) joint engagement zone (JEZ). In air defense, that airspace of defined dimensions within which multiple air defense systems (surface-to-air missiles and aircraft) are simultaneously employed to engage air threats. (Joint Pub1-02)

WILCO*. I understand and I will comply. This is a manually generated response by an operator who has received the order and has determined that the order can and will be carried out.

word format*. The type of Link 16 word construction. There are four such types: initial, extension, continuation, and variable message format.

ZOMBIE*. A Suspect Air Track conforming to Air Traffic Control (ATC) rules or outside NATO airspace following a recognized traffic pattern.

NOTE: Terms marked "*" are not standardized within the Department of Defense and are applicable only in the context of this document.

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