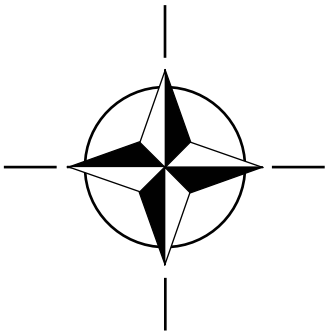
ADatP-22(A)

STANDARD OPERATING PROCEDURES

FOR NATO LINK 22



ADatP-22(A)

STANDARD OPERATING PROCEDURES

FOR NATO LINK 22

FEBRUARY 2006

ADatP-22(A)

NORTH ATLANTIC TREATY ORGANISATION

NATO STANDARDISATION AGENCY (NSA)

NATO LETTER OF PROMULGATION

February 2006

1. ADatP-22(A) – STANDARD OPERATING PROCEDURES FOR NATO LINK 22 is a NATO UNCLASSIFIED publication.

2. ADatP-22(A) is effective upon receipt. It supersedes ADatP-22 which shall be destroyed in accordance with the local procedures for the destruction of documents.

J MAJ
Brigadier General, POL(A)
Director, NSA

This page is reserved for
National Letter of Promulgation

CHAPTER	RECORD OF RESERVATIONS BY NATIONS
1	NONE
2	NONE
3	NONE
4	NONE
5	NONE
6	NONE
7	NONE
8	NONE
ANNEX A	NONE
ANNEX B	NONE
ANNEX C	NONE
ANNEX D	NONE
ANNEX E	NONE

NATION	RESERVATION

RECORD OF CHANGES

CHANGE NO.	DATE ENTERED	EFFECTIVE DATE	BY WHOM ENTERED

ALLIED DATA PROCESSING PUBLICATION 22

THE STANDARD OPERATING PROCEDURES FOR NATO LINK 22

(SHORT TITLE: ADATP-22)

Reference: STANAG 5522

FOREWORD

1. These standard operating procedures are produced by the Information Systems Sub-Committee (ISSC) - Data Link Working Group (DLWG).

2. Proposed changes to this document should be addressed to:

NATO HEADQUARTERS
NHQC3S/ISEB (DLSS)
B-1110 BRUSSELS
BELGIUM

CONTENTS

Chapter Page

8 MANAGEMENT PROCEDURES

List of Figures

List of Tables

Annexes

CHAPTER 1

GENERAL INTRODUCTION

SECTION 1 – INTRODUCTION

1.1 Purpose of Document

The purpose of this document is to establish the North Atlantic Treaty Organization (NATO) Standard Operating Procedures (SOPs) for all organisations operating Link 22 in the High Frequency (HF) and Ultra High Frequency (UHF) wavebands. In this document, the term "Link 22" is taken to mean the end-to-end data link and encompasses the NATO Improved Link Eleven (NILE) system, which provides the transmission, technical and security services to the Link 22 user. Link 22-equipped units are known as Link 22 Units (NUs).

1.1.1 Allied Data Processing Publication (ADatP) -22 is the standard operational reference document for the Tactical Commander and individual NUs participating in a Link 22 interface. The SOPs and guidelines provided could form the basis for the development of Local Operating Procedures (LOPs) to specify detailed operator-initiated actions.

1.1.2 ADatP-22 is an operational manual that makes an ideal baseline reference for the training of operators.

1.2 Scope of Documentation

Procedures are defined for the exchange of tactical information among NUs, and for the establishment of, entry into, operation of, management of, exit from and termination of Link 22. In addition, data forwarding procedures are defined to enable effective data exchange with other data links.

1.2.1 The annexes to this ADatP provide additional information on the Link 22 (F-Series) message catalogue and give a broad outline of implementation of functional area levels by nation and NATO commands. All NUs, and in particular the Tactical Commander, need to have a clear understanding of the Link 22 capabilities and limitations of other units participating on Link 22. Detailed bitfield host system implementation levels are not included and should be requested from the individual nation(s) concerned, if required.

1.2.2 A Glossary of Terms and Acronyms/Abbreviations and Link Management Codes applicable to Link 22 are contained within Annexes A and D respectively.

1.2.3 ADatP-22 does not contain a detailed description of all operator actions, but assumes knowledge by the operator of basic host system operation.

1.3 Document Composition

A Summary of Contents is shown at Table 1.1.

1.4 Related Documents

In order to obtain a more detailed appreciation of any of the information presented in this document, reference should be made to:

a. STANAG 5522 - for specification of Link 22 in terms of message standard, system procedures, communications protocols and network management principles.

b. STANAG 5616 (Volumes 2 and 3) - for specification of rules, protocols and translations for data forwarding between tactical data systems employing Link 22 and those employing Link 16 and/or Link 11/11B.

c. STANAG 4444 - Technical Standards for a Slow Hop HF ECCM Communications System.

d. STANAG 4372 - SATURN UHF Fast Hop Communications.

e. STANAG 4430 - Precise Timing & Frequency Standards for Military Electronic Systems.

f. STANAG 4285/4539 - HF Fixed Frequency.

g. STANAG 4538 - Automatic Radio Control System.

h. STANAG (TBD) - for specification of the NILE System Network Controller (SNC).

CHAPTER NUMBER	TITLE	SUMMARY OF CONTENTS
1	Introduction	Introduction, purpose and scope of ADatP-22.
2	General System Description of Link 22	Details the operational characteristics of Link 22 and briefly describes the technical functions employed to support them.
3	Link 22 Duties and Responsibilities	Defines the responsibilities of the Tactical Commander and individual NUs, according to network duties assigned.
4	Setting Up Link 22	Defines procedures for the establishment of Link 22 operations.
5	Communications Procedures	Details procedures for the operation of Link 22, including network initialisation and management, and communications security procedures.
6	Data Exchange Procedures	Details procedures for the exchange of tactical information over Link 22.
7	Interaction With Other Links	Details procedures for data forwarding between Link 22 and Link 11/11B and between Link 22 and Link 16.
8	Management Procedures	Details procedures for the management of Link 22.
Annex A	Glossary of Terms and Acronyms/Abbreviations	As title.
Annex B	Link 22 Message List	As title.
Annex C	Link 22 Amplification Data	Lists the Command and Weapon Engagement Status values available for transmission over Link 22.
Annex D	NATO Link Management Codes	Details the 3-letter management codes for use with Link 22.
Annex E	NATO/National Systems Link 22 Message Implementation	Highlights differences in Link 22 capabilities between platforms, which may impact on interoperability.

Table 1.1 Summary of Contents for ADatP-22

CHAPTER 2

GENERAL SYSTEM DESCRIPTION OF LINK 22

SECTION 1 - DATA LINK CHARACTERISTICS

2.1.1 General

Link 22 is a secure, reliable, Electronic Counter Measures (ECM) resistant, medium speed digital data link, employed within NATO to support maritime operations through the exchange of tactical data among ships, submarines, fixed-wing aircraft, helicopters and shore-based units. The Link 22 communications system allows many users to contribute to, and access, a real time database of tactical information in a controlled manner. Information is exchanged in a format specified by the Link 22 message standard for F-series messages. Tactical data may be selectively exchanged among NUs within communities of interest, which are defined by functional requirements. Exchange of information is largely automatic but subject to operator control.

2.1.2 Operating Frequencies

Link 22 operates in the HF (2 - 30 MHz) and UHF (225 - 400 MHz) frequency bands in both fixed frequency and frequency hopping modes. When operating in frequency hopping mode, the Link 22 system pseudo-randomly selects the frequency for transmission from a subset within the range of allowable frequencies in accordance with the waveform protocols of the medium in use. The media options available for Link 22 network operation are:

a. HF Fixed Frequency.

b. HF Frequency Hopping.

c. UHF Fixed Frequency.

d. UHF Frequency Hopping.

2.1.3 Single/Multi-Network Operations

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 'supernetwork'. 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. In supernetwork operations, the Link 22 system will automatically select the best network or set of networks on which to transmit data to a particular NU or group of NUs. The automatic process of network selection and operation is transparent to Link 22 operators.

2.1.4 Communication Ranges

When communicating on HF, Link 22 provides gapless coverage up to a range of 300 nautical miles (nm). With the UHF medium, direct communications can only take place over line-of-sight (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. Employment of relay will enable the Operational Commander to receive information and direct operations throughout his area of responsibility. Relay is a system function, requiring minimal operator action.

2.1.5 Data Link Information Security (INFOSEC)

Tactical data transfer over Link 22 is cryptographically secure. Cryptovariables are employed for:

a. Network Security (NETSEC) - The NETSEC cryptovariable provides encryption/ decryption of all operational and technical Link 22 messages.

b. Transmission Security (TRANSEC) - When operating with a frequency hopping radio system, the TRANSEC cryptovariable determines the frequency hopping pattern used for data transmission.

2.1.5.1 Link 22 systems are capable of storing cryptovariables for the next cryptoperiod in addition to the current cryptoperiod and automatically perform rollover to the new cryptovariable at the required time. Cryptoperiods are of 24 hours duration, in accordance with established NATO Communications Security (COMSEC) policy.

2.1.6 Data Reliability

Different Error Detection and Correction (EDAC) techniques are employed, depending on channel conditions and the medium in use. These techniques allow the corruption or loss of a proportion of the signal to be tolerated by the system. EDAC performances vary for different media.

2.1.7 Channel Access Protocol

2.1.7.1 TDMA Architecture. 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, known as time slots. Time slots must contain an integer number of minislots (media dependent), but need not be of equal length and are sized to meet individual NU transmission requirements. The partitioning and allocation of network capacity defines the network cycle structure (NCS), as shown in Figure 2-1 below.

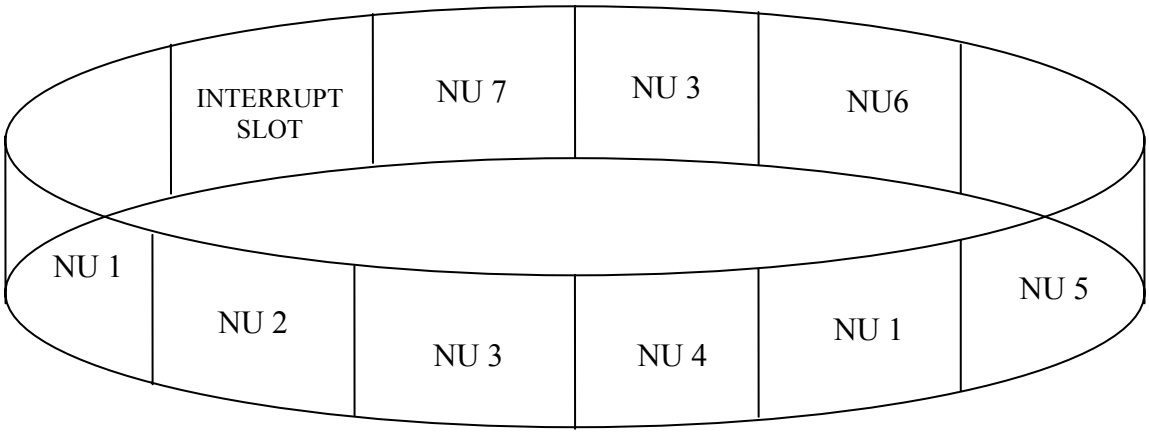


Figure 2-1 Schematic Diagram of TDMA Network Cycle Structure

2.1.7.2 The shortest periodic sequence of defined time slots is known as the Network Cycle Time (NCT). Consequently, each NU requiring to transmit in a network has a guaranteed transmission opportunity at least once per NCT. Link 22 does not operate in a polling mode. The NCT is determined by the numbers of participating NUs, volume of data to be exchanged and required data update rates. Typically, a community of 20 NUs will operate with an NCT in the range of 5 - 10 seconds.

2.1.7.3 NU Time Slot Allocation - Each NU is normally allocated one Assignment Slot per network cycle. Only the NU allocated a particular Assignment Slot can transmit for the duration of that Assignment Slot. NUs receive messages in those time slots in which they do not themselves transmit. Time slot duration is set individually for each NU, thus providing the flexibility to assign greater transmission capacity to users with a higher reporting load. Allocation of time slots of different duration to NUs, according to their anticipated reporting load, is a more efficient use of available network capacity than the allocation of several time slots to a single user. However, with a single time slot allocation per network cycle, the highest data update rate that can be achieved for the majority of data would be once per NCT, so that NCT is a critical factor in the performance of a network. To avoid this dilemma, it is possible to assign an NU more than one Assignment Slot per network cycle. The interrupt slot is available on a contention access basis for the transmission of Priority 1 (see paragraph 2.2.2.1) messages; its use is transparent to the operator.

2.1.7.4 Late Net Entry Slot - Transmission capacity may also be defined within the NCS for use by units which join an established network during its operation. In such circumstances Late Net Entry (LNE) procedures should be used (see paragraph 5.3.3), which are designed to cause minimum disruption to existing network operations. NUs conducting LNE procedures will use the LNE Slot to request information about the NCS and dedicated transmission capacity. The LNE Slot will be inserted in the NCS by the NMU when one or more LNE units are expected and will be available on a contention access basis. The LNE Slot will not normally occur in every network cycle.

2.1.8 System Time

In order to maintain the NCS and, thereby, communicate, network participants must be synchronised to a common Time of Day (TOD) prior to commencing transmission. A common TOD is maintained by all NUs referencing Universal Time Coordinated (UTC) in accordance with STANAG 4430.

SECTION 2 - PRINCIPLES OF MESSAGE EXCHANGE

2.2.1 Message Format

Information may be transmitted over Link 22 in either fixed or variable message formats:

a. Fixed format messages consist of those containing fixed data fields (i.e., information reported in a prescribed order) and an alphanumeric free text message. Both types are used to pass operational information. The text message, because it is adaptable for any type of data, may also be used to pass other than operational traffic. Operators should minimise use of text messages to conserve Link 22 network capacity.

   (1) Tactical messages provide for the exchange of tactical data in either fixed content or text messages.

   (2) Network Management messages provide for establishment or change of network and/or supernetwork parameters for Link 22 operations.

b. Variable Message Format messages are used for the automatic exchange of technical messages between NILE Communications Equipment (NCE). These messages will not be visible to the operator.

The majority of data transmitted over Link 22 will be in fixed format messages.

2.2.2 Message Prioritisation

Since Link 22 operates in accordance with TDMA protocols, each NU can only transmit messages in each NCT for the duration of its allocated time slot(s). It is a network management responsibility to ensure that, wherever possible, NUs are allocated sufficient transmission opportunity to meet their operational needs. However, when the NCS is required to accommodate large numbers of participants, the implications of network loading become more significant and information exchange will become degraded where NUs have insufficient transmission capacity to transmit messages at the required update rates. In order to ensure that messages are selected for transmission, according to their operational importance, a message prioritisation scheme is employed.

2.2.2.1 Link 22 messages, both operational and technical, are allocated one of four priority levels as follows:

a. Priority 1 (Immediate) -

b. Priority 2 (High Priority) -

c. Priority 3 (Normal Priority) -

d. Priority 4 (Routine) -

2.2.2.2 Maximum reporting update rates are specified for each message and thresholds are defined when each message is to be considered "late" and "excessively late" by the Link 22 system. Messages eligible for transmission will be selected according to priority, i.e., Priority 1 messages will be scheduled for transmission first, followed by Priority 2 messages and so on. As the number of messages awaiting transmission increases, the stage will be reached when the maximum reporting update rate for low priority messages can no longer be maintained. When a message for transmission is delayed beyond its late threshold, the priority of that message is automatically upgraded by one, increasing its eligibility for transmission. If message transmission is further delayed beyond the excessively late threshold, the priority level is upgraded again by one. However, messages will not be upgraded to Priority 1 solely because they are late or excessively late. Operating the message prioritisation scheme in this way ensures that, whilst tactically significant messages are selected for transmission in preference to lower priority messages, even routine messages are transmitted within defined acceptable limits.

2.2.2.3 Data Update Rates

In addition to message prioritisation, messages are also assigned one of two data update rates:

a. Standard Update Rate (SUR) - Messages are automatically presented for transmission at the SUR, in accordance with the maximum reporting rate and priority level as shown in Table 6-2 of this document.

b. High Update Rate (HUR) - Individual track reports may be manually selected for HUR reporting by operator action or generated automatically. Selection of HUR has the effect of reducing the time between updates and the time after which a message is considered late, thus increasing its eligibility for transmission. Procedures for HUR selection are contained in paragraph 6.1.10.

2.2.3 Receipt/Compliance (R/C)

An addressed Link 22 message which is not generated in response to another message is known as an original message (OM). Some messages which are addressed to a specific NU require an acknowledgement from the receiving unit and an indication of the response taken. This protocol is known as Receipt/Compliance and the following responses may be made:

a. WILCO - Receiving unit will comply. Response initiated by the operator.

b. HAVCO - Receiving unit has complied. Response initiated by the operator.

c. CANTCO - Receiving unit cannot comply. Response initiated by the operator.

2.2.3.1 Other responses may be made automatically without the operator being aware of the transmission, as follows:

a. Machine Receipt (MR) - Message received error free.

b. CANTPRO - Message cannot be processed.

2.2.3.2 If a response is not received by the originating terminal within the time-out interval specified, the message is automatically retransmitted for a predetermined number of times. If no response or a response of CANTCO or CANTPRO is received, the operator at the originating terminal may be alerted (depending on system implementation). Operator-originated responses of WILCO, HAVCO and CANTCO also require automatic acknowledgement by machine receipt. The MR on Link 22 is provided by the NCE. The Data Link Processor (DLP) of the message originator requests the MR when necessary and the NCE notifies relevant addressees that an MR is required. The MR is automatically generated by the addressee and returned to the originator of the OM; this indicates whether the message was correctly received and passed to its host, or correctly received but was unable to be passed to its host. In this latter case, or if no MR was received, the NCE of the originator alerts the operator that the message was not received correctly so that alternative measures can be considered.

2.2.3.3 There is a remote possibility that receipt of a response message may disclose certain error conditions between the NU transmitting and the NU receiving the message as follows:

a. Receipt of a response message for which no OM has been transmitted; this may be caused by cryptographic problems, media problems, undetected message errors or spoofing.

b. Receipt of a response that contains an identifying reference number for a different message from that which was transmitted to the addressee; this may be caused by possible garbling of the OM and/or undetected message errors.

When either of the above conditions occur, an operator will be alerted that there are possibly some problems with the NCE of either himself or the designated Link 22 addressee. The Network Management Unit (NMU) should be informed immediately and remedial action taken as follows.

2.2.3.4 The NMU should identify the source of the problems. Depending on the problems remedial actions can be:

a. In case a single NU is causing the problems, this NU can be instructed to either reconfigure or re-initialise. The NU can re-enter the network through an LNE procedure.

b. In case multiple NUs are having a problem, the entire network can be instructed to either reconfigure or re-initialise (see Chapter 8).

c. In case the problem is caused by cryptographic problems, spoofing or other security violations, the NMU should inform the Supernetwork Management Unit (SNMU) immediately. The SNMU can instruct a key-rollover to all NUs in the supernetwork or the SNMU/NMU can instruct a key-rollover on individual networks. The SNMU may also take other appropriate counter measures.

2.2.4 Link 22 Address

Each NU participating on Link 22 is assigned at least one reference number (address) of 5 octal digits which is used:

a. To identify the originator of a message by Track Number (TN).

b. To address messages to a specific NU.

Further details of addressing techniques are contained in paragraph 5.3.2.8. Details of address and TN allocation are contained in paragraph 6.1.8.

SECTION 3 - UNIT DEFINITIONS

2.3 The following definitions apply throughout this ADatP:

a. Interface Unit (IU) - A Link 22 Unit (NU), Link 16 Unit (JU), Participating Unit (PU) or Reporting Unit (RU) providing information to the interface.

b. Link 22 Unit (NU) - A unit communicating directly on Link 22. All NUs will have a command and control (C2) capability.

c. Link 16 Unit (JU) - A unit communicating directly on Link 16. JUs may be further classified, according to their C2 capability, into either C2 JUs or nonC2 JUs.

d. Participating Unit (PU) - A unit communicating directly on Link 11.

e. Reporting Unit (RU) - A unit taking part in the exchange or transfer of tactical data on a point-to-point data link to which data can be addressed and from which data can be identified as to source, e.g., Link 11B.

f. Indirect Unit - A PU or RU whose data are being forwarded onto Link 22.

g. Supporting Unit (SU) - A unit operating in support of an NU, JU, PU or RU which is providing data for the interface but which is not specifically identified as a data source.

h. Forwarding Link 22 Unit (FNU) - An NU that translates and forwards data among units using F-Series messages, J-Series messages and/or M-Series messages. An FNU can be assigned to function in one of many forwarding configurations depending on the requirements of the multilink interface. Further details are contained in paragraph 7.1.3.4.

i. Standby FNU (SFNU) – An FNU capable IU that does not forward data, but monitors the status of the FNU in order to assume the FNU function expeditiously if the FNU is determined to be inactive or otherwise unable to forward on any Link to which it is assigned as FNU.

j. Forwarding Multifunction Information Distribution System (MIDS) Unit (FJU) - A MIDS Unit (JU) that translates and forwards data between Link 16 and either Link 11 or Link 11B, or both. For brevity, FJU is used to refer to FJUA, FJUB, or FJUAB (see below); the latter 3 abbreviations are used if a specific meaning is required. An FJU can function in one of the following three configurations:

   (1) Forwarding MIDS Unit A (FJUA): Forwards between Link 16 and Link 11.

   (2) Forwarding MIDS Unit B (FJUB): Forwards between Link 16 and Link 11B.

   (3) Forwarding MIDS Unit AB (FJUAB): Forwards between Link 16, Link 11, and Link 11B.

k. Standby FJU (SFJU) - An FJU capable IU that does not forward data, but monitors the status of the FJU in order to assume the FJU function expeditiously if the FJU is determined to be inactive or otherwise unable to forward on any Link to which it is assigned as FJU. The SFJU(s) normally participate actively on Link 16.

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

m. Forwarding Reporting Unit (FRU) - An RU which is forwarding data between two or more RUs.

n. Concurrent Interface Unit (CIU) - An IU that originates data simultaneously on more that one Link, e.g., Link 11 and Link 22, but does not forward data between the Links.

CHAPTER 3

LINK 22 DUTIES AND RESPONSIBILITIES

SECTION 1 – COMMAND LEVEL

3.1 General

Link 22 will support the tactical information exchanges of maritime forces for NATO operational plans. Since the majority of operations will be conducted in a multilink environment, Link 22 will require close coordination with other data link operations, e.g., Link 16, Link 11. Specific authorities and responsibilities are detailed in this Chapter to enable planning and execution for joint/combined Link 22 operations.

3.1.1 MNC Level

The Major NATO Commanders (MNCs) will:

a. Validate requirements for joint/combined information exchanges.

b. Resolve conflicting inter-regional MSC and NATO/national Link 22 requirements.

c. Establish crypto network management policies and procedures.

d. Establish frequency management plans and allocate communications resources.

3.1.2 MSC Level

In support of the MNCs, the Major Subordinate Commanders (MSCs) will:

a. Exercise Operational Control (OPCON) of Link 22 operations within their Area of Responsibility (AOR).

b. Resolve conflicting intra-regional NATO/national Link 22 requirements.

c. Coordinate with the appropriate NATO COMSEC Agency to plan for and distribute cryptonet instructions and equipment.

d. Establish multilink requirements for joint/combined operations.

3.1.3 PSC Level

The Principal Subordinate Commanders (PSCs) will:

a. Designate the Tactical Commander responsible for Link 22 operations.

b. Establish multilink priorities.

3.1.4 Tactical Commander Responsibilities

The Tactical Commander is responsible for planning the detailed use of Link 22 for the intended mission. Responsibilities include:

a. Providing the following Link 22 planning data that will best support the mission:

(1) Link 22 supernetwork definition.

(2) Determining to which networks NUs should belong.

(3) Mission Area Subnetwork (MASN) composition.

(4) Managing Link 22 Address allocation.

(5) Track Number Block allocation.

(6) Data Forwarding Unit responsibilities.

b. Exercising Tactical Command (TACOM) of the appropriate Link 22 network(s).

c. Selecting a suitably equipped NU, or NUs, to perform the following Link 22 duties, including standbys, for each network:

(1) SNMU and Standby SNMU.

(2) NMU and Standby NMUs.

d. Issuing and updating the Operational Tasking Data Link (OPTASK LINK) to disseminate essential operational and system information to all participating NUs (see Section 4.3).

e. Coordinating operations with other tactical data links.

3.2.1 Supernetwork Management Unit Responsibilities

The NU designated in the OPTASK LINK as the SNMU is responsible to the Tactical Commander for coordinating the operations of the different Link 22 networks during multi-network operations. SNMU responsibilities include:

a. Selecting and managing system-wide operational parameters.

b. Monitoring overall supernetwork performance and configuration.

3.2.2 Network Management Unit Responsibilities

The NUs designated in the OPTASK LINK as NMUs are responsible to the SNMU for the management of individual networks. NMU responsibilities include:

a. Monitoring the performance and configuration of an individual network and reporting its operational effectiveness to the SNMU.

b. Management of network media parameters.

3.2.3 Link 22 Unit Responsibilities

Individual NUs are responsible for:

a. Initialising their host system according to instructions contained in the OPTASK LINK (as detailed in paragraph 4.3.2).

b. Conducting Link 22 operations in accordance with agreed operational procedures.

c. Informing the NMU of any changes required to Assignment Slots during Link 22 operations.

d. Responding to all requests and commands from the Tactical Commander or the designated SNMU/NMU.

CHAPTER 4

SETTING UP LINK 22

SECTION 1 - PRE-MISSION PLANNING

4.1.1 General

Pre-mission Planning encompasses the planning and coordination of Link 22 operations and is the responsibility of the Tactical Commander. It involves the process of specifying the communications requirements in support of planned tactical operations and translating those requirements into communication and network operating parameters for initialisation by all intended Link 22 network participants. Regional Link 22 supernetworks must make provision for Link 22 participants from other regions, including units in transit through areas of operation, and make adequate provision for the addition of significant numbers of Link 22 platforms to the Order of Battle (ORBAT) in times of crisis and war. Similarly, Link 22 platforms from one region must be able to participate effectively in the network(s) of an adjacent region, as required.

4.1.2 Link 22 Supernetwork Requirements Definition

The primary task for the Tactical Commander during Pre-mission Planning is to specify a Link 22 supernetwork structure to support mission requirements. The following information must be specified:

a. Link 22 supernetwork definition, in terms of:

   (1) Number of networks to be deployed.

   (2) Participants on each network.

   (3) Frequencies to be used for each network.

   (4) Crypto parameters to be used by each network.

b. Link 22 Address allocation.

c. MASN definition, if required.

d. TN block allocation.

e. Data forwarding unit responsibilities.

4.2.1 Introduction

For each Link 22 operation, an OPTASK LINK message must be distributed to all NUs intending to participate. Where a given Link 22 operation involves multiple networks, these should be addressed by a single OPTASK LINK message. The OPTASK LINK is a Message Text Format (MTF) or character oriented message that is transmitted in advance of operations. This message permits Tactical Commanders or other designated authorities to promulgate detailed instructions regarding operation of tactical data links (e.g., Link 16, Link 11/11B, Link 1, Link-4A, Link 14, Interim Joint Tactical Information Distribution System (JTIDS) Message Specification (IJMS) and Link 22). It is essential that all participating NUs receive the same OPTASK LINK, including any subsequent updates to it, and operate in accordance with the directives contained therein.

4.2.2 Link 22 OPTASK LINK Parameters

The OPTASK LINK must include as a minimum the parameters required to be loaded by each participating NU in preparation for the Initialisation phase:

a. Supernetwork Parameters:

(1) Lowest allocable NILE address for this supernetwork.

(2) Supernetwork Duty Assignments: Link 22 addresses of SNMU and standby SNMU.

(3) Definitions of MASNs: for each MASN a MASN identifier and a list of 15 bit addresses of participating NUs.

b. Network Parameters: for each network:

(1) Network Identifier: a number from 0 to 7.

(2) List of NUs active in the network specified by either:

For each NU:

(a) 15-bit address of the NU.

(b) Capacity Need Index of the NU (0 smallest need - 3 largest need).

(c) Channel Access Delay (0 longest delay - 3 shortest delay).

or:

(d) Media Fragmentation Rate.

(e) Operational NCS specified by:
For each NU:

i. 15-bit address of time slot owner.

ii. Size of time slot (in minislots).

(3) List of 15 bit addresses of NUs not active on the network: these NUs can either be expected to join the network later or may operate in receive only.

(4) Link 22 network duties assignment: 15 bit addresses of NMU and standby NMU.

(5) Network Initialisation type:

- Short Initialisation: a single Media Setting Number.

- Channel Probing: on or more Media Setting Numbers.

(6) Network Start Time: time on which network initialisation will start.

(7) Frequency or Frequency hopset.

(8) Dynamic Time Division Multiple Access (DTDMA): on/off.

(9) Crypto Integrity Mode: on/off.

(10) Crypto Key Identifiers:

(a) Key Pair Key.

(b) Key Pair Identifier.

(11) Specifying Variable Track Quality (VTQ) Settings.

(12) Automatic Correlation/Decorrelation Parameters.

4.2.3 Standing OPTASK LINK(s)

Where appropriate, Standing OPTASK LINK(s) may be established and held at all operational units. This would require only changes to the Standing OPTASK LINK to be promulgated prior to Link 22 operations.

4.2.4 Other Considerations

To reduce the Media Access Time, which is the delay from when a unit has a requirement to transmit and that unit's next available opportunity, the following points should be considered:

a. Allocate several time slots to units capable of issuing commands and to relay units.

b. Avoid the use of Priority Interrupt slots when the time interval between two consecutive Assignment slots is less than 2.5 seconds; this is usually possible for UHF networks.

c. Minimise the number of relay legs between command units and those to whom commands are sent.

d. Favour the use of UHF for relay units; many more time slots are available during a given time at UHF, as opposed to HF, and therefore it is possible to allocate many more separate Assignment slots to NUs at UHF thus giving them access to the network with reduced delay.

4.2.4.1 Specifying Variable Track Quality Settings

VTQ settings may be specified for some NUs in the OPTASK LINK in the GENTEXT/REPORTING REQUIREMENTS set during operations as the situation dictates. The track correlation process depends on the reporting of accurate TQ (see paragraph 4.2.5). Therefore VTQ can contribute to the incorrect correlation of two tracks, which are actually two separate vehicular objects. If many incorrect correlations occur involving NUs using VTQ, the TDC should consider directing that VTQ not be used.

4.2.5 Automatic Correlation Considerations

NUs use a standard set of automatic correlation tests to test for correlation between two Air or Surface (Maritime) tracks, in order to prevent or detect dual designations. A dual designation occurs when two NU's report the same vehicular object using two different TN's. The tests are described in more detail in paragraph 6.6.16.1.1. Certain parameters to be used in the correlation tests need to be determined and specified in the planning process. They are described below. Two terms that are to be understood in order to understand the use of variable correlation parameters are:

a. Incorrect Correlation: An incorrect correlation occurs when two tracks which are actually two separate vehicular objects are incorrectly correlated, thus losing one of the tracks until it is decorrelated.

b. Missed Correlation: A missed correlation occurs when two tracks which are actually the same vehicular object are not correlated, thus creating a dual or allowing a dual to persist.

4.2.5.1 Variable Correlation Parameters

a. Operational or testing experience may indicate that the correlation tests will result in fewer incorrect correlations and/or missed correlations if parameters used in correlation algorithms are adjusted. Therefore, C^2 NUs' correlation algorithms are programmed with nine different variable parameters that can be modified either in the initialisation load or by operator selection in each C^2 NU. Each parameter has a default value, minimum and maximum allowable values, and a prescribed variability increment within the range of allowable values.

b. The settings for each of the variable correlation parameters are to be defined in the OPTASK LINK, in the GENTEXT/REPORTING REQUIREMENTS sections. The default settings should be specified unless data link planners or managers, e.g., the DLM/ICO or TDC, are aware of reasons to specify otherwise. Such reasons might include known test results, local operating conditions, recent tracking observations, planned correlation tests, etc. This should be done by inclusion of the statement "USE DEFAULT CORRELATION PARAMETERS" or "USE DEFAULT CORRELATION PARAMETERS, EXCEPT (list parameters to be set to other than default, and the values to be set)". Changes to the variable correlation parameter values may also be directed by voice during operations. However, if the DLM/ICO determines that the automatic correlation process is not to be used, it should be indicated in the OPTASK LINK under Conditional Capabilities or directed by voice.

c. Table 4.1 lists the variable correlation parameters and their default, minimum, and maximum values and variability increments. Each parameter is designated by a letter that corresponds to the variable in systems' correlation algorithm equations. The letters can also be used for brevity in the OPTASK LINK or voice communications. The use of the parameters is described in more detail in paragraph 4.2.5.2.

Ltr	Parameter	Default	Minimum	Maximum	Increments
a	Window Size Multiplier	1.0	0.5	3.0	0.1
b	Minimum Window Size	0.5 dm	0.0 dm	2.0 dm	0.25 dm
c	Minimum TQ	7	3	7	1
d	Maximum TQ	10	8	15	1
e	Restricted TQ	4	2	6	1
f	Course Differential	45^o	15^o	90^o	15^o
g	Speed Differential	40%	10%	100%	10%
h	Altitude Differential	10K feet	5K feet	50K feet	5K feet
j	Minimum Qpg	2	1	5	1
k	Maximum Qpg	11	1	15	1
m	Decorrelation Window Multiplier	1.5	1.0	2.0	0.1
n	Consecutive Decorrelation	2	1	5	1

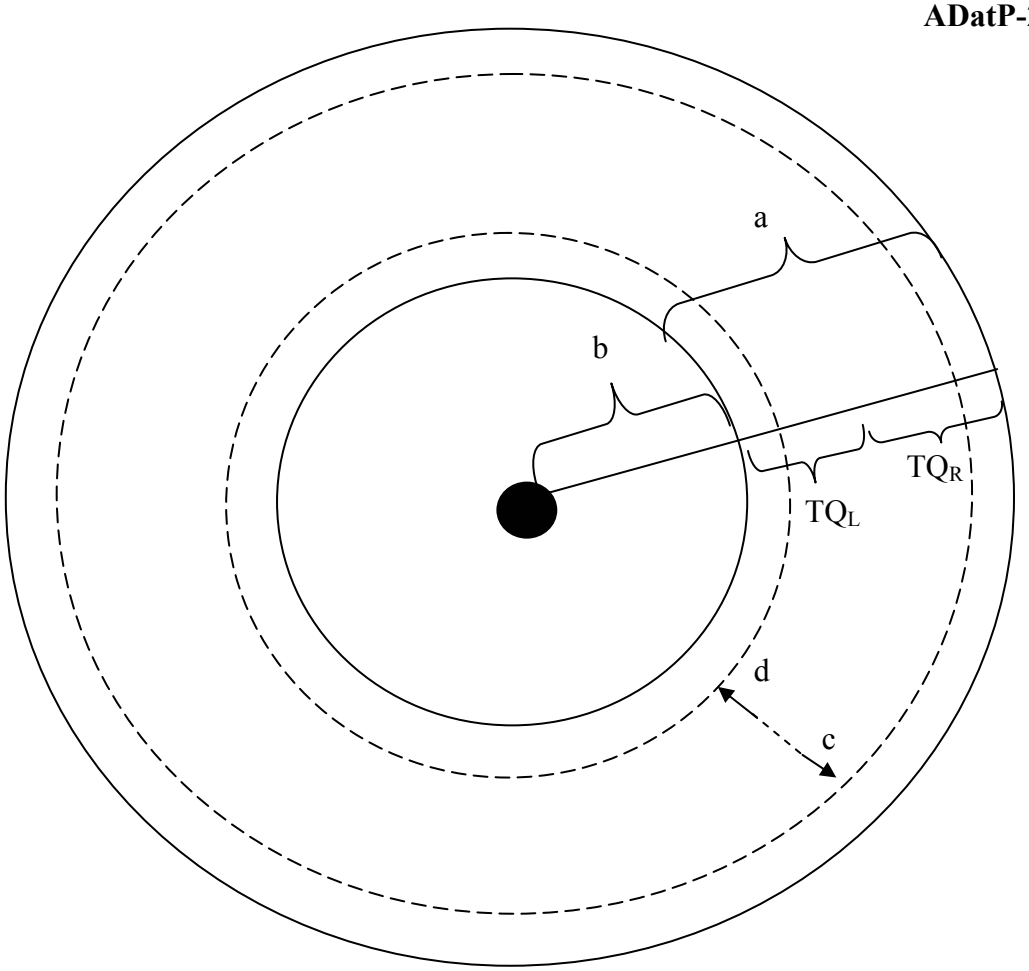
Table 4.1 - Variable Correlation Parameters

4.2.5.2 Correlation Parameter Descriptions

Each of the variable correlation parameters is described below in terms of their use in automatic correlation algorithms, and their potential operational effect:

4.2.5.2.1 Correlation Window Parameters

The correlation window is a circle with a radius based upon the positional accuracies associated with the TQs of the two tracks (see Table 6.2a). (The radius is not based on the actual sum of the positional accuracies, but on the square root of the sum of squares, since TQ represents a variance.) The circle is centred on the track being checked against surrounding tracks. Tracks within the circle are eligible for correlation with the track being checked, subject to other tests. Correlation algorithms use the variable parameters a through d to compute the radius of this circle. Figure 4-1 depicts the correlation window and which portions of the radius are affected by the parameters a through d. When the default values for parameters a through d are specified, correlation algorithms compute correlation windows between 0.64 dm (for 2 tracks with TQ $\geq$ 10) and 4.64 dm (for 2 tracks with TQ $\leq$ 7) in radius. The purpose of each of these "window" parameters is described below.



TQ_L = Positional accuracy for TQ of local track represented by minTQ and max TQ.
TQ_R = Positional accuracy for TQ of remote track represented by minTQ and max TQ.

Figure 4-1 - Effect of Variable Parameters on Correlation Window

4.2.5.2.1.1 Window Size Multiplier (a)

The correlation window can be loosened or tightened uniformly for all NUs in an interface by increasing or decreasing the window size multiplier. The window size multiplier stretches or reduces the entire window radius. This might be necessary if it is determined that there are many incorrect correlations (decrease (a)) or missed correlations (increase (a)) attributable to distances between the tracks.

4.2.5.2.1.2 Minimum Window Size (b)

Essentially an estimation added to the basic window calculated from TQs, to insure that windows are not so small as to prevent valid correlations. The default value insures a correlation window of at least a half-mile, even if the TQs of both tracks are very high.

4.2.5.2.1.3 Min TQ (c)

The minimum TQ to be used in positional correlation calculations. This prevents correlation windows from being unrealistically large. The positional accuracies associated with lower TQs are quite large. TQ = 6 reflects a potential track positional error of almost 6 miles, TQ = 2 almost 30 miles, and TQ = 1 greater than 30 miles to an indefinite distance. Allowing correlation of tracks in a correlation window that is too large would probably result in many incorrect correlations. (As "c" decreases the TQ positional error increases causing the radius of the correlation window to increase.)

Therefore, the correlation algorithms treat TQs below a certain value as if they were at least the Min TQ. Experience may show that a Min TQ lower than the default value of 7 (positional accuracy approximately 3 miles) is desirable, if the default value results in many missed correlations of low quality tracks. Note: The value used for c can never be less than the value used for e.

4.2.5.2.1.4 Max TQ (d)

Similar to Min TQ, but prevents correlation windows from being unrealistically small because very high TQs are used. TQ = 11 reflects track positional accuracy of about 300 feet, TQ = 15 about 18 feet. Experience may show that a Max TQ higher than the default value of 10 (positional accuracy approximately 600 feet) is desirable, if the default value results in many incorrect correlations of high quality tracks. (As "d" increases the TQ positional error decreases causing the radius of the window to decrease, resulting in a smaller correlation window.)

4.2.5.2.1.5 Restricted TQ (e)

Tracks with TQ less than or equal to the Restricted TQ are not eligible for correlation, since their low TQ reflects a high degree of uncertainty about their position. Restricted TQ may require lowering if it appears that too many duals involving low TQ tracks are occurring. (As an exception, correlation of new local real-time tracks with any TQ is attempted before they are initially reported, since an incorrect correlation in this instance will not create a dual, and may keep false tracks off the interface.)

4.2.5.2.2 Kinematic Variable Parameters

Tracks within the correlation window are checked for matches of their course, speed, and altitude with the track being checked. The allowable kinematic differences for correlation between the two tracks are specified by parameters f, g, and h, described below.

4.2.5.2.2.1 Course Differential (f)

The maximum difference between the reported course of the remote track and the calculated course of the local track. For surface tracks, if the speed of either track is less than 10 dmh, "course differential" is not applied in the correlation test, since course calculations for slow-moving tracks are subject to large errors.

4.2.5.2.2.2 Speed Differential (g)

The maximum percentage by which the speed of the faster track may differ from the speed of the slower track. Since the speed of new tracks is usually unreliable for a short period of time until tracking stabilises, this parameter is particularly important in detecting correlation of new, unreported tracks with existing reported tracks.

4.2.5.2.1.5 Altitude Differential (h)

The maximum altitude difference between two air tracks. This parameter is not applied to surface tracks, and is applied only if the Altitude Source of both air tracks is Sensor, Aircraft Automatic Altitude, or PLI Report. If many duals appear to be occurring due to altitude differences, the TDC should ascertain if NUs with sensors that do not have accurate altitude finding capability are setting their Altitude Source to Sensor. If so, they should be directed to set Altitude Source to No Statement/Estimated. However, if many incorrect correlations or missed correlations occur for tracks which are both being reported by NUs with accurate 3-D sensors, this correlation parameter may require lowering (to prevent incorrect correlations), or increasing (to prevent missed correlations).

4.2.5.3 Min Q_{pg} (j) and Max Q_{pg} (k)

NU PLI reports are also tested for correlation with track reports. In this case, the Geodetic Position Quality (Q_{pg}) is used for the NU instead of TQ. Min and Max Q_{pg} are equivalent to Min and Max TQ used in correlation tests of two tracks, and the guidance for their setting is similar. The default Min $Q_{pg} = 2$ has an associated positional accuracy of almost 4 data miles and the default Max $Q_{pg} = 11$ has an associated positional accuracy of about 500 feet. Correlation of NUs with $Q_{pg} = 0$ is not attempted, since this essentially states that the NU's Link 22 Terminal Navigation is not working properly and the PLI position is considered unreliable. PUs and RUs are tested for correlation as if they were a track with TQ = 7.

4.2.5.4 ID and IFF/SIF Mode II Correlation Capabilities

Normally, two tracks which have conflicting IDs or different nonzero IFF/SIF Mode II codes are not correlated automatically. However, NUs have operator selectable capabilities to selectively remove either or both of these correlation restrictions if operational conditions dictate, e.g., IDs or Mode II codes are unreliable and incorrect IDs or Mode II codes are preventing valid correlations and creating duals. The use of these capabilities is to be controlled by the TDC, and shall apply to all NUs in the interface. They should also be promulgated in the OPTASK LINK/ REPORTING REQUIREMENTS section, including the initial OPTASK LINK if pre-planning indicates the need to use the capability from the start of operations. The default value of each of these capabilities is "on", i.e., the correlation restriction applies unless turned off by an operator.

4.2.6 Automatic Decorrelation Considerations

After two tracks have been correlated to form a single common track, they are then checked for decorrelation upon receipt of each remote track report. Similar to the variable correlation parameters, there are two variable decorrelation parameters that may also require adjustment for reasons similar to the correlation parameters. These are to be defined in the OPTASK LINK/REPORTING REQUIREMENTS section in the same manner as suggested for the variable correlation parameters. If the default values are to be used for all of the correlation and decorrelation parameters, then the single statement "USE DEFAULT CORRELATION AND DECORRELATION PARAMETERS" should be stated. The variable decorrelation parameters are:

4.2.6.1 Decorrelation Window Multiplier (m)

The amount by which the distance between the common and remote track is to exceed the applicable correlation window for the two tracks in order to be decorrelated. The default value is 1.5, e.g., if the correlation window for a common and remote track is 5 miles, the local and remote would decorrelate at 7.5 miles. The multiplier can be varied between 1.0 and 2.0 in increments of 0.1.

4.2.6.2 Consecutive Decorrelations (n)

The number of consecutive remote track reports which must meet the decorrelation criteria before the decorrelation is executed. The default value is 2, variable between 1 and 5 in increments of 1. Excessive incorrect decorrelations may indicate the need to use a higher value. It is unlikely that 1 would ever be appropriate.

CHAPTER 5

COMMUNICATIONS PROCEDURES

SECTION 1 - VOICE COORDINATION

5.1.1 Introduction

Link 22 supports only data exchange, including free text messages, in accordance with the defined Link 22 message standard and protocols, and the procedures laid down in this ADatP. Link 22 should always be supported by a secure voice capability for coordination purposes. The primary method of data conflict resolution should be via automatic data exchange. Conflict resolution by voice will only be required between dissimilar link systems and in cases where automatic procedures fail to achieve a solution. In such cases the operator will be alerted.

5.1.2 Voice Net(s)

A voice coordination net (or nets) should be established to support the following:

a. Interface Coordination - For interface command and control coordination.

b. Track Coordination - To control and coordinate procedures used by track surveillance personnel to maintain a common, recognised tactical surveillance picture throughout the Link 22 supernetwork. In the event of Tactical Data System (TDS) automated display malfunctions, this net could be used to coordinate manual track cross tell, handovers and commands.

c. Data Link Coordination - To coordinate the technical operation of Link 22 system equipment and to coordinate the distribution of pre-defined initialisation data prior to initiation of Link 22 operations. This could also include unit to unit coordination if technical problems exist during Link 22 initialisation or operations.

d. Multilink Coordination - To coordinate data forwarding operations.

The Tactical Commander may direct that voice coordination of interface, track and data link issues be conducted on a single voice net, to assist platforms with limited radio availability.

5.1.3 Procedures

Effective use of voice communications relies on operator adherence to established voice procedures. When voice reports are necessary, agreed standard voice procedures must be used[1].

Where voice reports cannot be covered by such standard procedures, or where possible ambiguity may occur, NATO Link Management Codes applicable to Link 22 (as detailed in Annex D) should be used.

SECTION 2 - INITIALISING A NETWORK/NETWORK ENTRY

5.2.1 Overview

Link 22 tactical data exchange cannot commence until the full initialisation process has been completed. The initialisation of a Link 22 supernetwork and/or network is a largely automated process, with the supernetwork tasks being the responsibility of the SNMU and network level tasks the responsibility of the assigned NMU. Initialisation is conducted in three stages:

a. Platform Initialisation.

b. Network Level Initialisation.

c. Supernetwork Initialisation.

5.2.2 Platform Initialisation

The process of Platform Initialisation is a decentralised one, conducted at operational units. NUs requiring to participate on a Link 22 network or networks must be pre-loaded with the initialisation parameters required for the Network Initialisation phase for each network on which they are to participate, as promulgated in the OPTASK LINK message, prior to the designated Initialisation Start Time (IST). Other operational network parameters are disseminated over the air during the Network Initialisation phase (see paragraph 5.2.3).

5.2.2.1 Any problems encountered during the platform initialisation process for a network should be referred to the appropriate NMU.

5.2.2.2 Equipment Checkouts and Set-up Procedure

Equipment checkouts and set-up procedure must be completed for each participating NU well before the designated IST. This process will include:

[1] 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).

a. Preliminary checks on the data equipment, radios, computers and inter-connections.

b. Equipment checkouts by utilisation of the Link 22 system's built-in test equipment. (Each system will use the individual checklist or procedure developed from appropriate handbooks of operation and maintenance instructions).

c. Loading of initialisation parameters for each network into each NU, according to established LOPs for each platform type. Wherever possible, platforms should utilise automatic loading facilities to reduce the risk of error introduction. Manual loading should be used only as a fallback procedure.

d. Checks on crypto key validity and data.

e. Correct loading of cryptovariables to ensure participation in the network initialisation phase and subsequent network operations.

5.2.3 Network Level Initialisation

Network level initialisation is conducted by performing either a Short Network Initialisation procedure or a Network Initialisation procedure with Channel Probing. The decision to go for one of these Network Initialisation procedures is a trade off between the capacity of the Officer in Tactical Command (OTC) to reasonably predict the initial Network and Media parameters, and the complexity and length of the Network Initialisation phase. The method chosen by the OTC is specified in the OPTASK LINK Message.

5.2.3.1 In Short Network Initialisation, each NU determines automatically the initialisation parameters as directed in the OPTASK LINK message. These parameters consist of the network parameters and the ONCS. Based on the directions in the OPTASK LINK message, the DLP of the NU or the SNC of the NU is requested to design the ONCS. If the DLP is requested to design the ONCS, it depends on the national implementation of the DLP whether the assistance of the operator is required. At the directed Operational Start Time (OST) the NUs will engage the active state and commence Link 22 operation.

5.2.3.2 Network Initialisation with channel probing implies that the Media parameters and/or the Network parameters have to be optimised. Therefore, the NU will probe the channel for one or more candidate Media Setting Numbers (combination of waveforms, coding schemes & modulations) and/or optimise the Operational Network Cycle Structure (ONCS) with connectivity information for the selected or specified Mission Subnetwork (MSN). This is achieved by performing the following procedure:

a. Shortly before IST, each NU will automatically determine the Initialisation Network Cycle Structure (INCS) from the parameters input from the OPTASK LINK message.

b. At IST, each NU participating in the network will take part in the channel probing sequence. For the candidate MSNs, the NMU collects data on the channel characteristics.

c. The NMU (and the Back-up NMUs) automatically determines the network parameters and the ONCS based on the parameters in the OPTASK LINK, the results of the channel probing, the expected transmission capacity requirements of the different NUs and the DTDMA mode. Based on the directions in the OPTASK LINK message, the DLP of the NU or the SNC of the NU is requested to design the ONCS. When the DLP is requested to design the ONCS, it depends on the national implementation of the DLP whether the assistance of the operator is required. If Fixed TDMA mode is to be used, the ONCS must be optimised as far as possible to meet the expected requirements of participating NUs for the duration of network operations, since the ONCS cannot be modified on-line without reconfiguration or reinitialisation. However, if dynamic TDMA mode is to be used, the ONCS will automatically adapt to meet NUs' communications requirements. The ONCS is defined in terms of:

(1) Operational Network Cycle Time (ONCT).

(2) Operational Assignment Slot(s) for each NU.

(3) Interrupt Slot and, where appropriate, LNE Slot(s).

(4) Network connectivity data.

d. The NMU continues the network initialisation process by transmitting the network parameters and the ONCS. The flooding technique is used to ensure distribution to all network participants.

e. Each NU automatically rebroadcasts the received data in his Assignment Slot within the INCS.

f. Each NU transmits a ready message when it has acquired the ONCS. Each NU (except the NMU) rebroadcasts all "ready" messages received from other NUs to ensure that they are conveyed to the NMU.

g. When the NMU has received information that 80% of NUs are ready (or after a time-out of 10 NCTs if 80% cannot be reached), the NMU determines that network initialisation is complete and transmits the OST.

h. At OST, the network reaches the active state and all NUs can commence Link 22 operations.

i. If the Back-up NMU has not received anything from the NMU within 15 network cycles of IST, it should begin to transmit its ONCS. If the Secondary Back-up NMU has received nothing within 20 network cycles, it should begin transmission and so on.

5.2.3.3 NU Failure to Achieve Network Initialisation

Assuming full equipment serviceability, an NU may fail to achieve network initialisation owing to loading of incorrect initialisation parameters and/or incorrect cryptovariables. In such cases operator should confirm TOD and reinitialise the system. If an NU fails to achieve successful network initialisation, LNE procedures should be followed, as defined in paragraph 5.3.3.

5.2.4 Supernetwork Initialisation

Supernetwork initialisation is potentially a complex and lengthy process and requires a considerable preparation time to select the basic communications and operational parameters for each constituent network. However, once all this information has been disseminated via the OPTASK LINK to all network participants, the supernetwork initialisation process involves the coordinated initialisation of the constituent networks using the procedure described in paragraph 5.2.3.1.

SECTION 3 - MAINTAINING THE NETWORK

5.3.1 Initiation of Network Operations

The ONCS to be used will determine the order of network transmission by NUs, in accordance with the allocation of time slots. Procedures are required to ensure an orderly initiation of surveillance data exchange, to minimise redundant transmissions and dual designations. Normally the NU with the largest track load should transmit surveillance tracks first. Other NUs should commence transmissions with filters imposed for all surveillance tracks (Procedures for the use of data filters are covered in paragraph 6.6.20).

5.3.1.1 Each NU should:

a. Establish itself on the interface by transmission of own PLI reports.

b. Receive all remote surveillance tracks being reported on the interface and attempt correlation with all local tracks held to determine commonality, monitor data registration and eliminate dual designations.

c. The minimum wait prior to removing transmission filters is 12 seconds before reporting air and space tracks and 96 seconds before reporting surface and land tracks. This is a minimum wait time and may be extended if necessary, to accomplish a. and b. above.

d. Remove transmission filters as required to commence reporting of tracks for which local sensor data is held, in accordance with R2 rules (see paragraph 6.3.2.3).

5.3.1.2 This procedure ensures that reporting of surveillance data on the network is commenced in an orderly manner. However, should operational necessity dictate, all or several NUs may begin to transmit on the link prior to expiration of the minimum wait time. This could result in a severe degradation of the surveillance picture and could last for an extended period of time until correlation between local and remote tracks has been resolved by all units.

5.3.2 Link 22 Operations

5.3.2.1 Network and Supernetwork Modes of Operation - Modes of network operation must be considered at two levels, the Network level and the supernetwork level. Individual networks within a supernetwork may operate in different modes. There are three modes of operation which apply at both the network level and the supernetwork level:

a. Engineering Mode - All participants in a network or all networks in a supernetwork are in the Engineering Mode. This enables only the exchange of technical information (e.g., during the initialisation process).

b. Normal Operations Mode - At least one participant in a network or at least one of the constituent networks in a supernetwork is in Normal Operations Mode, i.e., is able to exchange both tactical and technical messages using the ONCS.

c. Radio Silent Mode - All participants in a network or all networks in a supernetwork are in the Radio Silent Mode.

The mode of operation of an individual NU may be independent of the mode of network operation and is detailed below:

5.3.2.2 NU Modes of Operation - An individual NU may operate in one of the following modes; these are operator-selectable and determine the conditions of NU participation in the network:

a. Engineering Mode - An NU can only transmit technical information (e.g., during Initialisation, Reinitialisation or Late Net Entry).

b. Normal Operations Mode - An NU is fully active on the network and can transmit tactical and technical messages unconditionally within its Assignment Slot allocation in the ONCS.

c. Radio Silent Mode - An NU retains its Assignment Slot allocation. It can receive messages but its transmissions are restricted in accordance with the direction of the Tactical Commander.

d. Listen Only Mode - An NU can receive messages but has no Assignment Slot for the transmission of Link 22 messages. High priority (Priority 1) messages only can be transmitted using the Interrupt Slot.

5.3.2.3 TDMA Modes of Operation - TDMA channel access protocols ensure that Link 22 is robust and nodeless. Networks will continue to function, even if one or more participants are jammed or leave the network. Two modes of TDMA operation are available:

a. Dynamic TDMA Mode - This is the usual mode of operation of a Link 22 network, enabling network capacity to be dynamically managed by NUs thereby enabling the network to adapt to changing user demands and ensuring the most efficient allocation of transmission capacity. Dynamic TDMA operates automatically without any operator or NMU intervention. Two types of dynamic TDMA mode have been defined:

(1) Fixed Slot Length Dynamic TDMA (FiSLDTDMA) - Time slot lengths remain fixed but individual time slots may be reallocated among NUs initialised to operate in this mode. There is no impact on other NUs which are participating in the network using Fixed TDMA mode.

(2) Variable Slot Length Dynamic TDMA (VaSLDTDMA) - In addition to the reallocation of complete time slots, time slots may be divided and portions of time slots reallocated to other NUs. This mode provides the most flexibility in adapting the ONCS to meet changing demands. Successful operation of this mode requires good connectivity between participating NUs and is not suitable under conditions of poor connectivity or high levels of jamming.

b. Fixed TDMA Mode - This is a restrictive mode of Link 22 operation in that, once established, the NCS and therefore the allocation of network capacity remains fixed and can be changed only by network reconfiguration or network reinitialisation. Fixed TDMA mode may be selected when an unchanging NCS is desired, e.g., to facilitate Silent Join/Late Net Entry.

5.3.2.4 Network Capability

An NU may participate in Link 22 operations as either a Single Network unit or a Multi-Network unit:

a. Single Network Unit - An NU that is capable of operation in one network only at a time (HF or UHF). A single network NU is not capable of performing extranetwork relay, i.e., relay of messages between different networks.

b. Multi-Network Unit - An NU that is capable of simultaneous participation in one or more networks. A Multi-Network NU is capable of performing all NILE relay functions.

A supernetwork may contain any combination of Single Network and Multi-Network units.

5.3.2.5 Multi-Network Operations

At the simplest level, Link 22 may be operated as separate, discrete networks providing data exchange only among the participants of each respective network. However, in order to meet the requirements of the tactical situation and to provide the fullest dissemination of tactical data amongst the components of the total battle force, it is envisaged that Link 22 will be operated as a series of interconnected networks, known as a Link 22 supernetwork. This will allow information to be exchanged both within individual networks (Intranetwork Exchange) and across interconnecting networks (Extranetwork Exchange). As explained in paragraph 2.1.3, the component networks may use the same media or any combination of media, subject to restrictions of mutual interference.

5.3.2.6 Multi-Network Configurations - A multi-network Link 22 supernetwork may be configured in one of the following two forms:

a. Total Network Overlap - All NUs are multi-network nodes and participate in all of the interconnected networks. Data reliability is increased by transmitting the same information over different communication paths but by selective transmission of different types of tactical data total throughput can be significantly increased.

b. Partial Network Overlap - The interconnected networks contain some NUs which are not members of all networks (e.g., single network nodes). Multi-network nodes may be assigned automatically as Extranetwork Relay Units to extend the distribution of data to and from those less capable units, but will require additional network capacity to provide this service. The assignment of Relay Units is an automatic process in the Link 22 communications equipment. Additional Relay Units may be assigned by the SNMU in order to ensure connectivity for units which operate in Radio Silence mode or Listen Only mode.

5.3.2.7 Mission Area Subnetworks (MASNs)

Apart from the physical grouping of NUs in networks, NUs can also be grouped in a MASN. It is not required that all NUs participating in a MASN are connected to the same network. A MASN is a logical grouping of NUs cooperating on a common mission and allows quick and easy addressing of tactical information to all participants. Membership of a MASN is defined by the Tactical Commander either before Link 22 operation, in the OPTASK LINK message, or during a Link 22 operation. During Link 22 operations, the management of MASN assignment is performed by the SMNU (see Chapter 8). All NUs assigned the same Group Identifier Address (including the Forwarding NU or NUs) shall be formed into a Non-Machine Receipt (MR) MASN.

5.3.2.8 Link 22 Addressing Techniques

Within a Link 22 supernetwork, a number of addressing techniques are available to ensure that individual messages are automatically routed to the correct destination. Messages may be addressed to:

a. An Individual NU (Point-to-Point) - Each NU is assigned a reference number (Link 22 Address) of five octal digits, which is used by other units to address messages to that NU. The Link 22 Address is also used to identify the originator of a message.

b. A Group of NUs (Point-to-Multipoint) - Individual NUs may be organised into different types of groups as follows:

(1) A MASN - The initial composition of a MASN will normally be defined in the OPTASK LINK but can be changed via Link 22 network management messages during network operations. Messages addressed to the MASN Number are automatically routed to each member of the group

(2) An Ad-hoc Group - A temporary group of between two and five NUs, defined as a dynamic list. Such groups do not have to be pre-defined and can be specified, managed and terminated during operations in response to changing communications requirements. When using the dynamic list address capability, an NU will automatically maintain a list of the Link 22 Addresses of the individual ad hoc group participants.

c. All NUs in the supernetwork - This is known as the Totalcast.

d. All NUs in a network - This is known as Netcast.

e. All NUs within Radio Frequency (RF) Range - Messages are transmitted to all NUs within RF range of the source unit on the network(s) on which that unit is active. This is known as Neighbourcast.

Details of address and TN allocation are contained in paragraph 6.1.8.

5.3.2.9 Transmission Techniques

The following transmission techniques are available to support the addressing techniques described above:

a. Broadcast - The transmission of data on one network to the source's RF neighbours. No relay process is involved. Broadcast may be used to support any of the addressing techniques described above.

b. Relaycast - The transmission of data and associated technical information destined for onward transmission by Intranetwork Relay and/or Extranetwork Relay. Relaycast can be used to support point-to-point, point-to-multipoint, netcast and totalcast addressing.

c. Flooding - The relay of designated data by each NU receiving that data. Flooding may be used to distribute data to all NUs in a supernetwork when the supernetwork connectivity data is not known. Data may be specified for

retransmission only on the network on which it was received or on all available networks.

5.3.3 Late Net Entry Procedure

A unit that wishes to join an established Link 22 network must be expected by the SNMU. The SNMU should know the LNE unit's communication requirements, Link 22 system capabilities (i.e., single or multi-network configuration) and anticipated duration of network participation. The SNMU will determine the appropriate network(s) that the LNE unit should join. This procedure may involve communication over the voice net as described in paragraph 5.1

5.3.3.1 The LNE unit must be initialised with the basic radio, crypto and operational parameters in use on the network(s) it is to join. These are normally obtained from the OPTASK LINK message. The LNE unit must also be assigned a Link 22 Address. Synchronisation is achieved by all NUs having access to UTC. (See paragraph 2.1.8)

5.3.3.2 Once initialised, the LNE unit will perform the following automatic actions:

a. Determine the location of the LNE Slot.

b. Obtain permission from the SNMU to join the supernetwork.

c. Obtain the ONCS by using the LNE slot to request the necessary information.

d. Obtain permission from the SNMU to join the Network.

e. Obtain a dedicated Assignment Slot, if the NU requires to be active.

f. Obtain a 7 bit NILE Address, if not already known.

5.3.3.3 The LNE unit may receive data but cannot transmit data until an Assignment Slot is obtained. The LNE unit must follow the procedure in paragraph 5.3.1.2 before commencing transmission of surveillance tracks, in order to minimise redundant transmissions and prevent dual designations.

5.3.3.4 If the LNE unit is to join more than one network, it must perform steps a., c. and d. above for each network.

5.4.1 Normal Exit

The following procedure should be used to coordinate the exit of NUs wishing to leave a Link 22 network:

a. Exiting NU requests permission from appropriate NMU on Data Link Coordination Net (DCN) to execute Link 22 exit procedures, stating:

(1) Reason for departure.

(2) Time of departure.

(3) Anticipated duration of non-participation.

(4) Network duties currently assigned.

(5) Desire to maintain/release time slots assigned.

b. The NMU will 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 NMU will reassign to other NUs those interface functions being performed by the existing unit with an effective date and time that coincides with the unit's departure.

d. The NU should send Drop Track Reports on all tracks for which it holds R2.

e. The NU will transmit a Participant Location and Identification (PLI) message with the Network Participating Status Indicator field set to "Inactive - non specific".

f. The NU will inform all other NUs in the supernetwork about the planned departure from the network by means of the appropriate Link 22 management message.

g. At the designated time, the departing NU will cease Link 22 transmissions on the network.

When leaving a Link 22 supernetwork, the NU should follow the above procedure for all networks on which it is participating and should coordinate with the SNMU. Then the NU will inform all other NUs in the supernetwork about the scheduled departure from the supernetwork by means of the appropriate Link 22 management message. At the designated time the departing NU will cease Link 22 operations.

5.4.2 Unscheduled Network Exit

If an NMU detects that PLI messages are no longer being received from an NU, he should:

a. Attempt to contact the NU to determine:

(1) Reason for departure.

(2) Anticipated duration of non-participation.

b. Determine whether time slot capacity and Link 22 Address is to be retained if the NU's absence from the network is likely to be of short duration, and reassign network duties to other suitable NUs, as required.

c. Inform the SNMU of the departure and instruct those NUs to assume new network duties with immediate effect.

The SNMU will inform all other NUs in the supernetwork that the NU has left the supernetwork with the appropriate Link 22 management message.

SECTION 5 - TERMINATION OF A NETWORK

5.5.1 Network Shutdown

In order to terminate a network:

a. The Tactical Commander should inform the NMU of the network of any changes to the time of network termination, as promulgated in the OPTASK LINK.

b. The NMU of the network will instruct all NUs to cease all transmissions on the network at the designated time with the appropriate Link 22 management message.

5.5.2 Supernetwork Shutdown

The Tactical Commander will initiate the order to shutdown a Link 22 supernetwork. The following procedure should be followed:

a. When directed by the Tactical Commander, the SNMU will transmit a Shutdown order to all supernetwork participants via the appropriate Link 22 management message.

b. The order should also be confirmed by the SNMU by voice over the Link Coordination Circuit.

c. At the designated time in the shutdown order, all NUs should cease all Link 22 transmissions in accordance with LOPs.

CHAPTER 6

DATA EXCHANGE PROCEDURES

SECTION 1 – OVERVIEW

6.1 Functional Areas of Data Exchange

Link 22 provides a capability for exchanging tactical data in support of the following operational functional areas.

6.1.1 Participant Location and Identification

Link 22 incorporates an inherent identification and self reporting capability known as PLI. Each NU automatically transmits PLI messages containing accurate information on the NU's own position, identity and amplifying information. By transmitting a PLI message at regular, specified intervals, an active NU reports itself on Link 22 and, thereby, supports the surveillance function. Data exchange procedures for each of the functional areas are provided in the subsequent sections of this Chapter. Some data exchange procedures, e.g., use of Data Update Requests, are common to more than one of these functional areas and are dealt with in each of the relevant sections.

6.1.2 Surveillance

Link 22 messages are defined for the reporting of tracks and tactically significant points in support of air, surface, subsurface, land and space surveillance. Threat Warning information transmitted to establish a track or amplify an existing track is used to support the Surveillance function.

6.1.3 Intelligence

Link 22 provides the capability to report tactical intelligence information, in support of the surveillance function.

6.1.4 Information Management

Link 22 messages provide the capability to manage the surveillance data exchanged on the Link 22 interface and to resolve data differences and data conflicts, in support of the surveillance function.

6.1.5 Electronic Warfare (EW)

Link 22 messages are defined for the exchange of:

a. Evaluated EW product data such as emitter number, emitter function, where this information is available.

b. Raw parametric data derived from electromagnetic sources (e.g., frequency, scan rate, scan characteristics).

c. Orders and requests for the control and coordination of EW actions, including Electronic Support Measures (ESM), Electronic Countermeasures (ECM) and Electronic Protective Measures (EPM).

6.1.6 Mission Management

Link 22 messages are defined for the reporting of current status and employment information on air, surface, subsurface and land platforms.

6.1.7 Weapons Coordination and Management

Link 22 messages are defined to enable NUs to coordinate and direct the employment of units with weapon systems under their tactical control, to meet tactical objectives defined by the Operational Commander.

6.1.8 Track Numbers

TNs are used to provide a common reference number for information exchange within and between links. Link 22 TNs comprise five numeric or alphanumeric characters in the format AAXXX, where A represents a value in the range 0 to 7 and A through Z, less I and O, and X represents a purely numeric value in the range 0 to 7. TN assignment is detailed in the OPTASK LINK (see Section 4.3) and defines:

a. A Link 22 Address for each NU, to be used for the duration of network participation. No two units may be assigned the same Link 22 Address in a network. NU addresses are always octal.

b. A collective identifier for each MASN defined by the Tactical Commander for use during network operations. Use of a single address for a MASN allows relevant information to be sent to all members of the group with reduced overhead.

c. Block(s) of contiguous TNs for each NU, to be used for the reporting of tactical information, including tracks, bearings, Areas of Probability (AOPs), fixes and points/lines/areas. Some systems can only accept one TN block.

Therefore, it is recommended that no more than one block of the low TNs (00200-07776) and/or one block of the high TNs (10000-77776 and all alphanumerics) should be allocated to a single NU. A TN block allocation must contain either all numeric or all alphanumeric characters, but not a mixture of both types. The use of TN pools is not permitted. A system may subdivide its block for allocation to subordinate units. Each NU should be allocated a larger number of TNs than its local track capacity to account for temporary use of TNs by other units as a result of changes in reporting responsibility. Where this is not practical, TN blocks should be sized according to:

(1) Individual NU estimated data transmission requirements.

(2) Data forwarding requirements, as appropriate. An FNU may additionally be allocated a separate low TN block to be used for forwarding tracks to Link 11/Link 11B.

All Link 22 systems must maintain account of all TNs in their assigned block. The permitted allocation of Link 22 addresses and track numbers for Link 22 use is shown in Table 6.1. Messages directed to all units are addressed to the Collective Address (00177).

TN RANGE	NO. TNs	TYPE	TN USE
00000	1	N	No Statement
00001-00076	62	N	NU/FNUA/FNUAB/PU/FPU/FJUA/FJUAB/FJUN/FJUNA/ FJUNAB/C^2 JU/IJMS Unit/Group Identifier Addresses
00077	1	N	Illegal (not used)
00100-00175	62	N	NU/FNUB/FJUB/FJUNB/RU/FRU/ C^2 JU/IJMS Unit/Group Identifier Addresses
00176	1	N	Link-11/Link-11B Pseudo-Source TN
00177	1	N	Collective Address
00200-07776	3,967	N	Link-11/11B/16/22/IJMS Surveillance TNs or NU/JU/IJMS Unit Addresses
07777	1	N	Illegal (not used)
0A000-0Z777	12,288	AN	Link 16/22 Surveillance TNs
10000-17777	4,096	N	Link 16/22/IJMS Surveillance TNs or NU/JU/IJMS Unit Addresses
1A000-1Z777	12,288	AN	Link 16/22 Surveillance TNs
20000-27777	4,096	N	Link 16/22/IJMS Surveillance TNs or NU/JU/IJMS Unit Addresses
2A000-2Z777	12,288	AN	Link 16/22 Surveillance TNs
70000-77776	4,095	N	Link 16/22/IJMS Surveillance TNs or NU/JU/IJMS Unit Addresses
77777	1	N	Link 16 Network Manager Address
7A000-7Z777	12,288	AN	Link 16/22 Surveillance TNs
A0000-ZZ777	393,216	AN	Link 16/22 Surveillance TNs
TBD	1	TBD	SNMU Address

Legend: N = Numeric TN block (NU)
AN = Alphanumeric TN block (NU)

Table 6.1 Multilink Track Number Sequence and Use

6.1.9 Pseudo Data Source

In the multilink environment, multiple track numbering conventions are involved. Link 22, like Link 16, has the capability to utilise IU addresses as great as 77777. However, Link 11/Link 11B is limited to unit addresses no greater than 175. When data are forwarded from Link 22 for NUs having address(es) between 00200 and 77777, to Link 11/Link 11B, the data forwarder attributes all of that data to a pseudo data source address which is 00176. Commands or other addressed messages will not be forwarded from Link 22 units having addresses greater than or equal to 00200.

6.1.10 Data Reporting Rates

Link 22 data may be reported at one of two rates, Standard Update Rate (SUR) and High Update Rate (HUR). SUR or HUR will be used under the following circumstances:

a. Standard Update Rates - NUs will automatically report Link 22 messages at the SUR, in accordance with the appropriate message transmission protocols and prioritisation.

b. High Update Rates - Link 22 provides the capability to report selected tracks at a higher update rate when, for operational reasons, a rapid refreshment of data is required. Selection of HUR reporting has the effect of reducing the time between updates and the time after which a message is considered late, thus increasing its eligibility for transmission. HUR status can be applied only to real-time tracks. The increase in reporting rate effected by assigning HUR status depends on the Environment of the track, and is shown in Table 6.2.

Track ENV/CAT	Periodic Update Rate (seconds)	
	SUR	HUR
Air, Real-Time (Tolerance Level)*	12 (10-20)	** (>6**)
Air, Nonreal-Time (Tolerance Level)*	48 (36-72)	-
Surface, Real-Time (Tolerance Level)*	96 (72-120)	24 (20-30)
Surface, Nonreal-Time (Tolerance Level)*	140 (120-160)	-
Subsurface, Real-Time (Tolerance level)*	96 (72-120)	24 (20-30)
Land, Real-Time (Tolerance Level)*	96 (72-120)	24 (20-30)
Land, Nonreal-Time (Tolerance Level)*	140 (120-160)	-
Ballistic Missile, Real-Time (Tolerance Level)*	12 (10-20)	** (>6**)
Ballistic Missile, Nonreal-Time(Tolerance Level)*	48 (36-60)	-

Legend: * - Tolerance Level defines the period within which the track may be reported before it is designated as "Late". Earlier reports are not permitted. (NU)

** - Air/Ballistic Missile tracks designated HUR are reported following every sensor update, but no more frequently than 6 seconds for air tracks and, as requested by Data Update Request for Ballistic Missile tracks. (NU)

Table 6.2 SUR/HUR Reporting Rates

6.1.10.1 HUR status may be assigned under the following circumstances:

a. By operator action, where the operator determines that a real-time track is of particular importance to own unit or to the Link 22 operational community in general. HUR status may be assigned to:

(1) A track for which own unit holds R^2. HUR status must be cancelled by operator action once the operator considers that the operational reason for initiating HUR no longer exists.

(2) A remote track for which own unit holds no local data. A Start HUR Command message is transmitted, by operator action, addressed to the collective address and with the Objective TN set to the TN of the track. Upon receipt of the message, the NU with R^2 automatically sets HUR status on the track and commences reporting at HUR. When an

operator in the NU which ordered HUR reporting considers that the operational reason for HUR no longer exists, a Cease HUR Command message must be transmitted to cause the NU with R^2 to revert to SUR reporting of the track.

b. When a unit with command authority directs another NU to conduct an Engage/Assign action against a specific target, the Command message directing the action is automatically followed by a Start HUR Command message, addressed to the collective address, with Objective TN set to the TN of the target. If the NU ordered to take the action holds local data on the assigned target, HUR reporting is not required and that NU will transmit a Cease HUR Command message. Otherwise HUR reporting on the target will be maintained by the unit with R^2 until:

(1) The unit with command authority terminates the Engage/Assign action.

(2) The NU conducting the action reports "Effective/Target Destroyed/Grand Slam" or "Engagement Broken".

Note: The unit with command authority will automatically transmit a Cease HUR Command if the NU responds to the Engage/Assign action with a CANTCO or CANTPRO response.

6.1.10.2 Whilst HUR reporting provides a valuable capability to the operator for increasing the data refresh rate of an operationally significant track, its use must be strictly controlled. Excessive use of HUR can lead to greater numbers of lower priority tracks becoming excessively late, with a resulting increase in the number of R^2 shifts, causing disruption to the Link 22 interface. Operators must, therefore, ensure that, once manually initiated on a track, the requirement for HUR reporting is regularly reviewed and that an operator action is taken to terminate HUR reporting whenever that requirement is no longer considered to warrant HUR status on that track.

SECTION 2 - PARTICIPANT LOCATION AND IDENTIFICATION

6.2.1 Introduction

The PLI function is implemented by all Link 22 units and provides a self-reporting capability. All units operating with active status on Link 22 will automatically report data on own unit, including:

a. Position.

b. Course, speed and altitude (as appropriate).

c. Amplification data, e.g., strength, platform, activity, mission correlators.

d. IFF/SIF data.

6.2.2 Alert Status in PLI Reports

Individual NUs may assign themselves alert status by setting the appropriate alert indicator (Force Tell or Emergency) within the PLI message. Only an operator on an active NU is permitted to assign alert status to that NU. Once the alert condition has cleared, the alert indicator must be cleared by operator action. (For information on track alerts, refer to paragraph 6.4.4).

6.2.3 Exercise Status in PLI Reports

NUs participating as friendly assets in an exercise should report their exercise status by setting the Exercise Indicator in their PLI message. An exercise participant acting as a hostile force will not be an active NU on the same Link 22 friendly force network. When authorised, operators at NUs participating in an exercise may elect to report artificial data in own PLI messages, for training purposes only. Operators must not report artificial data without first assigning exercise status to own unit. Artificial values may be reported for the following data:

a. Command and Control Indicator.

b. Flight Leader Indicator (TBD).

c. Strength.

d. Platform.

e. Activity.

Operators receiving PLIs with the Exercise Indicator set should assume that the values reported for the above data are artificial and for training purposes only. All other data must be considered real.

6.2.3.1 When an NU ceases to participate in an exercise, the operator must clear the exercise status as reported by own unit. This action will automatically cause all artificial data to be cleared or set to default values immediately, and clear the Exercise Indicator in that unit's PLI report. Depending on system implementation, artificial data will be automatically replaced with real data or No Statement/default values will be reported until changed by the operator. NUs cannot change the exercise status of another active NU by Link 22 message; voice procedures must be used to request/order another active NU to change its exercise status. (For procedures on the use of the Exercise Status Change Order, refer to paragraph 6.3.6.6.3).

6.2.4 Indirect PLI Report

Indirect PLI reports are transmitted by FNUs on Link 22 and contain details of active PUs/RUs. Indirect PLI reports may be assigned alert status using the procedures outlined above.

6.2.5 Integration of PLI Reports Into the Surveillance Picture

PLI reports from active NUs are integrated into the surveillance picture, such that there is no requirement for active NUs to be reported by other units on the interface. However, once an NU switches to Radio Silent mode or goes inactive, it becomes eligible for track reporting. Procedures are contained in paragraph 6.3.5.

6.2.6 PLI Reports and Filters

PLI reports cannot be filtered from reception on Link 22.

SECTION 3 – SURVEILLANCE

6.3.1 Types of Surveillance Reports

Surveillance information derived from a number of sources, including data forwarded from other tactical data links (Chapter 7 for Data Forwarding procedures), is compiled by NUs and exchanged in the form of:

a. Air, surface, subsurface, land and space tracks.

b. Reference Points/Lines/Areas, Emergency Points and Land Points.

c. ASW Acoustic Reports.

d. Intelligence data.

e. IFF/SIF data.

f. Threat Warning Reports.

6.3.2 Protocols/Conventions for Surveillance Data Exchange

The exchange of surveillance data on the interface requires the following protocols and conventions to be adopted by all participating NUs:

a. Data Registration - Accurate data registration is fundamental to the operation of the interface, particularly for track correlation, and is discussed in paragraph 6.3.2.1.

b. Track Quality (TQ) – TQ is used to report the positional reliability of a track and is discussed in paragraph 6.3.2.2.

c. Reporting Responsibility (R^2) - R^2 is discussed in paragraph 6.3.2.3. R^2 rules are defined, according to the type of data being reported, and are summarised under the appropriate sections of this chapter.

d. Standard Identity - Standard identity definitions are used by all NUs to report surveillance data over Link 22 and are listed at paragraph 6.3.2.4.

e. Track Correlation - Correlation is necessary to resolve dual designations; procedures are contained in paragraph 6.4.6.2.

f. Track Decorrelation - Decorrelation is necessary to prevent duplicate track numbers; procedures are contained in paragraph 6.4.6.3.

g. Minimum Wait Time - After entering a network, returning to Active status from Inactive status or TDS failure, or deactivating a filter, NUs capable of assuming R^2 for air, space, surface or land tracks should wait a minimum amount of time before transmitting tracks in order to ascertain R^2, execute correlation and perform data registration. Failure to wait can create unnecessary R^2 shifts and dual designations, resulting in severe degradation of the overall surveillance picture; procedures are contained in paragraph 5.3.1.

6.3.2.1 Data Registration

Data registration is a condition of correct relative alignment between local and remote track positional data. It involves measuring and adjusting positional data. Optimum interface data registration occurs when all NUs hold their locally derived track positional data at the same geodetic position as remote positional data for the same tracks. Poor data registration will degrade a system's ability to correctly correlate local tracks with remote tracks.

6.3.2.1.1 Errors Affecting Data Registration

The errors that affect data registration are listed below:

a. Local unit errors in:

(1) Geodetic position.

(2) Sensors.

(3) Data processing.

b. Remote unit errors.

6.3.2.1.2 Magnitude of Errors

The magnitude of the errors will vary according to the characteristics and configuration of each NU. For example, a stationary NU that has been accurately surveyed has fewer potential errors of geodetic position than a mobile NU with limited navigational capability. Regular gridlocking is required to align the surveillance pictures of all NUs and thereby achieve a common correlated force picture.

6.3.2.2 Track Quality

The positional reliability of a real-time air, surface or land track is reported by its TQ which is a numerical value from 1 to 15, with the higher values indicating higher accuracy of track positional data, as defined in Table 6.2a. The TQ of a track is assigned based on an area within which there is a 95% probability that the track lies, as determined by the unit reporting the track. Nonreal-time tracks are assigned track quality of zero.

TQ	Maximum Error
15	18 feet
14	36 feet
13	60 feet
12	120 feet
11	300 feet
10	600 feet
9	3500 feet
8	1.18 dm
7	2.93 dm
6	5.92 dm
5	8.87 dm
4	11.82 dm
3	14.78 dm
2	29.61 dm
1	>29.61 dm

Table 6-2a - Maximum Positional Errors Represented by TQ

6.3.2.2.1 The TQ of a space track is a measure of the reliability of the kinematic data reported on the track. This will be determined automatically by the NU with R^2.

6.3.2.2.2 Operators must not artificially increase TQ. (e.g., some systems may have a variable track quality capability, described below, which is operator controlled.)

a. Some surface IUs and air platforms have a capability to manually enter a maximum TQ value, between 3 and 15, depending on the link, to be assigned by that IU to any track, regardless of whether the unit is operating on Link 11, Link 11B, Link 16 or Link 22. This capability allows the Interface Control Officer (ICO) or the Track Data Coordinator (TDC) (see paragraph 6.4.1.2) to direct IUs with less accurate sensors to limit their TQ in order to ensure that the most accurate positional data is reported on the interface. It also provides a means of biasing R^2 towards the Gridlock Reference Unit (GRU) when

necessary to ensure that the GRU reports a sufficient number of tracks to allow proper gridlock.

b. Variable Track Quality settings may be specified for some IUs in the OPTASK LINK in the GENTEXT/REPORTING REQUIREMENTS set during operations as the situation dictates.

6.3.2.3 Reporting Responsibility

The purpose of R^2 rules is to ensure that new tracks are reported and that existing tracks are maintained with the best data available within the interface. All NUs are responsible for reporting local tracks that cannot be correlated with remote tracks being received from another unit. When a local track is correlated with a remote track, it is referred to as a common track, and R^2 rules are applied to ensure that only the NU with the best positional data on the track reports it on the Link 22 interface. R^2 rules applicable to air, surface and land track reporting are contained in paragraph 6.3.3.4; those applicable to point reporting are contained in paragraph 6.3.4.6; R^2 rules for the reporting of subsurface tracks are contained in paragraph 6.3.8.1; rules for the reporting of space/ballistic missile tracks are to be found at paragraph 6.3.9.

6.3.2.4 Standard Identity

Standard identity is reported by all NUs using the following definitions:

a. Pending (PEN) - A track which has not been subjected to the identification process.

b. Unknown (UNK) - An evaluated track which has not been identified.

c. Assumed Friend (AS FRD) - A track which is assumed to be a friend because of its characteristics, behaviour, or origin.

d. Friend (FRD) - A track belonging to a declared friendly nation.

e. Neutral (NEU) - A track whose characteristics, behaviour, origin, or nationality indicate that it is neither supporting nor opposing friendly forces.

f. Suspect (SUS) - A track which is potentially hostile because of its characteristics, behaviour, origin or nationality.

g. Hostile (HOS) - A track declared to belong to any opposing nation, party, group or entity, which by virtue of its behaviour or information collected on it such as characteristics, origin or nationality contributes to the threat to friendly forces.

6.3.2.4.1 Special Interest Tracks

a. Tracks may also be identified as being of Special Interest. This designation is generally independent of the track Category, Identity, and other identifying information, except for the limitations listed below. The reason for the special interest is normally not specifically reported on the interface, but should be reported by voice as necessary. The following limitations on use of the Special Interest designations are defined in data link documents:

(1) An Air Suspect track must not be designated Special Interest unless it meets the criteria for a ZOMBIE (see Glossary). Any Special Interest Air Suspect track received will be considered a ZOMBIE.

(2) A Surface Suspect track must 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 will be considered a TRAVELLER.

(3) An Air Friend track must not be designated Special Interest unless it meets the criteria for KILO (see Glossary). Any Special Interest Air Friend track received must be considered a KILO.

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

6.3.3 Reporting of Surveillance Tracks

All tracks in the surveillance picture are derived either from real-time or nonreal-time data.

a. Real-Time Tracks - Real-time track reports on contacts are normally based on track data derived from either active sensors (e.g., radar, Identification Friend or Foe (IFF)) or passive sensors (e.g., ESM, ECM detection). The Passive/Active Indicator in air, surface and land track reports indicates whether reports of positional data have been derived by active or passive means. Real-time tracks are always reported with positional data extrapolated to the time of report transmission. When sensor contact is interrupted, the reporting unit continues reporting the track and decrementing TQ as appropriate.

b. Non-Real Time Tracks - Non-Real time tracks are reported with TQ=0. An operator action is required to designate a track as nonreal-time. Nonreal-time track reports should be used for contacts if any of the following conditions prevail:

(1) The track data originated from a non-tactical data system (non-TDS).

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

(3) The track data have been derived from other than integrated sensors.

(4) The operator judges that the time elapsed since the last update based on sensor information is such that the validity of the track position is questionable.

c. Passive Tracks - Passive tracks are tracks which have been derived by passive detection means, e.g., Electronic Warfare support (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 ASW system developing the track fixes is considered an integral sensor. Although such tracks can be originated on and forwarded to Link 11 or Link 11B, the fact that they were derived by passive detection means cannot be reported on Link 11 or Link 11B.

6.3.3.1 Action on Loss of Sensor Contact

If the loss of sensor contact continues, subsequent track reporting is determined by individual system design which provides one or more of the following alternatives:

a. Automatic purging of the track and initiation of a Drop Track Report if R^2 is held.

b. Operator action to continue reporting the track. 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.

c. Replacement with a nonreal-time track.

6.3.3.2 Reporting Responsibility for Tracks

The R^2 rules for the reporting of air, surface and land tracks are summarised below:

a. The NU which initiates a track report has R^2 for that track.

b. An NU transmits a track report only when R^2 is held for that track.

c. An NU will automatically assume R^2 on a track for which local data is held under any of the following conditions:

(1) Local TQ at the time of transmission exceeds the received TQ by two or more, or remote TQ is equal to local TQ and the local Source TN is greater than the reporting unit's Source TN.

(2) Real-time data are held locally and nonreal-time data were received.

(3) A remote report has not been received on an air track for approximately 40 seconds (10 seconds if track has HUR status), or on a space track for approximately 25 seconds (10 seconds if track has HUR status) or on a surface or land track for approximately 240 seconds (30 seconds if track has HUR status).

(4) A Drop Track report is received on a track for which local reporting eligibility remains and a remote track report has not been received on that track. Immediately prior to assuming R^2 for an air or surface track after receipt of a Drop Track message, an NU shall test the track for correlation in accordance with paragraphs 6.6.16.1.1, 6.6.16.1.2, and 6.6.16.1.3, except the test shall be conducted only once.

(5) A nonreal-time track is updated locally by a new nonreal-time report. (Note: the time value in a nonreal-time track report is not a criterion for a change in R^2).

(6) A PLI message is received, with the Network Participation Status (NPS) Indicator (NPS IND) set to Inactive, Radio Silence or TDS Failure, from an NU that has R^2 for a locally held track for which local reporting eligibility remains and a remote track report has not been received on that track.

d. An NU with R^2 on a track will retain R^2 until it is relinquished in accordance with the above rules or until the track is dropped.

6.3.4 Point/Line/Area Reporting

Data may be exchanged over Link 22 on various types of points/lines/areas for surveillance purposes.

6.3.4.1 Reference Points/Lines/Areas

NUs may transmit the Reference Point/Line/Area message to report tactically significant geographic references in the form of points, segmented lines, multi-sided areas, circles ellipses and volumes (e.g., waypoints, Combat Air Patrols (CAPs), Forward Edge of the Battle Area (FEBA), Missile Engagement Zones (MEZ), Hostile Weapon Zones (HWZs), safe corridors). Corridor widths are defined such that when reporting a Corridor or Low Level Transit Route, the width value specified represents the value that is closest to but does not exceed the required width. The reported line represents the centre line of the corridor or LLTR. Each point, line or area is assigned a TN by the reporting NU. Positional data is reported using geodetic (latitude/longitude) values. Altitude/elevation data may also be reported, as appropriate. Corridor Altitude and altitude ranges apply only to a single word sequence, i.e., a single track number. This is to allow different altitudes to be applied to different segments of the same line. Points, lines and areas may be reported with associated time in hours/minutes and Time Function, to define the meaning of time as used in the report (e.g., Time of Activation, Deactivation).

6.3.4.1.1 The originator of a reference point/line/area retains R^2 as long as the originator remains active and reports the point. If the point/line/area is dropped, the originator is declared inactive or no periodic update is received for three consecutive update intervals, another NU may, by operator action, assume R^2 for the point/line/area. If an operator requires immediate information on a point/line/area for which his unit does not hold R^2, a Data Update Request should be transmitted with the Reference TN set to the TN of the desired point/line/area (see paragraph 6.4.5.3.2).

6.3.4.1.2 Procedures for the use of the Exercise Indicator when reporting points/lines/areas are contained in paragraph 6.3.6.4.

6.3.4.1.3 Any NU may initiate/terminate a Force Tell alert on a point, line or area; emergency alerts are not used on reference points, lines or areas (see paragraph 6.4.4.3).

6.3.4.1.4 Points must not be correlated with any other point or track. Operators may report an association between a point and another point or track (see paragraph 6.4.10).

6.3.4.2 Emergency Points

NUs will use the Emergency Point message to report the location of an emergency condition that requires search and rescue. Operators should include the type of emergency and personnel involved, where this information is known. An NU may report on a previously reported emergency point when that unit has additional or more current data on the point. The NU may also report the point if the originator drops the point, is declared inactive or has not updated the point. The latest unit to report on the emergency point has R^2 for it. In both cases, operator action is required.

6.3.4.2.1 Emergency points will be forced through data filters and are, therefore, not required to be reported with Force Tell or Emergency alert status. If an emergency point is reported for training purposes, the operator must set the Exercise Indicator prior to transmission (see paragraph 6.3.6.5). Operators may report an emergency point as related to a previously reported track or point (e.g., to report the position of a downed aircraft - see paragraph 6.3.4.2.2).

6.3.4.2.2 If an NU loses all contact with a friendly track and there is cause to believe that an emergency situation exists, the operator should establish an emergency point at the last reported position of the track. The TN of the previously reported track should be entered as the Related TN and the IFF/SIF modes and codes of the track should also be included in the emergency point report. Some Air nonC^2 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 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 C^2 JUs automatically report such a Bailout Point upon receipt of the PPLI from an aircraft under their control. However, any C^2 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. (Some IUs receive the Emergency Point, “PU Bailout,” as a “Man-in-the-Water” Emergency Point.)

6.3.4.2.3 The terminate Emergency Point sequence will normally be transmitted by the NU in charge of the Search and Rescue or Emergency Search operation but may be transmitted by an NU delegated to do so by the unit in charge of the operation. The unit will terminate the Emergency Point:

a. By assuming R^2 for the Emergency Point, if not already held.

b. By transmitting the Emergency Point message with the Time Function set to Deactivation Time and the time set to the hours and minutes at which the emergency has been terminated.

c. Following this by transmission of a Drop Track message for the Emergency Point TN.

6.3.4.2.4 Following receipt of the Drop Track message, or after a suitable time interval if no updates of the Emergency Point are received, the Emergency Point may be purged by operator action.

6.3.4.3 Land Points

NUs will use the Land Point message to report the location of fixed ground units or objects, e.g., airbases, troop concentrations.

6.3.4.4 Moving Points/Lines/Areas

Reference points, lines and areas may be reported with course and speed data to indicate movement. Position and Intended Movement (PIM) and Submarine Position and Intended Movement (SIM) points should be reported with an activation time at which the reported position, course and speed becomes effective. Other points/lines/areas established with an activation time in the future will only be reported as moving once the activation time has been reached. Emergency and land points are only reported as static points. A change in geodetic position must be transmitted to show that an emergency or land point has shifted.

6.3.4.5 Slaved Points/Areas

Certain reference points and regular areas may be slaved to a track being reported on the interface (e.g., a marshal point used during aircraft recovery operations onboard an aircraft carrier). The position of a slaved point or area is reported as a constant bearing (true or relative) and range from the related track. Lines and irregular multi-sided areas cannot be slaved. Anti-Submarine Warfare (ASW) AOPs cannot be slaved but an operator may associate an ASW AOP to a track or point (e.g., a subsurface track for which contact has been lost or a datum point) by transmitting an Association message (see paragraph 6.4.10).

6.3.4.6 Reporting Responsibility for Points/Lines/Areas

For reference points/lines/areas and land points, the following R^2 rules apply:

a. The NU originating the point/line/area retains R^2 as long as that NU remains active and reports the point/line/area.

b. An NU may, by operator action, assume R^2 for a point/line/area, using the same Reference TN, only under one of the following conditions:

(1) A Drop Track message is received on the point/line/area.

(2) The NU holding R^2 goes Radio Silent or Inactive.

(3) No report is received for three or more consecutive update intervals.

6.3.4.6.1 The R^2 rules for the reporting of emergency points are as follows:

a. Any NU may, by operator action, report on a previously reported emergency point when that NU has additional or more up-to-date information on the point.

b. An NU may assume R^2 for an emergency point, by operator action, only under one of the following conditions:

(1) A Drop Track message is received on the point.

(2) The NU holding R^2 goes Radio Silent or Inactive.

(3) No report is received for three or more consecutive update intervals.

6.3.5 Reporting of NU Data

6.3.5.1 Active NUs

NUs will automatically attempt to correlate received PLI reports with local sensor data. Where correlation is found, a separate track shall not be reported, except when a PLI report is received from an NU with the NPS Indicator set to Limited Status as indicated in Table 6.3.

NPS LIMITED STATUS	ACTION REQUIRED
Inactive	2
Radio Silent (Passive)	2
High Error Rate	1
TDS Failure	1,3

Actions:

1. Received PLI accepted in preference to received surveillance data for same TN.

2. An NU with local track data will immediately assume R^2 for this NU using the NU Address as TN.

3. Errors may exist in received PLI. NUs with local track data may initiate an associated track for surveillance using TN from the NU's assigned TN block.

Table 6.3 PLI Versus Surveillance R^2

6.3.5.2 Inactive NUs

a. When an NU determines another NU is no longer active on the interface and that NU holds local data on the inactive NU, it will report the position of the inactive NU in a Surveillance Track Report with an identity of Friend. The most current IFF/Selective Identification Feature (SIF) [IFF/SIF] data available will be reported. Where locally derived IFF/SIF data differs from that previously reported by the inactive NU, the locally derived data will be transmitted. The Reference TN will be set to the inactive NU's assigned address. Values of platform and activity data previously reported by the inactive NU will also be retained. This action will also apply if a Drop Track report is received from an FNU with respect to an Indirect PLI report.

b. When an NU assumes R^2 for an inactive IU, it automatically sets a "PLI TN/ID Indicator" in the track reports, indicating that the TN is the IU's address and the Friend Identity (ID) is based on previous receipt of PLI reports from the IU. A "PLI IFF/SIF Indicator" may also be set to indicate that the Mode II or all IFF/SIF mode codes reported for the track are based solely on PLI 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.

6.3.6 Reporting of Exercise Data

Link 22 provides operators with the capability to report exercise data over the interface. Exercise data constitutes data on real vehicles which may be reported with artificial values for training purposes only. Operators should note that the reporting of artificial data is only permissible when authorised prior to operations and promulgated in the OPTASK LINK and

must never be reported on any track with non-exercise status, as indicated by the setting of the Exercise Indicator. However, data which impacts directly on unit safety (e.g., positional data) will always be interpreted as real and must never be reported with artificial values. Detailed procedures for the reporting of exercise data are contained in the following paragraphs.

6.3.6.1 Exercise Tracks

Tracks may be reported with the Exercise Indicator set to enable exercise and non-exercise tracks to be distinguished on the interface. Exercise tracks are live tracks which are participating in an exercise. The Exercise Indicator will be set to "Exercise Track" by operator action, to report exercise status on a track. This status will remain valid until a further operator action is taken to set the Exercise Indicator to "Non-Exercise Track" (see paragraph 6.3.6.6). Operators should note that Link 11 only supports the reporting of Air and Surface Exercise Hostile (brevity Code “Faker”) and Exercise Suspect (“Joker”) tracks. All other Exercise Tracks originated on Link 22 are forwarded to Link 11 only as General Friend tracks. Operators must not attempt to assign exercise status as follows:

a. To tracks which have a standard identity other than Friend.

b. To tracks which have emergency alert status.

c. To any other active NU. (For procedures on assignment of exercise status to own unit, see paragraph 6.2.3). Inactive NUs are not subject to this restriction.

6.3.6.1.1 When exercise status has been assigned to a track, the exercise identity of that track is for exercise purposes only and may be set to one of the following:

a. Exercise Pending.

b. Exercise Unknown.

c. Exercise Assumed Friend.

d. Exercise Friend.

e. Exercise Neutral

f. Joker (a friendly track acting as Suspect for exercise purposes).

g. Faker (a friendly track acting as Hostile for exercise purposes).

6.3.6.1.2 When authorised, operators may elect to report artificial data in exercise track reports, for training purposes only. Operators must not enter artificial values without first assigning exercise status to the track concerned. Artificial values may be reported for the following data:

a. Special Interest Indicator.

b. Strength.

c. Platform/Activity.

d. Specific Type.

Operators receiving track reports with exercise status set should assume that values reported for the above data are artificial and for training purposes only. All other data must be considered real. Artificial IFF/SIF codes will not be reported.

6.3.6.1.3 Emergency Indicator on Exercise Tracks

Operators must only set the Emergency Indicator on a track with exercise status to report a real emergency over Link 22. 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 (see paragraph 6.3.6.5).

6.3.6.1.4 Force Tell Indicator on Exercise Tracks

Operators may set the Force Tell Indicator (FT IND) on a track with exercise status. The FT IND is always real and never artificial.

6.3.6.2 Exercise Threat Warning Reports

When a Threat Warning (FJ15.0) report is transmitted to report threat information on a track with exercise status, all threat data included in the report should be considered artificial and for exercise purposes only.

6.3.6.3 Exercise Reference Points/Lines/Areas

Operators may initiate MEZs or HWZs with exercise status for reporting on the interface. Exercise MEZ or HWZ definitions should be considered artificial and for training purposes only, posing no danger to friendly forces. No other reference points, lines or areas can be reported with exercise status. Operators must not change the Exercise Indicator to "Exercise MEZ or HWZ" if the MEZ or HWZ has been previously established with the Exercise Indicator set to "Non-Exercise MEZ or HWZ".

6.3.6.4 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 training purposes only. Operators must not change the Exercise Indicator to "Exercise Emergency Point" if the emergency point has been previously established with the Exercise Indicator set to "Non-Exercise Emergency Point".

6.3.6.5 Termination of Exercise Status

Termination of exercise status on surveillance reports can be achieved either:

a. By operator action to clear exercise status on an individual TN.

b. By operator action to clear all exercise data from the interface.

When an operator takes action to clear the exercise status of any individual track, the following automatic actions will be taken; the identity will be set to Exercise Friend, any artificial data will be reset to real values, if available, or to No Statement/default values and the Exercise Indicator in the track report will be set to "Non-Exercise". This will cause the track to be transmitted with an ID of Friend. If the track is the subject of an engagement, the operator should ensure that the engagement is terminated on the interface. These procedures also apply to inactive NUs.

6.3.6.6 Exercise Status Change Order

In a multilink interface, the NMU must parallel the Link 22 Exercise Status Change Order with a voice order, “Cease Exercise Track Reporting.” to all IUs other than Link 22 and some C^2 JUs, e.g., US Model 5, if the Exercise Status Order is transmitted prior to the scheduled or intended finish of the exercise (FINEX). The voice FINEX order has the same effect as the Exercise Status Order for interface track reporting. Some IUs, e.g., US Model 5, operating on Link 11 should be able to enter a received “Cease Exercise Track Reporting” or FINEX order into the Combat Direction System (CDS) and the above actions will occur automatically for all Fakers and Jokers

6.3.6.7 On cessation of an exercise, during which exercise data has been exchanged over the interface, it is essential that all exercise data be rapidly cleared from the Link 22 interface. This requires operator action at the unit with command authority to initiate an Exercise Status Change Order for transmission to all other NUs. On receipt of an Exercise Status Change Order, all systems will automatically:

a. Alert the operator.

b. Set the identity of all exercise tracks held to Exercise Friend.

c. Reset all data held which may contain artificial values, including data on own unit, to No Statement/default values until real values are available.

d. Clear the exercise status of own unit and set the Exercise Indicator of all tracks held with the status "Exercise Track" to "Non-Exercise Track". This will cause the tracks to be transmitted with an ID of Friend.

e. Where system capabilities allow, inhibit transmission or reception of any further exercise data.

6.3.6.7.1 When alerted to the receipt of an Exercise Status Change Order, NU operators should:

a. Implement exercise filters, if own system does not incorporate an automatic exercise inhibition capability, in order to prevent the transmission of exercise data.

b. Ensure that all locally originated engagements involving former exercise tracks are broken or cancelled.

c. Ensure that all locally originated commands involving former exercise tracks for NUs having address(es) between 00200 and 77777 are terminated.

d. Ensure that all MEZs or HWZs and emergency points generated with exercise status, and for which R^2 is held, are terminated on the interface.

e. Enter real values for those data which may have contained artificial values, as appropriate.

6.3.7 Reporting of Simulated Data

Simulated tracks (including points, bearings, fixes and AOPs) and units, which are not derived from any live sensor data, may be reported on the interface for training or test purposes. All data generated from simulated sensor inputs must be reported with the Simulation Indicator set. The simulation status of a track cannot be changed on Link 22. If, for reasons of operator error, it is necessary to correct the simulation status of a track, the operator must drop the track and initiate a new track report with the correct status. NUs may have the capability to filter simulated track/PLI reports. These tracks/units must not be correlated with live tracks.

6.3.7.1 Simulation Procedures

Simulated and live data may be reported concurrently. All of the procedures and capabilities provided for live tracks, points, EW Product data, and IUs apply equally to simulated tracks, except as follows:

a. Simulated data are clearly distinguished from live data on operator displays.

b. Simulated tracks will not be correlated with live tracks. However, simulated data may be paired or associated with live data, and a simulated track may be engaged with a live track.

c. Track alerts do not force simulated data through filters.

6.3.7.2 Simulation Restrictions

a. The capability to simulate tracks, points and EW data (Sim tracks) differ technically from the capability to simulate IUs (Sim IUs). Some IUs are capable of recognising Sim Tracks and Sim IUs. However, other IUs cannot recognise Sim tracks and/or Sim IUs. Such IUs will believe that the Sim Track or Sim IU is a live track or IU. This is obviously operationally undesirable. These are referred to as "Sim Track Limited" and "Sim IU Limited" IUs. NUs are expected to be capable of recognising simulated tracks and simulated IUs.

b. The OTC must determine whether any IU is Sim Track Limited and/or Sim IU Limited. This information will be provided by participating IUs during the planning phase of the exercise. ***If any Sim Track Limited IU is in the interface, the NMU must direct that Simulation Filters be inserted as necessary to ensure that Sim Tracks are not originated on, or forwarded to, any link on which a Sim Track Limited IU is operating. If any Sim IU Limited IUs are in the interface, the NMU must direct that no Sim IUs be reported on the interface.***

c. A live track will not be initiated based on simulated video, nor will a simulated track be initiated based on live video.

d. A simulated track will not be changed to a live track, nor will a live track be changed to a simulated track. In the event 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.

6.3.8 SAM Reporting

Land-based Surface to Air Missiles (SAMs) are reported in Land Track/Point messages, defining the location and specific type (if known) of the SAM. Ship-based SAMs are reported in Surface Platform and System Status messages, defining the location and specific type (if known) of the SAM. Airborne assets receiving hostile SAM information will be able to determine doctrinal SAM engagement envelopes from Specific Type information contained in the reports. When required to pass generic doctrinal weapon engagement zones for hostile anti-air threats to provide an avoidance cue to friendly aircraft, these are to be reported in Reference Point messages using Point type Area/Hazard/Hostile Weapon Zone.

6.4.1 Introduction

Different rules apply to the reporting of subsurface surveillance information, as compared with other tracks, because of the nature of the data source. Tactically significant information derived from ASW sensors may be reported on the Link 22 interface in a number of forms.

6.4.2 Subsurface Tracks

The R^2 rules for the reporting of subsurface tracks are different from those for air, surface, land and space tracks. Subsurface tracks are not reported with track quality. An Anti-submarine Warfare Link 22 Unit (ASW NU) detecting and reporting a contact will retain R^2 of that TN, rather than of the track. Other ASW NUs may report on what is believed to be the same contact but must use a different TN and must only report locally derived data on that contact, unless a Drop Track report is received on that TN or a report is not received for two successive period updates. Operators should report a data association (see paragraph 6.4.10) to indicate that two, or more, TNs are being used to report information believed to pertain to the same object. However, where an operator is certain that a local contact is the same as that being reported on the Link 22 interface, that operator may initiate the transmission of an ASW Contact Confirmation Report. The Contact Level should be set to "Hot" and the Reference TN set to the TN used to report the track on the interface.

6.4.2.1 All subsurface track reports are time tagged to the nearest minute. Initial contacts are reported with Time Function set to "Time Contact First Acquired"; subsequent reports specify "Time of Current Positional Data". When contact is lost, a subsurface track report is transmitted with Time Function set to "Time Contact Lost".

6.4.3 Datum Reporting

a. When contact is lost on a subsurface track, the operator may elect to continue reporting the track as a Datum with the same Reference TN. The report will contain data on the time contact was lost, last known position, last calculated course and speed and type of sensor which held contact before contact was lost. All data will remain the same as reported in the initial Datum report unless changed by operator action. The Datum will remain stationary until contact is regained or the Datum is dropped by operator action.

b. When a Datum has been established and contact is subsequently gained, the contact should be reported as a new subsurface track with a TN different 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.

c. The following action 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 Anti-Submarine Warfare Commander (ASWC) or any other IU believing the new contact and Datum to be the same should associate them.

(3) When the ASWC is confident the new contact is the same as the Datum, he should direct the IU which 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.

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

d. Datums may also be established independently from 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.

6.4.4 Acoustic Bearing/Range Reports

Acoustic Bearing/Range messages are used to report acoustic bearing and/or range of subsurface contacts from the detecting sensor origin. As with subsurface tracks, track quality is not applied and R^2 is retained by the unit originating the report. Other ASW NUs wishing to report the same acoustic contact, must use a different TN. Bearings are reported from the sensor origin. Where a bearing is determined to be ambiguous, two bearings should be reported from the same origin, otherwise a single, resolved bearing is reported. Either range or bearing can be reported independently. Additional information such as frequency, bearing accuracy and source associated with the bearings may also be reported.

6.4.5 ASW Points/Lines/Areas

ASW points, lines and areas may be used to report positional and other information on a potential target when no sensor measurement of course/speed is available for reporting as a track. Reports include data on Time and Time Function (e.g., time established, activated, deactivated). ASW points, lines and areas may also be reported to assist in the coordination of ASW assets and mission planning (e.g., No Attack (NOTACK) Area, Friendly Weapon Danger Area (FWDA)). Such reports are reported with time of activation and deactivation.

6.4.6 Association Between Subsurface Tracks and ASW Points/Lines/Areas

A Sinker, Brief Contact, Estimated Position (EP) or ASW Fix must be established with a different TN than the Subsurface Track or Passive Contact, if any, to which it is related. The operator should associate the point to the track or contact if applicable. However, if one of these four types of ASW points is changed to another of these four types, it automatically retains the same TN. An ASW 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. ASW AOPs are reported as follows:

a. The area may be circular, elliptical, square, or rectangular, of a radius up to 248 miles.

b. An ASW 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 Track or Datum.

c. 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 in order to cause the AOP to move with the same course and speed as the associated track.

d. When an ASW AOP is converted to an ASW FIX, or vice versa, it automatically retains the same TN.

SECTION 5 - SPACE AND BALLISTIC MISSILE REPORTING

6.5.1 Introduction

Space and ballistic missile surveillance tracks are reported using the Space Track message. In addition, the Reference Point message is used to report the actual or expected Launch Point and Impact Point associated with a specific ballistic missile. These messages are exchanged to provide targeting and threat warning information among systems involved in Theatre Ballistic Missile Defence operations.

6.5.2 Reporting Responsibility Rules

6.5.2.1 Ballistic Missile Reporting Responsibility - The R^2 rules for the reporting of ballistic missile tracks are summarised below:

a. The NU which initiates a ballistic missile track report has R^2 for that track.

b. An NU transmits a track report for a ballistic missile track only when R^2 is held for that track.

c. An NU will assume R^2 on a track for which local data is held under any of the following conditions:

(1) Local TQ at or before time of the remote time tag exceeds the received TQ by one or more, or remote TQ is equal to local TQ and the local Source TN is greater than the reporting unit's Source TN.

(2) A remote ballistic missile track is being reported with the Lost Track Indicator set to "Lost Track" and local "Tracking" data is held with a TQ of no less than 4 of that in the remote report.

(3) Real-time data are held locally and nonreal-time data were received.

(4) A remote report has not been received on a locally held ballistic missile track for 25 seconds (10 seconds for a track with HUR status). This rule only applies when the last remote report was received with the Lost Track Indicator set to "Tracking".

(5) A Drop Track report is received on a ballistic missile track for which local reporting eligibility remains and a remote track report has not been received on that track.

(6) A nonreal-time ballistic missile track is updated locally by a new nonreal-time report. (Note: the time value in a nonreal-time track report is not a criterion for a change in R^2).

d. An NU with R^2 on a track will retain R^2 until it is relinquished in accordance with the above rules or until the track is dropped.

6.5.2.2 Launch and impact Point Reporting Responsibility - The R^2 rules for the reporting of ballistic missile launch points and impact points are summarised below:

a. Any NU may initiate a report of an actual ballistic missile launch point or impact point. The originator of such a report retains R^2 for the point until it is relinquished.

b. The NU initially reporting a ballistic missile track may initiate an Impact Point report and may initiate a report on the related Launch Point. R^2 for the related Impact Point report will remain with the NU holding R^2 for the ballistic missile track.

c. An NU assuming R^2 for a ballistic missile track need not assume R^2 for the related Launch Point. The NU no longer holding R^2 for a ballistic missile track may continue to report the related Launch Point.

6.5.3 Reporting of Ballistic Missile Tracks

Ballistic missile tracks are reported as real-time tracks even if based on data derived from non-organic sensors. Ballistic Missile Track reports provide the positional data, velocity and error estimate data with the precision required for engagements. These reports contain a TQ field (see paragraph 6.3.2.2) and are time tagged to the integer second nearest to the time of measurement. All position, velocity and covariance data are extrapolated and interpolated with respect to this reported time; these tracks are not extrapolated to time of transmission. A Ballistic Missile Track report is not initiated if the predicted time to impact is less than 16 seconds or the altitude is less than 8 data miles (DMs) away from the estimated impact point.

6.5.4 Launch Point Reporting

The Reference Point message is used to report the actual or expected launch point. The Time Function field is used to enable reporting of past, present and future launch points. The message also provides the capability to relate the launch point to a ballistic missile track. The positional accuracy of the data is defined as an area within which there is a 95% probability that the point is located. A ballistic missile launcher that has been detected by sensors will be reported using the appropriate surveillance track report.

6.5.5 Impact Point Reporting

The Reference Point message is also used to report the actual or expected impact point and time of impact. The message provides the capability to relate the impact point to a ballistic missile track. The NU with R^2 for a 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.

6.5.6 Lost Track

A ballistic missile track is considered lost when the NU with R^2 does not receive any local sensor data since the last transmitted update, or the NU with R^2 uses own system criteria to determine that the track is lost. When this occurs, a Ballistic Missile Track report with Lost Track Indicator set to “Lost Track”, containing data held at the time of last sensor contact, is transmitted periodically unless another NU assumes R^2 or the estimated point of impact has passed.

SECTION 6 - INFORMATION MANAGEMENT

6.6.1 Track Management

On many occasions messages are exchanged on the interface for the purpose of managing and/or enhancing existing tactical data. These messages, while not reporting track information, manage and effect the flow of the information being reported on the interface.

6.6.2 Track Data Coordinator

The duty of Track Data Coordinator (TDC) is similar to that of Force Track Coordinator (FTC) in Link 11 operations but encompasses additional responsibilities. A TDC will be designated for the Link 22 interface. The ability of the TDC to effectively coordinate the efforts of all IUs to maintain a clear tactical picture depends on the information that is directly available to him on a real-time basis. The value of the database information depends on its quantity, quality and timeliness. Therefore, the individual designated as the TDC should have direct access to the maximum number of active tracks and reliable voice net communications with the maximum number of IUs. The TDC should have voice communications with Track Supervisors in all IUs. The TDC has overall responsibility to:

a. Assist in preparation of the OPTASK LINK (see section 4.3).

b. Manage the exchange of track data and related actions to ensure clarity of the tactical picture.

c. Supervise the resolution of interface anomalies such as dual designations, duplicate tracks, false tracks, runaway tracks, and identification and category conflicts.

d. Transmit Change Data Orders (CDOs) to resolve Environment and Identity conflicts when required.

e. Coordinate changes in areas of responsibility for surveillance as the tactical situation requires.

f. Coordinate and authorise the use of data filters.

g. Designate the EW Data Forwarding mode.

h. Act as net control station for the Track Supervision Net (TSN)

i. Designate the inter-Link GRU and direct inter-Link GRU changes as required.

The TDC responsibilities do not replace individual IU responsibilities in these areas.

6.6.3 Cease Reporting

The Drop Track Report should be used by NUs to report that they have dropped or ceased to report a track or point/line/area for which they hold R^2, unless either of the following conditions applies:

a. R^2 for the track is relinquished in accordance with normal R^2 protocols.

b. The subject track becomes an active IU on the interface with the same reported TN.

Tracks or points/lines/areas that are the subject of a Drop Track Report are eligible to be reported by another NU that holds valid reportable data and that elects to assume R^2.

6.6.4 Commonality of Data

When locally held data differ from the corresponding data received from another NU, a potentially disruptive situation known as a data difference exists. A data difference can occur only when local data is held on a track received from a remote source. Depending on the data involved, some action may be required to cause all NUs to hold common values for that data, although it should be noted that many types of data are not subject to this procedure (e.g., position, velocity, altitude/elevation). Operators should be aware that the locally held value for such types of data may vary from NU to NU and may indicate a Duplicate TN condition (see paragraph 6.4.6.3).

6.6.5 Difference Reporting and Conflict Resolution

The exchange of surveillance data requires procedures to recognise and resolve data differences that may occur. Recognition, resolution, or some corrective actions are applied to data differences in the following track data items.

a. Track Environment data.

b. Track Identity data.

c. Track IFF/SIF data.

d. Platform, Activity and Specific Type data.

Some data differences of Identity or IFF/SIF can be automatically resolved, whereas others are of sufficient importance to demand resolution by operator action. These latter differences are referred to as conflicts.

6.6.6 Track Environment

Where two or more NUs hold different Environments for the same TN, an Environment conflict exists. Such conflicts can occur as a result of erroneous sensor data or operator error, or may indicate a Duplicate TN situation (see paragraph 6.4.6.3). NUs not holding R^2 will declare Environment conflicts in an Information Difference Report, initiated either automatically or by operator action. The operator will be alerted in all cases where locally held Environment data differ from that reported on the Link 22 interface; resolution must be accomplished by manual acceptance or rejection of the change. An operator alert is also provided in cases where local and received data differ as to whether the TN is assigned to a track or to a point.

6.6.6.1 Some Environment differences are not permitted over Link 22, as follows:

a. Between space and surface, subsurface or land.

b. Between subsurface and space, air or land.

c. From a known Environment to No Statement/Unknown/Pending.

In such cases, or where NUs cannot agree, a new track must be established with the required Environment using a new TN; voice coordination may be required. Differences in Environment must be resolved before differences in Identity.

6.6.7 Track Identity

Where two or more NUs determine different identities for the same TN, an identity difference exists. NUs not holding R^2 may report their local assessment of identity in an Information Difference Report, initiated either automatically or by operator action. Other NUs, including the NU with R^2, will determine (either automatically or manually, depending on system implementation) whether to accept or reject the change. However, if an identity conflict exists (e.g., the proposed change is to or from "Hostile"), the operator will be alerted and the difference must be resolved manually; voice coordination may be required. No attempt should be made by an NU to change an established identity (i.e., other than Pending) back to Pending.

6.6.7.1 When locally held data differs from data reported on the interface as to whether a track has exercise status or non-exercise status, the operator will be alerted and the conflict must be resolved manually; voice coordination may be required. Conflicts of exercise status must be resolved before identity conflicts.

6.6.7.2 An NU controlling an aircraft is assumed to have the best identity data on that aircraft. All other NUs will automatically accept the identity reported by the controlling unit. Operators should note that a controlling unit will automatically reject changes in identity from other NUs for aircraft under its control, including that contained within a CDO (see paragraph 6.4.3); voice coordination may be necessary in such cases.

6.6.8 IFF/SIF Data Management

The capability is provided for IFF/SIF data associated with a particular track to be reported on Link 22 for Modes I, II, III and IV. The protocols adopted on Link 22 for Mode II, in common with other data links, are based on its utilisation as a unique identifier. Operators may be alerted if two or more tracks have the same Mode II code.

6.6.8.1 IFF/SIF Data Differences

IFF/SIF data associated with a particular TN is reported by the NU with R^2. All other NUs which hold local data on that track are responsible for monitoring IFF/SIF data on the track and reporting any differences between valid (i.e., non-zero) values. IFF/SIF differences may

occur through equipment malfunction, operator or system correlation error or the existence of a Duplicate TN situation. Any NU recognising 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:

a. Re-interrogate the track and update local data involved ensuring that such data are consistent and current.

b. If the track is controlled by own NU, verify the data by voice contact with the pilot.

c. After verification of the data, the operator should perform one of the following actions:

(1) If the operator believes that his local data is correct, generate an IFF/SIF Clear Request to cause all units to revert the indicated IFF/SIF mode(s) to zero ('no data' status) in their database, and manually initiate an IFF/SIF Difference Report containing the local data.

(2) If the operator believes his local data to be in error, accept the remote data into own database.

(3) Coordinate by voice with the appropriate TDC/FTC or with other involved unit(s) to resolve the difference.

d. If an IFF/SIF data conflict persists following the above procedures, the operator should decorrelate by establishing a new track with a different TN and associating the local IFF/SIF data with the new track, even though the positions of the two tracks may be identical. The IFF difference resolution matrix is shown in Table 6.4 below.

OWN UNIT DATA / REMOTE DATA			R² UNIT			NONR² UNIT			
			NO DATA	VALID DATA		NO DATA	VALID DATA		
				NON CURRENT DATA	CURRENT DATA		LOCAL		REMOTE
							NON CURRENT DATA	CURRENT DATA	
IFF DIFF REPORT FJ7.5 (ACT = 1)	MODE 1 OR 111 MODE II MODE IV		AT AT AT	AT C AC1	AT C AC1	NA or A NA or A NA or A	NA or A NA NA or A	NA NA NA or A	NA or A NA NA or A
TRACK REPORT F01.0-0 or F03.5-3	NO DATA in any mode		NA	NA	NA	NA	T1	T1	A
	VALID DATA	MODE I OR III	NA	NA	NA	A	A	TC or C	A
		MODE II	NA	NA	NA	A	C	C	A
		MODE IV	NA	NA	NA	A	AC2	AC2	A
PLI REPORT F02.0-0 or F02.1-0	ALL DATA MODE I, II OR III		NA	NA	NA	A	A	AC	A

LEGEND

A	=	ACCEPT.
AC	=	ACCEPT DATA, ALERT OPERATOR.
AC1	=	IF THIS IS AN UPGRADE[1], ACCEPT DATA AND TRANSMIT IFF/SIFF WORD. IF THIS IS A DOWNGRADE[2], ALERT OPERATOR AND INHIBIT TRANSMISSION OF ANY NONZERO MODE IV DATA UNTIL DIFFERENCE IS RESOLVED.
AC2	=	IF THIS IS AN UPGRADE[1], ACCEPT DATA. IF THIS IS A DOWNGRADE[2], ALERT OPERATOR.
AT	=	ACCEPT DATA AND TRANSMIT RECEIVED DATA IN AN IFF/SIFF WORD IN THE NEXT AVAILABLE ASSIGNMENT TIME SLOT.
C	=	THIS IS A CONFLICT. DO NOT ACCEPT DATA AND ALERT OPERATOR.
NA	=	NON APPLICABLE. NO ACTION ALLOWED EXCEPT AS IN PARAGRAPH 1.7.6.3c OF STANAG 5522.
NT	=	DO NOT ACCEPT DATA AND TRANSMIT LOCAL DATA IN AN IFF/SIFF WORD AT NEXT AVAILABLE ASSIGNMENT TIME SLOT.
T1	=	TRANSMIT LOCAL DATA IN AN FJ7.5 (ACT = 1) MESSAGE.
TC	=	AS T1. IF THE SAME REPORT IS SENT TWICE WITHIN 30 SECONDS, AUTO TRANSMISSION OF AN FJ7.5 (ACT = 1) IS INHIBITED AND ALERT THE OPERATOR.
NOTES	[1]	UPGRADE: AN INCREASE IN THE NUMERICAL VALUE OF THE DATA ITEM CODE.
	[2]	DOWNGRADE: A DECREASE IN THE NUMERICAL VALUE OF THE DATA ITEM CODE.

Table 6.4 IFF/SIF Difference Resolution Matrix

6.6.8.2 Clear IFF/SIF Data

An operator at any NU, who considers that erroneous IFF/SIF data for a particular track are being reported on the Link 22 interface, can manually initiate a Clear IFF/SIF message. This will cause all IFF/SIF data held for the specified track in the corresponding mode(s) by NUs to be cleared to a "No Data" status (denoted by all zeros) until the next update. Operators at receiving NUs will be informed that a Clear IFF/SIF message has been received.

6.6.8.3 IFF/SIF Data Update

IFF/SIF data reported on the interface may be updated by several methods:

a. The NU with R^2 transmits updated IFF/SIF data in a Surveillance IFF message.

b. The NU with R^2 transmits zero IFF/SIF data in a Surveillance IFF message, which causes all NUs with valid local data automatically to transmit that data.

c. An NU without R^2 generates an IFF/SIF Difference Report.

d. An NU generates an IFF/SIF Clear Report by operator action.

e. An NU generates an IFF/SIF Update Request message, with the applicable mode indicator(s) set, by operator action. NUs holding local data on the subject track will respond as follows:

   (1) The NU with R^2 will transmit a Surveillance IFF message containing all IFF/SIF data on the subject track.

   (2) NonR^2 NUs will respond if valid data are held locally for the requested mode(s).

6.6.9 Special Codes

Link 22 provides the capability to report Special codes which have agreed meanings among implementing NUs. Systems will ensure that Special codes and IFF/SIF codes can be readily distinguished by operators. Special codes are initiated, changed or cleared by operator action and reported in the Special code message. An NU that originates or changes a Special code retains special code reporting responsibility for the track until a special code message is received from another NU or the track is dropped.

6.6.10 Platform, Activity and Specific Type

Differences in Platform, Activity and Specific Type data for friendly platforms may exist on Link 22 without any corrective action being required. Such differences cannot be reported on Link 22 unless an Environment or Identity difference is also reported. Receiving NUs, with the exception of the controlling unit, will automatically accept the values of Platform,

Activity and Specific Type reported on the Link 22 interface, if implemented. Activity differences involving the Activity "Tanking" may cause an operator alert, depending on system implementation. Where Environment or Identity differences are not reported and the operator considers resolution is necessary, voice coordination is required. Alternatively, the CDO may be used by units with proper authority (see paragraph 6.4.3).

6.6.11 Strength Change

An NU without R^2 for a surveillance track may initiate a change of reported strength by transmitting a Strength Change message. All NUs will either automatically accept a change of strength on a track or alert the operator, depending on system implementation.

6.6.12 Change Data Order

The Change Data Order is transmitted to cause all NUs, except the controlling unit, to accept automatically the same Environment, Identity (including Hostile and including Exercise and Special Interest Indicators), Platform, Activity and Specific Type as transmitted by the unit issuing the order. Upon receipt of a CDO, a controlling unit with different data will transmit a FJ7.0 (ACT=1) difference report to report a difference of Platform, Platform Activity, Specific Type, or Special Interest Indicator without any E/C or ID difference. The Change Data Order is initiated only by operator action, and only by a unit with designated authority, as promulgated in the OPTASK LINK.

6.6.13 Track Alerts

A track alert provides a method of indicating the presence of a track with an emergency or with a condition of particular interest to units within the interface. Alerts are of such importance that their receipt must be ensured. However, tactical data systems have a finite track capacity which may become saturated by receiving many messages with the Force Tell or Emergency Indicator set. Track alerts will be forced through all filters, including security filters established for SPI data (discussed in paragraph 6.4.8).

6.6.13.1 Types of Track Alert

There are two types of alerts:

a. Emergency Alert - An operator or automatic action that indicates the existence of a life-threatening condition that requires immediate action or assistance.

b. Force Tell Alert - An operator action that indicates that a condition exists that is sufficiently important to ensure that all systems operating within the interface are apprised of the presence of the track. The effectiveness of Force Tell status when applied to a track depends on its use being strictly controlled by the operator.

6.6.13.2 Use of Track Alerts

Any NU may initiate or terminate an emergency or force tell alert on any track being reported over Link 22. An NU cannot change the emergency alert status of another active NU (see paragraph 6.2.2). A change of alert status is accomplished either by:

a. The NU with R^2 transmitting a change of emergency or force tell status in the next track or point/line/area report.

b. A nonR^2 NU transmitting either an Emergency Status Change message or a Force Tell Status Change message to cause the change of alert status for the track, point, line or area to be reported on the interface.

Track alerts are initiated by operator action and should be terminated, by operator action, once the alert condition has cleared.

6.6.14 Alert Indicators for Reference Points/Lines/Areas

6.6.14.1 Any NU may initiate and terminate a force tell status on any point/line/area being reported on Link 22. Emergency status cannot be applied to an existing reference point, line or area; however, emergency points may be established to report a geographical location requiring search and rescue operations (see paragraph 6.3.4.2).

6.6.14.2 An NU initiating a Force Tell alert on a slaved reference point or area also initiates an alert on the Related TN, if the Related TN does not already have an alert set. When the alert is terminated for the reference point or area, the alert is automatically terminated for the Related TN, unless the Related TN already had the alert set prior to the slaved point or area alert being indicated.

6.6.14.3 An NU terminating a Force Tell alert on a track automatically terminates the alert on any reference point or area that is slaved to the track.

6.6.15 Data Update Requests

The Data Update Request is used for requesting certain data from one or more other NUs. While this request may occur automatically, it is normally initiated by operator action. The response to a data update request from any NU is automatic and requires no operator involvement. A request may be used to update the following:

a. Information purged or dropped locally.

b. Information missed during periods of inactivity.

c. Information missed due to poor data reception.

d. Information missed owing to filtering.

e. Information required immediately (i.e., before the R^2 unit's next transmit opportunity).

6.6.15.1 Data Update Request by Specific TN

Any NU may request data on a specific TN of interest, which may be an active NU, a track, a point/line/area or a ballistic missile track. When requesting an update on a segmented line or area/volume, the operator need only specify one of its constituent TNs to receive an update of the complete line, area or volume. The request may be addressed to a specific NU, group of NUs or to the collective address.

6.6.15.1.1 On receipt of a valid request, the following responses are transmitted automatically:

a. An active NU, which is the subject of the request, will transmit Engagement Status messages to report the status of all engagements they are conducting.

b. The NU with R^2 for the specified TN will respond by transmitting a report on the TN including any amplification data (e.g., intelligence data, EW data etc.) originated by own unit, except that covariance data will not be included for a ballistic missile track.

c. NonR^2 NUs will transmit any amplification data on the TN originated by own unit, with the exception of ballistic missile data.

6.6.15.2 Data Update Request by Request Indicator

The operator at any NU may request an update of data of a particular type, either to a specific address or to the collective address, by specifying a Request Indicator (RI) from the following:

a. Reference Point/Line/Area.

b. Land Point.

c. ECM data.

d. ESM data.

e. EW Fixes.

f. Weapon Status.

g. Weather data.

h. Intelligence data.

i. Filter data (see paragraph 6.4.5.3.5).

6.6.15.3 When data is requested on a reference point/line/area or land point by RI, the NU with R^2 will respond with the appropriate message.

6.6.15.4 When data is requested on ECM, ESM or EW Fix data by RI, NUs will respond only with those data originated on the Link 22 interface by own unit or, if specifically addressed, with all such data held locally.

6.6.15.5 When data is requested on weapons status by RI, NU(s) will respond with Engagement Status messages to report the status of all engagements they are conducting.

6.6.15.6 Requests for filter data by RI must be specifically addressed and a filter number or all filters must be specified. The addressed NU will respond with all data on the requested filter(s).

6.6.16 Track Correlation / Decorrelation

6.6.16.1 Track Correlation

Each NU performs a correlation function to determine if its new contacts are new tracks or duplicates of existing tracks. Correlation occurs when the locally derived data are associated with an existing active TN. If a track does not correlate, a new TN is assigned and the new track is reported to the interface. This process is normally accomplished automatically by NUs, but may be also accomplished manually by the operator.

a. When tracking manually, the operator correlates the radar returns on the current scan with those received on the past three or four scans on the same radar. Local tracks are not to 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.

b. When attempting to manually 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, the operator should be aware that the same Mode II code is sometime assigned to multiple aircraft.

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

   (4) Other Data: Identity, Platform, etc.

c. An R^2 NU makes an automatic correlation check upon receipt of each remote real-time Air or Surface (Maritime) track report, which is not confirmed to have an existing correlation to a local track, or immediately prior to each transmission of a local track. Such tests will compare the received remote track or NU to local tracks of the same E/C, including previously common local tracks for which own unit has R^2.

d. When a correlation is executed, systems combine the two tracks into a single track and the retained track is given the higher ID as determined by the ID difference resolution processing. For IFF data, any nonzero Mode I, II, or III values from the retained track are to be kept in preference to IFF data from the dropped track, whilst the higher Mode IV value of the two tracks is to be kept e.g. Interrogated Valid Response is to be kept in favour of Interrogated No Response.

e. Conflicting IDs or Mode II data are restrictions against correlation, as described in paragraph 6.6.16.1.2. However, these restrictions can be turned off by the operator, as described in paragraph 4.2.5.4. When the ID conflict restriction is turned off, systems will keep the ID from the retained track, automatically treat the last track report on the dropped TN as an ID difference report, and provide operator alerts to resolve the conflict on the retained TN as described in paragraph 6.6.8.1. When the Mode II conflict restriction is turned off, the Mode II code of the retained TN is retained, and normal IFF/SIF difference resolution procedures as described in paragraph 6.6.8.1 can be used to resolve the conflict if it remains after the correlation.

6.6.16.1.1 Automatic Correlation Tests

The following briefly describes the standard position, altitude, and velocity tests applied by each NU system when testing two tracks for correlation. The parameters used in these tests may be changed based on operational or testing experience, or local operating conditions. The procedures for specifying and changing the correlation test parameters are provided in paragraph 4.2.5.

a. Position Tests. Systems use the TQ of the remote and local track being tested for correlation to determine the maximum distance between the two tracks allowable for automatic correlation. Each TQ has an associated radius of positional uncertainty. The test essentially adds the two TQs together to determine the maximum correlation distance, or the correlation "window". Very low or very high TQs are elevated or lowered for correlation purposes in order that the correlation distance not be unrealistically large or small.

b. Altitude Test. For air tracks which both have an Altitude Source of Sensor, Aircraft Automatic Altitude, or PLI Report, automatic correlation is allowed. Otherwise, altitude is not used in the correlation tests.

c. Velocity Tests. Automatic correlation is allowed only if the course and speed differentials between the two tracks are within a certain number of degrees and data miles per hour (dmh) of each other.

6.6.16.1.2 Correlation Restrictions

Two reported tracks that pass the correlation tests will not be correlated automatically if certain conditions exist. These are listed below and summarised in Table 6.5. (For the restrictions marked with an asterisk (*), the tracks are not tested for correlation.)

a. The two tracks have different Environments. *

b. Either track is a Subsurface track. *

c. The two tracks have conflicting basic identities, and the conflicting IDs correlation restriction has not been turned off (see paragraph 4.2.5.4). For this purpose, the basic identities 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 Identity. (When conflicting IDs are the only correlation restriction, an operator will be alerted to attempt to resolve the conflict. When resolved, the correlation will then proceed automatically, unless the two tracks no longer meet the automatic correlation test.)

NOTE: On Link 11/11B, NEUTRAL is treated as friendly.

d. The two tracks have different nonzero IFF/SIF Mode II codes, and the Mode II correlation restriction has not been turned off (see paragraph 4.2.5.4).

e. Either track is the subject of a pending Environment, Identity, 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, Identity, or IFF/SIF.

f. Both tracks are locally derived real-time tracks, i.e., being updated with local positional data.

g. Either track has a strength greater than one.

h. One of the tracks is simulated and the other is live.*

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

	Do not correlate if:	
Type of Restriction	One of the tracks	and the other track
Category	is: any Environment	is: any other Environment*
Subsurface	is: subsurface	is: any other track*
Identity	is: Suspect or Hostile	is: Friend, Assumed Friend, or Neutral**
	is: Neutral	is: Friend**
Mode II	has: any nonzero code	has: any other nonzero code**
Local	is: locally derived real-time	is: locally derived real-time
Strength	has: Strength greater than one	is: any other track
Simulation	is: simulated	is: live*
Dual	is: currently a dual track	is: any other track
Operational Contingency Constraint (OCC)	has: an OCC	has: an OCC

* The tracks are not tested for correlation.

** If the restriction has not been turned off (see paragraph 4.2.5.4).

Table 6.5 Automatic Data Link Correlation Restrictions

6.6.16.1.3 Operational Contingency Constraints (OCC)

When the system determines that two tracks automatically correlate and none of the restrictions in Table 6.5 apply, the track with the highest TN will be dropped, unless any of the below OCCs apply. In these cases, the correlating NU will automatically request the other track be dropped, unless it also has an OCC. If both tracks have an OCC, the correlation is not to be executed automatically until one of the OCCs no longer exists. (There is one exception to this restriction. Some units automatically correlate an Unknown or Hostile engaged by own unit to a Friend NU or a controlled Friend. This expedites automatically breaking the engagement to prevent a potential fratricide.) These OCCs are checked automatically by systems performing automatic correlation before correlation recommendations are made to the operator.

a. The subject of a current engagement.

b. The subject of a pending Command message for which a reply is required and has not been received.

c. Currently a controlled track.

d. An active or inactive NU.

6.6.16.1.4 Manual Correlation

a. Any two Air and Surface (Maritime) tracks, one of which is local or common, may be manually correlated irrespective of the positional tests and correlation restrictions in Table 6.5, except that two tracks are not to be correlated manually if:

(1) The two tracks are of a different environment or either track has an existing environment conflict.

(2) One is simulated and the other is live.

(3) Either 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. (Not applicable to some nations' platforms.)

(4) Either track is the subject of a pending command or mission assignment for which a response (WILCO, HAVCO, CANTCO, or CANTPRO) has not yet been transmitted or received. (Not applicable to some nations' platforms.)

(5) Both tracks are remote.

In addition to these restrictions, system options my also restrict correlations if:

(6) The two tracks have an identity (ID) difference which constitutes a conflict.

(7) The Dropped TN is currently a controlled track.

b. An NU should not reject the manual correlation of two tracks unless it holds them to be of different environment or one to be simulated and the other live, or if it holds them both as locally derived real-time tracks. Some systems will also reject a received manual correlation if either track is a subject of an engagement message or is the subject of a pending command or mission assignment.

c. Since the OCCs in 6.6.16.1.3 above do not constrain a manual correlation, an operator performing a manual correlation is to carefully consider the operational effects of such a correlation. Among other things, he should consider all of the OCCs, and not drop a track that has an OCC unless there are overriding operational considerations.

6.6.16.2 Decorrelation

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.

a. The distance at which automatic decorrelation occurs depends on the setting of the decorrelation window multiplier defined in paragraph 4.2.6.1. 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, unless the Mode II correlation restriction has been disabled (see paragraph 6.6.16.1.2).

b. 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, or many incorrect correlations. The latter suggest the possible need to adjust the variable correlation parameters.

6.6.16.2.1 Operator Actions Following Decorrelation

Upon decorrelation, a new track with an initial ID of PENDING will be generated automatically. Various operator actions may be required in order to ensure that accurate current information is being reported for the two resulting TNs. In most cases, an operator alert will be provided in applicable NUs as a cue to the operator to consider the following actions, based on his assessment of the situation after the decorrelation:

a. If the old TN (the TN of the common track before decorrelation) is the subject of an engagement reported by own unit, or is the target or engaging track for a current engagement reported by own unit and conducted by another unit, the operator will be alerted to break engage on the old TN if required. The operator must initiate an engagement on the new TN as appropriate.

b. If own unit is the controlling unit for the old TN, automatic decorrelation is prohibited. If manually decorrelated the operator is alerted to terminate control of the old TN if appropriate. However, the old TN must not be changed. Before decorrelating a non C^2 NU by own NU, 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. To take control of the new TN the operator must initiate a controlling unit report.

c. If the old TN is the subject of a command originated by own NU or addressed to own NU, and an operator response (WILCO, HAVCO, or CANTCO) has not yet been received or transmitted, pertinent data for both the old and new TN are displayed to the operator. Any reply already initiated by the operator is withheld by the system to give the operator the opportunity to change the reply if appropriate. The operator is to consider the fact that the WILCO or CANTCO reply 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 NU, retain the Force Tell or Emergency status of the old TN, by initiating the appropriate status for the new TN.

e. If the old TN is paired or associated by own NU, the operator is alerted to terminate the pairing or association on the old TN and initiate a pairing or association on the new TN as appropriate.

f. If the old TN has been associated with an Index Number reported by a controlled aircraft, the controller of that controlled aircraft must assess whether the Index Number should remain with the old TN or the new TN, and take appropriate action.

g. 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 automatic decorrelation is delayed until the handover process is completed or terminated. The pending decorrelation is displayed to appropriate operators. When the decorrelation is executed, the procedure in paragraph b above should be used.

6.6.16.3 Dual Designations

A dual designation exists when the same track or point is being reported by two or more units using two or more different TNs. A dual designation is caused by an NU reporting a track with a new TN where one already exists. Units entering or re-entering an interface must be particularly careful that all correlations have been accomplished prior to commencing track reporting (in accordance with procedures contained in paragraph 5.3.1.1). Other situations likely to lead to dual designations are:

a. Units participating with poor reception capability.

b. Existence of data registration errors.

c. Areas of high track density or reporting of tracks which are manoeuvring a great deal.

d. Tracks merging.

e. Poor operator performance.

f. Misuse of data filters by one or more units.

Each NU shares the responsibility for the prevention and early resolution of all dual designations. If digital resolution of dual designation fails, resolution may be accomplished by voice coordination.

6.6.16.3.1 Resolution of Dual Designation

There are two methods of resolving dual designations when detected. These are Voice Resolution and Data Link Resolution. They are described below, and the criteria for their use explained. The FTC is to ascertain if any NUs have not implemented the Correlation message. If so the FTC is to consider directing NUs to inhibit data link resolution and use only voice resolution. When voice resolution is to be used, all C^2 NUs are to be directed to inhibit transmission of the data link Correlation message. All C^2 NUs that implement this message are also required to have the capability to inhibit its use. Correlation Message inhibition should be specified in the OPTASK LINK, under Conditional Capabilities, or directed by voice.

6.6.16.3.2 Voice Resolution of Dual Designations

Voice Resolution of dual designations is necessary whenever the Data Link Resolution capability cannot be used. The voice dual designation resolution procedures are specified below and summarised in Table 6.6.

a. If the C^2 NU recognising 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 6.6.16.1.3 and 6.6.16.1.2, respectively), it may drop that track and make the remote track local. That action should resolve the dual designation without voice coordination. However, other NUs 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. Also, another NU may hold the dropped track as a common track and assume R^2, perpetuating the dual. Therefore, the NU should consider Voice Resolution of the dual designation in the same manner as specified in the following steps:

b. C^2 NU recognises dual designations

(1) If the C^2 NU recognising a dual designation does not have R^2 for either track, he is to advise the TDC by voice.

(2) If the C^2 NU recognising a dual designation holds an OCC or correlation restriction for the track for which it has R^2, he is to advise the TDC by voice and should recommend that the other TN be dropped.

(3) Since two tracks may be manually correlated irrespective of most correlation restrictions, the C^2 NU must inform the TDC and other C^2 NUs if the correlation was manually initiated, and the reason for the manual initiation. Note that holding OCCs for both TNs is a correlation restriction.

c. The TDC is to request all NUs to drop one of the TNs based on any OCCs held by the TDC. If the TDC holds a correlation restriction, he will advise the C^2 NU reporting the dual designation that it cannot be resolved.

d. All C^2 NUs are to determine if the specified TN has an OCC, or if the two tracks have a correlation restriction. If so, the TDC is to be informed immediately. If not, take action to drop the TN.

e. If any C^2 NU reports an OCC, the TDC is to request all NUs to drop the other TN, unless the TDC holds an OCC for it, and step 4 is to be repeated.

Step	Action
1	Any Unit: Upon recognising dual designation, advise the TDC by voice.
2	TDC: Request units drop a specific track number by voice. All Units: a. If unable to drop the specified TN due to operational considerations, inform TDC immediately. b. If able, take actions to drop reported TN. Additional voice reports not required. c. If no OCC or correlation restriction is held for the TN, or if the correlation was manually initiated despite a correlation restriction, take action to drop reported TN. Additional voice reports are not required.
3	TDC: If any unit reports that it is unable to drop the TN requested, request all other units to drop the other TN as in Step 2. All Units (still holding the first TN): Take actions specified in Step 2.
4	TDC: If any unit reports unable to drop TN as a result of Step 3, inform all units that the dual designation condition exists and will be resolved upon termination of the operational conditions (e.g., engagement status alerts, order pending, conflict, etc.) that would not allow for immediate resolution.

Table 6.6 Procedure to Resolve Dual Designations by Voice

f. If the correlation cannot be completed due to a correlation restriction, the TDC is to inform all NUs that the dual designation cannot be resolved until the restriction or OCC no longer applies, unless the correlation was manually initiated.

6.6.16.3.3 Data Link or Automatic Resolution

a. Data Link Resolution is accomplished using a Correlation message. The first C^2 NU to detect a dual designation automatically transmits the message. The automatic correlation process determines the TN to be retained (TN-1) and the TN to be dropped (TN-2). It also indicates whether a reverse correlation (reversal of TN-1 and TN-2) is acceptable, or that the correlation was manually initiated and therefore cannot be reversed. 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.

b. 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 utilise the correlation restrictions and OCCs in paragraphs 6.6.16.1.2 and 6.6.16.1.3 to make these recommendations. They should also be used by operators in assessing system recommendations when in the manual or manual override mode.

c. All C^2 NUs capable of reporting air or surface tracks are required to implement the Correlation message for transmission and reception.

d. The TDC is to ascertain if any C^2 NUs have not implemented the correlation message. If so the planner or TDC is to consider directing C^2 NUs to inhibit data link resolution and use only voice resolution. All C^2 NUs that can transmit the Correlation message are required to have an operator selectable capability to inhibit its transmission. However, the planner or TDC may decide to allow data link resolution even if some C^2 NUs do not implement the Correlation message. The primary disadvantage of doing so is that a non-implementing NU which has R^2 for TN-2 will not know the correlation has been recommended and will continue reporting TN-2, probably delaying resolution of the dual longer than if voice had been used initially.

6.6.16.4 Reception of Correlation Report

Upon receipt of a correlation report, the NU has three options:

a. Systems, which receive the Data Link 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 6.6.16.4.d below exist. The system acts without prompting, only alerting the operator when operator action is required.

b. Systems, which do not implement the Data Link 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 is to respond by voice to reject or reverse a correlation request. Therefore, the following procedures prescribe NU actions that may be performed automatically in some NUs, but manually in others.

c. Upon receipt of a Data Link or voice correlation request, the receiving NU has three options:

(1) Accept the correlation.

(2) Reject the correlation.

(3) Propose a reverse correlation.

d. Unless the correlation was manually initiated, it is rejected if any of the restrictions in paragraph 6.6.16.1.2 applies, or if own NU would decorrelate the two tracks. In the latter case the NU is to report the new correlation. In the event there is an OCC on TN-2 as specified in paragraph 6.6.16.1.3, but a reverse correlation is acceptable, the NU 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 NU is to accept the

normal correlation, and, if own NU has R^2 for TN-2, drop TN-2 from the interface.

6.6.16.5 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 are to be resolved by voice coordination between the reporting NUs and the TDC. Resolution is to consist of establishing a common point. The Data Link Correlation message is not used to resolve dual designation of points.

6.6.16.6 Dual Designation of NUs

A dual designation exists when an NU is reported as both a track/point and an NU with different TNs. When a dual designation exists, it is to be resolved in the same manner as dual designation of two tracks, see paragraph 6.6.16.3.1. The NU is not to be dropped, unless the correlation was manually initiated.

6.6.16.7 Correlation of Subsurface Tracks

The correlation procedures specified above do not apply to subsurface tracks. Operators should perform manual correlation of subsurface tracks as required.

6.6.17 Duplicate Track Number

A duplicate TN exists when the same TN is being used by two or more units for two or more different tracks. The most common cause of duplicate TN is the failure of two or more systems involved to track two targets identically through a merge and a subsequent separation. Other situations likely to lead to duplicate TN are:

a. Loss of data communication between units.

b. Erroneous correlation (either automatic or manual).

6.6.17.1 Resolution of Duplicate Track Number

Timely elimination of duplicate TNs, particularly when associated with Hostile tracks, is essential. Some systems are capable of automatic decorrelation but in cases other than where the two tracks have different Mode II codes, the distance between the local and remote tracks is required to be relatively large before decorrelation takes place. Duplicate TN resolution may, therefore, require manual procedures in many cases to ensure the integrity of the tactical picture, as follows:

a. Any operator who has reason to believe that a duplicate TN situation exists (e.g., by observing a "jumping track") should immediately take action to assign a new TN to any local data held for the duplicate TN.

b. If operational circumstances require, the operator should use voice coordination with other units to determine which of the two tracks being reported is to retain the TN in use.

c. If a track flagged with a Special Processing Indicator (SPI) is involved in a duplicate TN situation, the C^2 reporting a non-SPI track with the same TN should drop the track and create a new track.

6.6.18 Pointers

The Pointer (FJ7.3) message provides the operator with the capability to transmit a geographic position to another NU for tactical purposes; e.g., to direct the attention of an operator at another NU to a particular track, point or specific geographic area. Pointers can be addressed to a specific NU or NUs or to the collective address. By specifying the Pointer Action Value, an operator can direct the pointer to one or more operator positions, depending on operational function (e.g., surveillance, EW). Pointers should be accompanied by voice amplification of their purpose; they have no TN.

6.6.19 Special Processing

Sensitive information, such as that derived from intelligence sources, to be exchanged over Link 22 may be flagged with a Special Processing Indicator (SPI) to indicate that special handling of the data is required. Data with the SPI set are treated as having a higher security classification than normal and are releasable only to those NUs specifically authorised to accept such data. Operators should be aware that force tell or emergency alerts which have been set on SPI tracks will cause those tracks to pass through established SPI filters; such alerts should not be assigned to data flagged with the SPI. When an NU 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 the SPI IAW national requirements.

6.6.20 Data Filtering

Data filtering is the process of inhibiting data from transmission on a data link or the process of deleting data received on a data link prior to entry into a unit's data base. Filters under operator control can be used to:

a. Avoid overloading a unit's data base or data links.

b. Control transmission and reception of SPI, exercise and simulated data.

c. Tailor data exchange to area of responsibility.

6.6.20.1 Filters are under operator control and may be used to selectively inhibit data flow.

a. Restraint must be exercised in the use of data filters. Filter implementation should be a coordinated action and directed in the OPTASK LINK. Any

system which filters tracks/IUs on receipt must establish a transmit filter that duplicates or is more restrictive than the receive filter, to prevent dual designations.

b. Filters are terminated by operator action and must be reported as such on the interface. Since filters inhibit data from entering a system's database, NUs must treat filter deactivation much the same as initiation of surveillance operations, e.g., correlation and minimum wait time before resumption of transmission (see paragraph 5.3.1).

Filters implemented by an individual NU are identified by a filter number in the range 1 to 14. A filter number of 15 indicates all filters implemented by an NU.

6.6.20.2 Types of Filters

NUs have the capability to implement the following categories of filters:

a. Special Filters:

(1) Special Processing filters (established to filter data with SPI set).

(2) Exercise filters (established to filter data with Exercise Indicator set).

(3) Simulation filters (established to filter data with Simulation Indicator set).

b. Identity Filters.

c. Environment Filters, including reference points/lines/areas and EW product information.

d. Geographic Area Filters - it must be specified whether filtering is to be conducted inside or outside the defined area.

6.6.20.3 Multiple Filters

Filters may be applied singly or in combination. When in combination, filters of different categories are normally interpreted cumulatively; e.g., an Exercise/Friend/Air filter will cause all friendly air tracks with Exercise Indicator set to be filtered. Special filters are interpreted independently; e.g., a SPI/Exercise filter will cause all exercise and all SPI data to be filtered.

6.6.20.4 Moving Filters

Geographic filters may be slaved to another reported object (e.g., to the filtering NU or to a moving reference point) or given independent course and speed.

6.6.21 Transmission Filter Management

The implementation of transmission filters on a data link must be managed among the participating units to ensure that a comprehensive tactical picture is maintained and to prevent multiple dual designations. Initial transmit filter assignments will be directed in the OPTASK LINK prior to Link 22 operations. During operations, transmit filters may be dynamically controlled by the transmission of Filter Management messages to implement, report and delete specific transmit filters. Filter Unit Type must be specified to define whether the filter applies to individual NU transmissions or to transmissions by the FNU of data forwarded on to the Link 22 interface. Voice coordination will normally be required to support Link 22 filter management.

6.6.22 Filter Implementation Request

An NU may request another NU to implement a particular filter by transmitting a Filter Implementation Request. The filter category and necessary parameters must be specified. Where filters have been pre-planned and promulgated in the OPTASK LINK, the operator need only specify the appropriate filter number in the implementation request.

6.6.23 Filter Description Report

An NU will report filters implemented by own unit using the Filter Description Report. The latest information received from an NU on a particular filter number supersedes previously reported information for that number. Active filters are also reported in response to a data update request by filter from another NU (see paragraph 6.4.5.3).

6.6.24 Delete Filter Request/Report

An NU may request another NU to delete a filter or all filters by using the Delete Filter Request/Report. When an NU deletes one or all of its filters, it should inform all other NUs by addressing the report to the collective address.

6.6.25 Data Filter Restrictions

Unless flagged with a Simulation or Exercise Indicator, the following data must not be filtered:

a. IU PLI reports.

b. Any data with emergency alert or force tell alert status. However, operators should note that if any exercise track is reported with emergency alert status, the emergency must be treated as real.

c. Emergency points.

d. EW Emergency Message.

e. Data management and associated messages relating to an IU, track or point, line or area which is not filtered.

f. The correlation message is not to be inhibited by any filter.

6.6.26 Data Association

The Association message may be used by an operator to report that the data concerning two separate TNs are associated with the same contact; e.g., an ESM Line of Bearing and a track. An association must not be interpreted as a correlation. Once established, it is the responsibility of the originator to terminate the association when the operator judges that it is no longer valid on the interface. If either TN involved in the association is dropped, the association is assumed to be terminated.

6.6.27 Mission Correlators

a. A Mission Correlator (MC) is a unique decimal number between 1 and 255 assigned to all NUs or JUs participating in a specific overall mission. An MC allows the identification and isolation of the associated NUs and JUs.

b. The MC is not synonymous with the Mission Number assigned to a specific aircraft or flight of aircraft. Mission Numbers are assigned in the Air Tasking Order, Daily Air Plan, or OPTASK AAW, and normally do not have the same simple numeric form as MCs. MCs are only reportable on Links 16 and 22. The MC may be the same for numerous Mission Numbers. For example, one MC could be assigned to a nonC^2 JU strike mission and the supporting nonC^2 JU aircraft for that strike, i.e., pre- and post-strike tankers, CAP aircraft, EW support aircraft, and the FAC aircraft. A single MC could be assigned to all NUs and JUs in a navy battlegroup, with additional MCs assigned to uniquely identify NUs and JUs within task units, task elements, etc., of the battlegroup.

c. Assigned MCs are reported by NUs in their PLI messages. An NU can be assigned up to eight different MCs, depending upon system implementation. Through display filtering, all the NUs and JUs assigned the same MC, and thus participating in the same mission, battlegroup, etc., can be identified.

d. Predefined MCs should be assigned in the OPTASK LINK. MCs may also 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 nonC^2 JU aircraft under control. However, in order to do so, the controller's unit must have been allocated a block of MCs for this purpose, in order to avoid the confusion which would arise if NUs or JUs on separate missions were assigned the same MC.

e. MCs can only be assigned to NUs and JUs, not tracks or other IUs. When assigning MCs, It is important to consider the fact that MCs cannot be forwarded to or reported on Link 11/11B.

SECTION 7 - ELECTRONIC WARFARE

6.7.1 General

Link 22 provides the capability to exchange EW data derived from, and in support of, the conduct of ESM, ECM and EPM. For the purposes of EW data exchange, NUs are classified as either:

a. Electronic Warfare Link 22 Unit (EWNU) - Possessing organic EW processing capability and able to collect and analyse parametric ESM data and derive EW surveillance product information.

b. NonEWNU - Possessing no organic EW processing capability but able to:

(1) Request EW surveillance product information.

(2) Use EW surveillance product information in own surveillance systems.

(3) Coordinate the activities of weapons systems with other NUs.

(4) Control non C^2 weapon platforms.

6.7.2 EW Surveillance Reporting

EW surveillance information can be exchanged over Link 22 in the form of EW Lines of Bearing (LOB), EW Fixes and EW AOPs using the EW Reporting message, and passively derived tracks using the appropriate surveillance message. EW reports are transmitted when locally derived, tactically significant, data are available and in response to an EW Control/Coordination request or an EW Data Update Request. The EW Reporting message also provides the capability to report EW product, parametric, jamming and platform data, where such data are locally held by the reporting unit.

6.7.2.2 EW Lines of Bearing

EW LOBs are derived from various sources, such as ESM, ECM (jamming strobes) or Radio Direction Finding (RDF) equipment. Every LOB reported on the interface is assigned a unique TN by the originating EWNU, which is used for all subsequent updates to that LOB. LOB reports include information on the bearing, bearing origin, bearing type and, when available, bearing accuracy, threat evaluation and emitter number, emitter function and emitter confidence. Bearing origin may be reported as the location of the transmitting unit or any other unit, track or point (TN Origin), including geographic position (latitude/longitude). LOB reports always include the time of intercept.

6.7.2.2.1 When an EWNU initially detects an EW LOB, which is determined by either the system or the operator to be an imminent threat, the Initial LOB report should be designated for transmission using the EW Emergency message. This ensures earliest possible transmission of the data for two successive NCTs and ensures that, on reception, the data will be forced through any active filters. Subsequent updates of the LOB will be transmitted in the EW Reporting message, as in paragraph 6.5.2.2.1, using the same TN as used in the EW Emergency message.

6.7.2.3 EW Fixes

An EW Fix results from the crossing of two or more LOBs which are deemed to originate from the same emitter. The resulting EW Fix is reported using a new TN and not one of the TNs previously used to report one of the LOBs. EWNUs originating LOBs, that are used by own unit or another unit to create an EW Fix, should transmit a Drop Track report for each LOB used to create the EW Fix once the EW Fix is being reported. EW Fixes may be reported as static or moving (i.e., with independent course and speed); the time the fix was last updated is always reported. The EW fix report may also be used to announce the deployment by own forces of an active electronic decoy. Information provided will include position of the decoy, Identity, Platform and, for programmable decoys, the Emitter Number.

6.7.2.3.1 A single EW Fix may be changed to an EW AOP and reported using the same TN.

6.7.2.4 EW Areas of Probability

An EW AOP is defined as an area in which there is a 95% probability of locating a particular emitter. EW AOPs can be based on exchange of LOBs, analysis of EW Fix data, other organic data or a combination of the above. An EW AOP that is generated from the crossing of LOBs, is reported using a new TN and not one of the TNs previously used to report one of the LOBs. Likewise, an EW AOP that is derived from analysis of two previously reported EW Fixes with two different TNs, is reported using a new TN and not a TN previously used to report one of the EW Fixes. EWNUs originating LOBs or EW Fixes, that are used either by own unit or another unit to create an EW AOP, should transmit a Drop Track report for each LOB and/or EW Fix used to create the EW AOP once the EW AOP is being reported; the time the AOP was last updated is always reported.

6.7.2.4.1 An EW AOP can be changed to an EW Fix and reported using the same TN.

6.7.2.5 Passively Derived Tracks

Regular, sequential EW Fix or AOP reports may result in the establishment of a passively derived track, reported using a new TN, not a TN previously used to report one of the EW Fixes or AOPs, in the appropriate surveillance message (depending on Environment assigned). EWNUs originating EW Fixes or AOPs, that are used either by own unit or another unit to establish a passively derived track, should transmit a Drop Track report for each EW Fix and/or AOP used to establish the track once the track is being reported. Passively derived tracks are transmitted as real-time or nonreal-time reports. 'EW Tracks' cannot be reported on or forwarded to Link 11 or Link 11B, but a fix, AOP or vehicular track can be reported on and forwarded to Link 11 or Link 11B.

6.7.2.6 Reporting Responsibility for EW Surveillance Information

The EWNU originating an EW surveillance report (LOB, EW Fix, AOP or passively derived track) always retains R^2 and is solely responsible for updating the data and dropping it, when required, from the interface. Other EWNUs with local EW data on what is believed to be the same emitter must report that data using a different TN. There is no change of R^2 for EW surveillance reports.

6.7.2.7 Force Tell Alerts on EW Surveillance Reports

An operator may initiate a Force Tell alert on any LOB, EW Fix, AOP or passively derived track, irrespective of whether the report was originated by own unit or another EWNU. The Force Tell status will remain in effect on the Link 22 interface and must be terminated by operator action once the operational requirement for Force Tell status on the report no longer exists.

6.7.2.8 Special Processing of EW Surveillance Information

Special rules are required for the setting of the SPI on EW surveillance reports. EW Fixes, AOPs and passively derived tracks are formed from a number of contributing EW reports, some of which may have the SPI set. When LOBs are used to establish an EW Fix, AOP or passively derived track, the SPI need not be set for the resulting product only if two or more of the contributing LOBs have been reported with the SPI not set. Likewise, when more than one EW Fix or AOP is used to establish a passively derived track, the SPI need not be set for the track only if one or more of the contributing reports has been transmitted with the SPI not set. However, if all contributory EW surveillance reports have the SPI set, the resulting EW Fix, AOP or passively derived track must also be reported with the SPI set.

6.7.2.9 EW Data Update Request

6.7.2.9.1 NUs may obtain current EW data by transmitting a Data Update Request. EW data updates may be requested on a specific EW surveillance report of interest or on a particular type of EW data (i.e., ESM data, ECM data or EW Fix data). and may be addressed to a specific EWNU or to the collective address.

6.7.2.9.2 On receiving a collectively addressed EW data update request for a specific TN, the EWNU which originated the EW surveillance report will respond automatically to such a request with an Initial EW report containing all data currently held on that TN. Any EWNU which has performed either an EW evaluation or an EW association on the TN will respond automatically with either all emitter data held on the TN or any EW report associated with the reference TN.

6.7.2.9.3 On receiving an EW data update request for a particular type of EW data, an EWNU will respond automatically with all relevant LOB and/or EW Fix reports which were originated by own unit including, for any EW associations, the TN of the associated report.

6.7.2.9.4 Use of this facility should be reserved for situations requiring immediate updates of essential EW information, to avoid unnecessary link loading.

6.7.2.10 EW Parametric Data Reporting

EW parametric data may also be included in an EW surveillance report when such data have been detected by the originating EWNU. However, parametric data reporting will automatically cease on a particular TN once an emitter number has been assigned, in order to prevent overloading of the data link. Subsequent reporting of parametric data can only occur under the following conditions:

a. By operator action.

b. In response to an EW Control/Coordination request (see paragraph 6.5.3).

c. After a significant change in detected information (based on defined system criteria).

6.7.2.11 EW Report Termination

Prior to the execution of a scheduled termination of Link-22 operation or withdrawal as an EW participant, the EWNU should transmit Drop Track reports on all own-unit originated EW surveillance products that are being reported on Link 22.

6.7.3 Electronic Warfare Control and Coordination

EW control and coordination functions provide the capability to manage the flow of EW information and to coordinate EW activities among participating NUs. The Link 22 EW Control/Coordination message can be used by the Electronic Warfare Coordinator (EWC) to direct EW actions to be performed by EW participants (e.g., direction finding, jamming, deployment of decoys, frequency protections) and provides the capability for EW participants to request/recommend actions and to respond to EW orders/requests. The EW Control/Coordination message includes a C^2 Warfare Commander Indicator to enable receiving units to distinguish orders originating from the EWC from other requests. EW requests/orders should be tagged for execution at a specific time or flagged for immediate action. EW requests/orders also carry a request number for those units receiving more than one EW assignment.

6.7.3.1 While systems and implementations will vary, the EW Control and Coordination capabilities available on Link 22 are summarised in Table 6.7. After completing the requested action, the addressed unit will respond with either a Response to EW Request message, followed immediately by an EW report containing all available data pertaining to the request, or a No Find message to report no detection made or, if related to a previous report, contact lost. However, units will not report No Find if the EW request were addressed to the collective address.

EW Action	Description
• Request Evaluation	To request either an evaluation of a specific TN or an evaluation of specified parameters.
• Request Update Report	To make an initial report, then reports are to be made only when changes occur which are deemed by the operator to be tactically significant.
• Request Directed Search	To request another EWNU to search designated parameters in a specific sector/area and to report the results.
• Cancel Request.	To cancel a previous EW request, identified by Reference EW Action Value and request number.
• Cease Report.	To direct the addressed unit to cease reporting a specific TN and EW Action.
• Emitter Evaluation.	To report an initial EW evaluation or an alteration to the reported emitter evaluation, and/or Emitter Confidence of a TN.
• Parameter Association.	To report an EW association between the Reference TN and another TN with similar parametric information such that the emissions from the two TNs are deemed to originate from the same emitter
• Emitter Association	To report that EW information transmitted on the Reference TN and another TN are deemed to originate from the same platform but not the same emitter.
• Disassociation.	To report the disassociation of the Reference TN from all existing parameter and/or emitter associations.
• No Find.	To report a negative response to a requested EW action (i.e., no detection made or, if against a previously reported TN, contact lost).
• Response to an Electronic Warfare Request.	To report a positive response to a requested EW action, followed by the requested data that is available transmitted in an EW Reporting message.
• Evaluate Sector/Search Jammer.	To direct the addressed unit to evaluate the specified sector and to report ECM intercepts for the duration of time specified. Also to direct the search for a specific jammer or within a particular frequency/frequency range and/or Pulse Repetition Frequency/Pulse Repetition Interval (PRF/PRI).
• Direction Finder Request.	To direct a Direction Finder action specified by either TN or by frequency/frequency range and time of action.
• Protect Frequency/Frequency Range.	See paragraph 6.5.3.3.

EW Action	Description
• Jamming Request.	To direct a jamming action against a specified emitter/ platform, frequency/frequency range, track or known threats in a specified sector/area, or to direct the cessation of a jamming action.
• Deploy Decoys.	To request/order the deployment of decoys in a specified sector/area, or to order the cessation of decoy deployment.
• Parametric Data Update Request.	To request the addressed unit to report either all locally held EW parametric data, or only data on a specified TN.
• Set Emission Control (EMCON).	To order an EMCON action specified by Plan Source and Plan Number, either immediately or at a specified time.
• Intercept-to-Emitter Association.	To report an EW association between an intercept TN and an emitter TN to indicate that the emissions are deemed to originate from the emitter TN.
• Emitter-to-Platform Association.	To report an EW association between an emitter TN and a platform TN.
• Guard Frequency/Frequency Range.	See paragraph 6.5.3.3.
• Taboo Frequency/Frequency Range.	See paragraph 6.5.3.3.

Table 6.7 EW Command and Control Functions

6.7.3.2 Frequency Protection

The three EW orders "Protect", "Guard", and "Taboo" direct varying degrees of protection against friendly interference to specified frequencies or frequency ranges, for varying reasons. The orders may also specify the time of commencement and duration of the protection. They are briefly defined in Allied Communications Publication (ACP)-167(F) under the terms Protected Frequency, Guarded Frequency, and Taboo Frequency, respectively. The authority for use, and the specific actions to be taken upon receipt of any of these orders, are functions of EW doctrine and local EW procedures, not the data link operating procedures. Receiving TDS operators need only alert appropriate local EW/Communications personnel that the order has been received. Due to the criticality of the orders, this alert should be made on an urgent basis. If the received EW order requires an operator response, the TDS operator should transmit a WILCO before informing the appropriate authority, unless previously directed otherwise. For further clarification, the following unclassified explanations of the three terms are provided:

a. Protected - Those friendly frequencies used for a particular operation, identified and protected to prevent them from being inadvertently jammed by friendly forces while active EW operations are directed against hostile forces. These frequencies are of such critical importance that jamming should be restricted 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.

b. Guarded - Enemy frequencies that are currently being exploited for combat information and intelligence. A GUARDED frequency is time-oriented in that 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.

c. 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. These are generally long-standing frequencies. However, they may be time-oriented in that as the combat or exercise situation changes the restrictions may be removed.

6.7.3.3 Frequency Protection orders may be originated by any appropriate operational commander, and addressed to a specific EWNU, or all EWNUs collectively. A time of commencement and/or duration of frequency protection may also be ordered. If no commencement time is ordered, protection will last from the time of reception of the EW Control/Coordination message either until an appropriate cancel request is received or until a new protection for this frequency/frequency range is ordered. If a duration is ordered, the protection is to be lifted at the end of the specified duration. There is no automated means of ordering the lifting of frequency protection after it has been set prior to its scheduled termination. However, a frequency protection order may be cancelled prior to the scheduled commencement time by using the Cancel Request order.

SECTION 8 – INTELLIGENCE

6.8.1 Intelligence Data Reporting

Link 22 provides the capability to exchange amplifying intelligence data obtained by intelligence gathering techniques using the Intelligence Information message. Information can be exchanged concerning threat warning and nationality/political alliance, together with environment, platform, platform activity and specific type information. Intelligence information can only be reported on tracks/points which have been reported in the appropriate surveillance message; the Intelligence Information message cannot be used to initiate a track/point.

6.8.2 Reporting Responsibility for Intelligence Data

Intelligence information may be transmitted by any NU deriving such information and is independent of the R^2 for the track to which the information relates. There is no change of R^2 for intelligence information; any NU with more current intelligence information will report that information initially and when data changes.

6.8.3 Reporting of Remote Intelligence Data

An NU reporting intelligence information may include the latest data received from remote sources (i.e., from a data link) in those data fields for which no locally derived information is available. Additionally, if only remote intelligence data is held, an operator may elect to transmit that data, by operator action. Receiving units will automatically accept remote data if no locally derived data is available. However, if locally derived data is held, an NU may, by operator action, reject the remote data and transmit own locally derived information on Link 22.

6.8.3.1 If remote data is transmitted by an NU in an Intelligence Information message and that data is received with the SPI set, the special processing status must be maintained whenever the data is retransmitted. However, if all data included in the report has been locally derived and the operator determines that special processing is not required, the SPI need not be set.

6.8.4 Returning to No Data Status

NUs transmit the latest available intelligence information on Link 22. However, if the reported data becomes outdated and no longer tactically significant, or is determined to have been entered in error and there is no new data available, the operator should initiate a change to "No Data" status for the reported information to clear the unwanted data on the Link 22 interface. This change can be effected only by operator action and should be performed immediately the determination is made to prevent the continued use of potentially misleading intelligence information.

6.8.5 Intelligence Data Conflicts

Amplifying intelligence data that differs from surveillance data being reported on the track/point can be reported on the Link 22 interface without necessitating any conflict resolution action. Identity difference resolution and change data order procedures do not affect data being reported in an Intelligence Information message. However, if locally derived intelligence information differs from the surveillance data being reported on the track in terms of Environment, the conflict must be resolved before the intelligence information is reported on Link 22. If the operator determines that the Environment information being reported in the surveillance message needs to be changed and R^2 is not held for that track, the procedure in paragraph 6.4.2.2 should be followed. A Change Data Order does not apply to intelligence data.

6.8.6 Reporting of Non-Friendly Controlling Units and Engagements

The Intelligence Information message can be used to report the controlling unit of a non-friendly track, as well as the target that a non-friendly track is engaging. This information should be brought to command attention immediately, as it clearly affects engagement decisions. This capability is not used to report friendly controlling units and engagements (see paragraphs 6.7.4.4 and 6.7.4.3 respectively).

6.8.7 Termination of Intelligence Information Reporting

When a track or point is dropped from the Link 22 interface, the reporting of all related Intelligence Information must be terminated.

SECTION 9 - WEAPONS COORDINATION AND MANAGEMENT

6.9.1 General

Weapons Coordination and Management is the function of exchanging necessary information between C^2 IUs to effect weapons employment and to prevent mutual interference during tactical operations. It enables the Operational Commander to direct the activities of controlling units and the employment of weapons systems within his area of responsibility. This function includes the exchange of certain designated commands, weapon status and engagement status information and air control coordination. This section also considers the exchange of platform and system status information which applies to all NUs.

6.9.2 Commands

Link 22 Command procedures provide the means for directing C^2 activities and for promulgating weapon condition orders (e.g., weapons free/tight), threat warning conditions (white, yellow, red) and general alert conditions. Annex C identifies all commands available for use on the Link 22 interface.

6.9.2.1 Origination of Commands

Operational requirements and the command structure will determine the NU or NUs delegated the authority to originate commands on Link 22. Command messages are transmitted by other NUs to promulgate and execute these commands. Commands are generally addressed and require a receipt/compliance response (see paragraph 2.2.3). Weapons Free, Weapons Tight, Hold Fire, Cease Fire, Salvo/Clear Aircraft, Conduct Procedures Indicated, and Cease Conducting Procedures Indicated may be addressed to all units by means of the collective address. When this occurs, no reply will be sent. On receipt of a Command message, the operator will be alerted, in order to take the appropriate action(s). Hold Fire and Salvo/Clear Aircraft are emergency orders and may be originated by any NU.

6.9.2.2 High Update Rate Commands

Certain operational situations require HUR reporting of target information, e.g., in attack or close contact situations, or when an engaging NU does not hold local sensor data on the target. Any NU can initiate/terminate HUR reporting on a particular TN; for procedures see paragraph 6.1.3.2.

6.9.3 Link 22 Air Control Procedures

Link 22 provides the means to exchange data to coordinate and effect the handover of a controlled aircraft from one controlling unit to another. The handover process may be initiated as follows:

a. The current controlling unit requests another controlling unit to take control.

b. A new controlling unit requests the transfer of control to own unit.

c. An NU aircraft requests to be taken under control by one particular NU or any NU.

d. Receipt of a Transfer Control command.

6.9.3.1 Current Controlling Unit Initiates Handover

The procedure for a successful handover when the current controlling unit requests the transfer of control is detailed below. If a CANTCO operator response or CANTPRO automatic response is transmitted at any stage in the procedure, the current controlling unit retains control and voice coordination may be required.

a. The current controlling unit initiates a handover by sending a message requesting another controlling unit to assume control of the aircraft. The message will include appropriate information on the controlled aircraft (e.g., Voice Call Sign, Mission Correlator or details of a current engagement).

b. The receiving controlling unit acknowledges receipt (see paragraph 2.2.3.3) and alerts the operator who causes transmission of WILCO or CANTCO. When the response is WILCO, the new controlling unit may also provide appropriate control information (e.g., control channel/frequency and aircraft identification procedure to be used) to the current controlling unit for transmission to the controlled aircraft.

c. The current controlling unit acknowledges receipt and transmits a Controlling Unit Change message to the controlled aircraft, containing information on the new controlling unit (e.g., Controlling unit TN, Voice Call Sign).

d. The controlled aircraft acknowledges receipt to the current controlling unit followed by a WILCO or CANTCO.

e. The current controlling unit acknowledges receipt, transmits a Controlling Unit Report indicating “Handover in Progress” and ceases transmitting any current Engagement Status and/or Pairing reports for the controlled aircraft.

f. The controlled aircraft transmits a request to the new controlling unit to assume control.

g. The new controlling unit acknowledges receipt for the message to assume control and transmits a HAVCO confirming assumption of control.

h. The controlled aircraft acknowledges receipt.

i. The new controlling unit transmits a Controlling Unit Report, which completes the handover process, and initiates transmission of any Engagement Status and/or Pairing reports concerning the controlled aircraft.

Steps c. to d. and f. to h. above are accomplished by voice when nonIUs are involved as controlled aircraft. If, at any stage during the procedure, a required response is not received, the operator will be alerted and control will remain with the current controlling unit. If the new controlling unit holds no platform and system status information on the controlled aircraft, a data update request should be initiated, addressed to the current controlling unit, prior to completing the handover.

6.9.3.2 New Controlling Unit Initiates Handover

The procedure for a successful handover when a new controlling unit requests the transfer of control to own unit is detailed below. As in paragraph 6.7.3.2, if a CANTCO operator response or CANTPRO automatic response is transmitted at any stage in the procedure, the current controlling unit retains control and voice coordination may be required.

a. The new controlling unit initiates handover by sending a message to the current controlling unit requesting transfer of control of the aircraft to own unit. The new controlling unit may provide appropriate control information (e.g., control channel/frequency and aircraft identification procedure to be used) to the current controlling unit for transmission to the controlled aircraft.

b. The current controlling unit acknowledges receipt and alerts the operator who causes transmission of WILCO or CANTCO. Any operator concerns over the control information provided by the new controlling unit must be resolved by voice before the operator initiates a WILCO response.

c. If the response is WILCO, the new controlling unit acknowledges receipt and the handover process continues as at paragraph 6.7.3.2.c.

6.9.3.3 NU Aircraft Requests to be Taken Under Control

The procedure for a successful take-over of an aircraft by a unit is detailed below:

a. The aircraft that is not currently under control sends a message requesting a controlling unit (TN known or unknown) to assume control. The data on the controlled aircraft (e.g., Voice Call sign, Mission Correlator or details of a current engagement) are set to “No Statement”.

b. The receiving unit acknowledges receipt, and alerts the operator who causes transmission of WILCO or HAVCO or CANTCO.

c. The new controlling unit sends to the aircraft a control information message (e.g., Voice Call sign, Mode III code, Squawk flash Indicator, Radio Type, Secure Radio Indicator) which may be used.

d. The controlled aircraft transmits a receipt acknowledgement to the new controlling unit automatically, followed by a WILCO or CANTCO.

e. The new controlling unit transmits a Controlling Unit Report, which completes the take-over, and initiates transmission of any Engagement Status and/or Pairing reports concerning the controlled aircraft.

If, at any stage during the procedure, a required response is not received, the operator will be alerted and the aircraft will not be under control.

6.9.3.4 Receipt of Transfer Control Command

Handovers may occur as a result of receiving an order to transfer control in a Command message. The receiving NU must initiate the handover process by following the appropriate procedures (see paragraphs 6.7.3.2 and 6.7.3.3).

6.9.4 Cancellation of Handover

a. The current controlling unit may cancel a handover at any time during the handover process prior to the new controlling unit transmitting a Controlling Unit Report for the controlled aircraft, in which case control will remain with the current controlling unit. However, once the new controlling unit has taken control, indicated by the transmission of Controlling Unit Reports for the controlled aircraft, the previous controlling unit must follow the handover procedure in full if there is a requirement for that unit to resume control of the controlled aircraft.

b. The new controlling unit may not cancel an Assume Control Request. If the controller changes his mind after sending a WILCO, he must attempt to complete the handover, and may then send an Assume Control Request to the former controlling IU or any other C^2 IU. If it is impossible to complete the handover, the aircraft may be instructed to report back to the current controlling unit for control. In this case, the current controlling unit may cancel the Assume Control Request when the aircraft checks back in with him.

c. The new controlling unit may attempt to cancel a Transfer Control Request at any time prior to its transmission of the initial controlling unit report. However, if the current controlling unit has already directed the aircraft to change control, the controller should respond with a CANTCO to the Cancellation Request, and the handover process must continue. If the new controlling unit desires to relinquish control after initiating controlling unit reporting, it must initiate an Assume Control Request to any appropriate C^2 IU.

d. The Handover Cancellation Request requires acknowledgement and response in the same manner as the handover request. However, a receiving controller should always WILCO the request except as indicated in c above. Receipt of any response other than WILCO by the cancelling IU must be resolved by voice with the other IU.

6.9.5 Termination of Control

When control of a particular aircraft is terminated or when a controlled aircraft is handed over to a nonIU controlling unit, the current controlling unit should transmit a Controlling Unit Report with Controlling Unit Status set to "Terminating Control". Engagements or pairings involving the aircraft need not be broken/terminated solely because control of the aircraft is terminated.

6.9.6 Reporting of Friendly Status

In addition to the PLI and surveillance reports discussed in previous sections, additional reports can be made on friendly platforms. The types of reports which can be transmitted are:

a. Platform and Systems Status Reports.

b. Engagement Status Reports.

c. Controlling Unit Reports.

d. Pairing Reports.

Friendly status reports may be initiated manually by operator action or automatically, depending on the extent of the individual system's implementation. Special uses and interpretations for these reports are discussed in the following paragraphs.

6.9.7 Platform and System Status Reporting

Platform and system status information is reported by each active NU for its own system. The information reported includes:

a. Operational status.

b. Equipment status.

c. Ordnance status.

d. Fuel status.

This information is reported on entering/re-entering a Link 22 network, by periodic updates, when significant data changes and when requested by a Data Update Request. NUs

requesting status information on nonIUs should address the Data Update Request to the controlling NU.

6.9.7.1 A controlling NU should report platform and system status information for those under its control which cannot report their own status directly on the interface. This will include any controlled units operating in Radio Silent mode.

6.9.7.2 Where conflicting platform and system status data are received from different units, the information contained in an NU's own status report will take precedence, followed by that reported by the controlling unit.

6.9.7.2.1 Airfield Status

6.9.7.2.1.1 Selected NUs will report the status of designated airfields and carrier (CV) flight decks. Which NUs report the status of which airfields and CV flight decks will be determined either by standing SOPs or as directed by the Tactical Commander. Using this message an NU can broadcast the following information to other NUs:

a. Airfield/CV flight deck air raid state, SHORADEZ status, NBC contamination state, crash services availability, QFE/QNH and, if known, the airfield ICAO code.

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

c. CV flight deck information, including designated flying course and landing approach condition.

d. Weather data including wind speed, gust and direction, cloud cover and height, visibility, base weather and wind shear indicator.

e. Support information including the capability to rearm with munitions, nitrogen and liquid oxygen availability.

6.9.7.2.1.2 The Time of Observation set in the message applies to the weather data only and will be the time that the weather observation was taken. If no weather data is included in the message, the time of observation will be set to No Statement. An indication will be provided when more than 60 minutes have elapsed since the Time of Observation.

6.9.7.2.1.3 An NU could receive airfield status messages on the same airfield or CV flight deck from more than one source. In this case the information stored will be that of the own unit status report or, if only a third party reports are available, the latest received message, with the exception of weather data. Weather data with the latest time of observation will be retained.

6.9.8 Reporting of Artificial Data for Exercise Purposes

The reporting of artificial platform and system status data may be authorised for exercise purposes. The decision to prohibit or allow artificial data reporting should be agreed prior to commencement of an exercise and should be promulgated in the OPTASK LINK. The reporting of artificial data is subject to the following procedures:

6.9.8.1 If a unit is being reported with exercise status, operators may elect to report artificial values for the associated platform and system status information for exercise purposes only. Operators must not report artificial data without first assigning exercise status to the unit to which the data relates. Artificial values may be reported for the following data:

a. Operational Capability.

b. Specific Type/Site Type.

c. Command and Control status information.

d. Equipment status information.

e. EW status information.

f. Stores status information.

g. ASW status information.

6.9.8.2 Artificial values must never be reported for the following data:

a. Fuel and Fuel Function data (applicable to air platforms only).

b. Time Report Function, Minute and Hour.

c. Flight Deck Status and Landing/Approach Condition (applicable to aircraft carriers only).

d. Airfield Status Data.

6.9.8.3 When artificial data reporting has been authorised, operators receiving platform and system status information on a unit with exercise status should assume that all platform and system status data pertaining to that unit are artificial and for exercise purposes only (with the exception of those data identified in paragraph 6.9.8.2 above for which real data will always be reported). On termination of exercise status, all artificial data will be cleared immediately and replaced with real data as they become available.

6.9.9 Engagement Status Reporting

A controlling NU is responsible for reporting the status of all engagements conducted by friendly weapon system platforms under its control. The tracks of both the friendly weapon system and the target it engages must already exist on the interface. The friendly weapon system can be an NU, a supporting unit or a controlled aircraft. Confirmation from the controlled unit, either by voice or operator observation, is required prior to reporting an initial or changed Engagement Status on Link 22. An "engagement" reporting the deployment of an active electronic decoy will have the Target TN set to the TN of the threat missile, not to the TN of the threat missile carrier.

6.9.9.1 Once initiated, the controlling NU must report the progress of the engagement until it is concluded or the engagement is broken. If an engaging aircraft is involved in a completed handover process, the previous controlling unit must not terminate the engagement on Link 22 and the new controlling unit must report the current engagement status upon acceptance of the handover. When control is terminated, the controlling NU must report a status of either Effective/Target Destroyed/Grand Slam if the engagement has been successfully concluded, or Engagement Broken to clear the reported engagement from the interface. Other NUs may transmit a Data Update Request to obtain the latest information on the weapon engagement status f any currently reported engagement from the controlling NU. Annex C identifies all engagement statuses available for use on the Link 22 interface.

6.9.9.2 In addition to reporting the engagement status of any units under control, NUs with their own weapon capability should also report own engagement status on the Link 22 interface.

6.9.10 Controlling Unit Reporting

All NUs performing an Air Control function for a designated friendly air weapon system platform must report its status as controlling unit for that platform on the Link 22 interface. The mission correlator and/or voice call sign of the controlled aircraft may also be transmitted. This information is reported by an NU when it assumes control of an aircraft and is updated periodically until control is transferred to a new controlling unit or until control is terminated. In the latter case, the controlling NU must report the termination of control responsibility for the designated aircraft.

6.9.11 Pairing Reports

A pairing is reported to establish an operational relationship between the two subject TNs, but should not be used to indicate any form of engagement between them. Several friendly tracks may be paired to a single track or point. A single friendly track may be paired to multiple tracks or points. However, system limitations may restrict multiple pairings.

6.9.11.1 Any NU may report the pairing of a friendly track with another track or point which is being reported on the Link 22 interface. However, pairings involving friendly aircraft under control may only be established and maintained by the controlling NU. If the controlled aircraft is handed over to a new controlling unit, an existing pairing involving that

controlled aircraft will be maintained by the new controlling unit; the old controlling unit should not terminate the pairing on the Link 22 interface. The NU responsible for reporting a pairing should report termination of the pairing when the operator determines that it is no longer valid. However, a pairing relationship will be automatically terminated when one of the two TNs is dropped from the Link 22 interface.

CHAPTER 7

INTERACTION WITH OTHER LINKS

SECTION 1 - GENERAL MULTILINK CONSIDERATIONS

7.1.1 General

This section provides guidance and considerations for operating Link 22 in a multilink environment. Specific data exchange procedures for Link 22 are included in Chapter 6.

7.1.2 Management of the Multilink Interface

7.1.2.1 Responsibilities

Responsibility for management of multilink networks is exercised by the Task Group Commander and the NMU. Their tasks are as follows:

a. The Task Group Commander

The Task Group Commander has the authority and responsibility to ensure the task group operates efficiently and cohesively in the multilink environment designated by him. His management tasks include:

(1) Ensuring that multilink requirements are considered during Pre-mission Planning.

(2) Preparation of technical and tactical plans to ensure the coordination of multilink operations.

(3) Maintaining a list of participants and supervising the allocation of addresses to IUs.

(4) Translating the total track exchange requirements to TN block allocations.

(5) Establishing the requirement(s) for data forwarding. Assigning data forwarding responsibilities to suitable IUs, including backups and/or replacements.

(6) Ensuring that sufficient transmission capacity is assigned to data forwarding units so that all required messages can be forwarded.

(7) Designating responsibility for Track Data Coordination on the multilink interface.

(8) Establishing the initial network structures to support operational requirements.

(9) Promulgating the OPTASK LINK

b. The Network Management Unit. The responsibility for the management of the multilink interface will be assigned to an IU with multilink capabilities. As part of this task, the designated unit will retain responsibility for its respective link, but will also assume responsibility for integrating the capabilities of all links into an effective system. Activities associated with multilink interface management include:

(1) Ensuring that multilink requirements are considered during Pre-mission Planning.

(2) Carry out the technical and tactical plans to ensure the coordination of multilink operations.

(3) Maintaining a list of participants.

(4) Monitoring that sufficient transmission capacity is assigned to data forwarding units so that all required messages can be forwarded.

7.1.2.2 Establishing the Network

For multilink operations, one OPTASK LINK should be issued containing the operational details for all links involved.

7.1.3 Types of Multilink Operation

7.1.3.1 Data Forwarding

Data forwarding is the process of receiving data on one digital data link and outputting the data in the proper format and protocol of another digital data link. During the process a message received on one data link is transformed to the appropriate message(s) required for transmission, in accordance with the transmit rules, of another data link. The translation of messages may vary, based on message content. A data forwarder will process the complete received message prior to taking any forwarding action.

7.1.3.2 Concurrent Operations

A concurrent operator is a system/platform that participates on more than one data link simultaneously. The IU transmits only locally derived data and conforms to all the applicable link protocols for the links on which it is transmitting. In concurrent operations, remote data received on one data link should not be passed to any of the other data links.

7.1.3.3 Loopback Reporting

Within a multilink interface, certain operating configurations can produce data looping when one or more IUs receive the same information from more than one data path. This can happen when both forwarding and concurrent operations are conducted across the same multilink interface. Operators should be aware that multilink configurations incorporating both data forwarding and concurrent operations could 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 multilink interface configuration.

7.1.3.4 Types of Forwarding Link 22 Unit

FNUs may be assigned to forward messages in one of the following configurations:

a. Forwarding Link 22 Unit A (FNUA) - A unit communicating on both Link 22 and Link 11, while forwarding information among Link 22 and Link 11 participants.

b. Forwarding Link 22 Unit B (FNUB) - A unit communicating on both Link 22 and Link 11B, while forwarding information among Link 22 and Link 11B participants.

c. Forwarding Link 22 Unit AB (FNUAB) - A unit communicating on Link 22, Link 11 and Link 11B, while forwarding information among Link 22, Link 11 and Link 11B participants.

d. Forwarding Link 22 Unit J (FJUN) - A unit communicating on both Link 22 and Link 16, while forwarding information among Link 22 and Link 16 participants.

e. Forwarding Link 22 Unit JA (FJUNA) - A unit communicating on Link 22, Link 16 and Link 11, while forwarding information among Link 22, Link 16 and Link 11 participants.

f. Forwarding Link 22 Unit JB (FJUNB) - A unit communicating on Link 22, Link 16 and Link 11B, while forwarding information among Link 22, Link 16 and Link 11B participants.

g. Forwarding Link 22 Unit JAB (FJUNAB) - A unit communicating on Link 22, Link 16, Link 11 and Link 11B, while forwarding information among Link 22, Link 16, Link 11 and Link 11B participants.

7.1.4 Track Number Management in a Multilink Interface

Link 22 and Link 16 both employ 19-bit TNs, composed of five numeric or alphanumeric characters, as described in paragraph 6.1.2.1. Link 11 uses a 12-bit TN composed of four

octal digits only. In a multilink interface if a track is reported using a different TN on each link, an additional burden will be placed on operators to associate, either by voice or data link message, those TNs being used to report the same object. Every effort should be made to ensure that tracks are reported using a common TN on a multilink interface. This can be achieved by equating TNs across links, whereby TNs assigned for use on the multilink interface are limited to the allowable range of the least capable link. Specific procedures for the use of TNs in a Link 22/Link 11/11B interface are contained in paragraph 7.3.1.

7.1.4.1 Situations may occur when the use of TNs cannot be limited in this way, e.g:

a. High track volume requires the use of a greater range of TNs than that provided by the least capable link.

b. Individual system capabilities may not fully support TN equating.

In such cases, TNs will not be able to be equated and the different TNs must be associated (see paragraph 7.1.4.2 below). However, IUs should always equate TNs whenever possible to minimise the requirement for TN association.

7.1.4.2 Track Number Association

In cases where objects are reported by different TNs on different data links, it is possible to relate these different TNs with the TN being used to report the object on Link 22 using the Track Identifier (FJ7.4) message. The Track Identifier message enables an NU to identify TNs being used on the following data links:

a. Link 11/Link 11B.

b. IJMS.

c. NATO Link 1.

d. Army Tactical Data Link (ATDL-1).

A Track Identifier Report may be initiated automatically or by operator action. Additionally, an operator may request TN association information by initiating a Track Identifier Request. There is no management of TN association information. The latest reported association supersedes any previously reported association.

SECTION 2 - OPERATION OF LINK 22 TO LINK 16 INTERFACE

7.2.1 Track Numbers

As there is not any difference in TN Address/Allocation between link 22 and Link 16, there should not be any special procedures to be followed.

7.2.1.1 Where any IU does not have the capability to distinguish between live and simulated data, simulated data must not be transmitted by any NU and must not be forwarded onto the interface.

SECTION 3 - OPERATION OF LINK 22 TO LINK 11/LINK 11B INTERFACE

7.3.1 Track Numbers

When operating a Link 22/Link 11/11B interface, the following procedures should be followed:

a. All NUs should be assigned an address below the octal number 07777, to ensure that each NU can be identified by a single address throughout the interface.

b. NUs which require to exchange addressed messages with Link 11/11B units must be assigned an address below the octal number 00176.

c. Whenever possible, each NU should be allocated one block of low TNs (00200 - 07776) and another block of high TNs (10000 - 77776 and all alphanumerics).

d. FNUs should be allocated, in addition to own host unit TN allocation(s), a block (or blocks) of low TNs specifically to allow the forwarding of Link 22 tracks with TNs greater than 07777.

7.3.1.1 Whenever possible, NUs should always attempt to originate tracks with TNs from the low TN block to minimise the need for interlink TN association. The high TN block should be utilised only as an overflow block when no low TN is available for use. When a track with a TN greater than 07777 is forwarded to Link 11/11B, the data forwarder will assign a Link 11/11B TN to the track and report the TN association to other IUs via the Track Identifier message on Link 22 (see paragraph 7.1.4.3) and the equivalent message on Link 11.

7.3.1.2 Where any PU or RU participating on the interface does not have the capability to distinguish between live and simulated data, simulated data must not be transmitted by any NU and must not be forwarded onto the interface.

CHAPTER 8

MANAGEMENT PROCEDURES

SECTION 1 – OVERVIEW

8.1.1 Introduction

This chapter describes the procedures for management of a Link 22 system. The objective of Link 22 management is to monitor performance and configuration of the Link 22 supernetwork and to optimise the configuration of the Link 22 supernetwork in order to maintain or improve the performance of the supernetwork within the tactical operational requirements.

8.1.1.1 In general the Link 22 management is divided into three levels:

a. Supernetwork management functions related to monitoring and optimising the entire supernetwork. Typically these functions are performed under the control of the SNMU.

b. Network management functions related to monitoring and optimising a network. Typically these functions are performed under the control of the NMU of that network.

c. NU management functions related to monitoring and optimising a single NU.

8.1.1.2 In the following sections a description is given of the various management functions available in the Link 22 system.

SECTION 2 - SUPERNETWORK MANAGEMENT FUNCTIONS

8.2.1 Supernetwork Reconfiguration Planning

The SNMU is responsible for any supernetwork reconfiguration planning. Based on the information contained in the performance messages received from all the NUs in the SN, the DLP of the SNMU determines whether the current SN configuration meets the tactical requirements. If the requirements are not met then the SNMU can plan and execute configuration changes in the following two areas.

8.2.1.1 SN Frequency Management

The SNMU is responsible for ensuring that the frequencies/hopsets used within the individual Link 22 networks do not interfere with each other. If considered necessary, the SNMU may distribute to the responsible NMU updates to the frequency allocation initially specified in

the OPTASK LINK message. The DLP of the SNMU has the capability to send the new frequency allocation to the responsible NMU using the Frequency Allocation tactical management message. On receipt of the Frequency Allocation tactical message by an NMU, the NMU will undertake and manage the necessary Network Reinitialisation procedures in order to bring the newly allocated frequency into operation.

8.2.1.2 SN Composition

The following describes how the SNMU manages changes in the composition of the supernetwork

8.2.1.2.1 Establishment of a New Link 22 Network

a. If the SNMU considers that the existing Link 22 networks do not meet the tactical requirements, the SNMU may establish additional networks up to a maximum of eight in any single Supernetwork.

b. The SNMU can establish a new network by distributing the required Network Establishment data via an external network (e.g., voice coordination circuit) to any members who are currently not connected to the SN. The network establishment data contains the same parameters as contained in the OPTASK LINK message. On receipt of the network establishment data the NUs will proceed to establish the network as described in chapter 5. The type of network initialisation to be used will be specified in the network establishment data.

c. When the new network is formed from NUs which are already connected to the network, the SNMU can use the current connections to distribute the Network Establishment data. The SNMU can assign all NUs currently connected to the supernetwork to be a member of the new network. If not all NUs are part of the new network, the SNMU can create a MASN which includes all NUs that are to be a member of the new network.

d. The network establishment data is now distributed by the DLP of the SNMU using a Network Media Parameters tactical management message. This message is either addressed to all NUs in the supernetwork (totalcast) or to the appropriate MASN. The network initialisation method is limited to Channel Probing only. The SNMU will determine the probing parameters and include them in the Network Media Parameters message.

e. On receipt of the Network Probing Parameters tactical message by the DLP of an addressed NU, the DLP will proceed to establish a Link 22 network as described in chapter 5.

8.2.1.2.2 Closing Down Existing Networks

When considered appropriate the SNMU may close down an existing Link 22 network as described in chapter 5.

8.2.1.2.3 Merging Supernetworks

The SNMU has the ability to merge two supernetworks. supernetworks may only be merged if they were established with a block of Link 22 addresses that do not conflict. The merging of two supernetworks requires voice coordination between the SNMUs of both supernetworks. The SNMUs will agree and instruct one or more NUs to join appropriate networks in order to provide connectivity between the two supernetworks. The chosen NUs will join the network(s) specified by the SNMU using the Late Net Entry procedure as described in chapter 5.

8.2.1.2.4 Instructing an NU to Join a Network

The SNMU may instruct an NU already part of the supernetwork to join another network which is either part of the supernetwork or part of another supernetwork. The DLP of the SNMU will send a Network Management Order tactical management message to the NU. This message includes the media parameters (Media Type, frequency/hopset, Media Setting Number, Media Fragmentation Rate) and crypto parameters (key pair key, key pair ID, Link Level COMSEC (LLC) integrity status) currently in use on the specified network. On receipt of the Network Management Order tactical management message the NU will join the indicated network using the Late Net Entry procedure as described in chapter 5.

8.2.1.2.5 Instructing an NU to Leave a Network

The SNMU may instruct an NU to leave a network as described in Chapter 5.

8.2.1.2.6 Instructing an NMU to Reconfigure the Network

The SNMU may instruct an NMU to reconfigure the network. This can be communicated to the NMU using an external circuit (e.g., voice coordination) or by sending a Reconfigure Order using the Network Management Order tactical management message. The only parameters which can be reconfigured using this message is the DTDMA setting in the network. If any changes are to be made by the SNMU to the networks ONCS then these changes can only be passed to the NMU via an external circuit. On receipt of the Network Management Order tactical management message by the DLP of the NMU, the DLP will execute the required network reconfiguration procedure.

8.2.1.2.7 Instructing an NMU to Reinitialise the Network

The SNMU may instruct an NMU to reinitialise the network. The DLP of the SNMU will use the Network Management Order tactical management message to communicate the new network parameters to the NMU including frequency/hopset, Media Setting Number(s) (MSN), Media Fragmentation Rate and crypto parameters. The SNMU can order the NMU to reinitialise the network using network probing and may specify up to four MSNs to be probed. On receipt of the Network Management Order tactical management message by the DLP of the NMU the NMU will perform the required reinitialisation procedure.

8.2.2 Directory Maintenance

Both the DLP and the SNC of each NU in the supernetwork will maintain a directory of the supernetwork. The directory contains at least the following information:

a. For each network in the supernetwork:

(1) Network ID.

(2) Media Type (HF, UHF, etc.).

(3) Network Cycle Time.

b. For each NU in the supernetwork:

(1) Link 22 address.

(2) Network ID(s) of networks in which NU participates.

(3) MASN ID(s) of MASNs in which NU participates.

(4) NU Role (SNMU, NMU, Standby SNMU, Standby NMU).

(5) NU Status (Active, Radio Silent, Receive Only, Inactive).

(6) NU Relay Setting (Automatic, Inhibited Potential Relay NU (PRNU), Preferred Reporting Potential Relay NU (RPRNU)).

8.2.2.1 The initial directory is compiled by each NU from the information in the OPTASK LINK Message. Both the DLP and the SNC will automatically update the information in the directory based on management messages received from various sources. Further the SNC of the SNMU will hold a master copy of the directory. The SNMU will send directory update messages to all NUs in the supernetwork when an NU is leaving/joining the supernetwork. It is also possible for a NU to request a copy of the directory from the SNMU.

8.2.3 Relay

Within the Link 22 system, the relay function is an automatic and distributed function. Normally the SNC of each NU in the supernetwork determines whether it should act as a relay for a message based on the destination(s) of the message and the connectivity of the NU. However, when necessary, the SNMU has the capability to influence the relay status of an NU in the supernetwork. This may be necessary for example to force an NU to relay messages in order to reach Radio Silent or Receive Only NUs, or at the other hand to inhibit an NU from relaying messages to ensure that the full allocated capacity is available to that NU to transmit its own traffic. The SNMU can change the Relay status of an NU as one of the following:

a. Automatic: this is the default setting of the Relay Status for each NU in the supernetwork and indicates that the NU is to provide relaying on the supernetwork.

b. Inhibited: indicates that the NU is not to be used for relaying on the supernetwork.

c. Preferred: indicates that the NU is to provide relaying on the network and will be selected in preference to NUs with "Automatic" relay status.

8.2.3.1 In order to change the relay status of an NU, the DLP of the SNMU passes the Link 22 address and Relay Status of that NU to its SNC. The SNC of the SNMU will send a Potential Relay NU (PRNU) Role technical message to the NU indicating its new relay status. When the addressed NU receives the PRNU Role technical message, its SNC will change its relay status accordingly and will inform its DLP about the change.

8.2.4 MASN Management

A Mission Area Subnetwork (MASN) is a logical grouping of NUs in a supernetwork to which tactical messages can be addressed. A Link 22 supernetwork may contain up to 30 MASNs. An individual MASN may contain between 2 and 124 NUs.

8.2.4.1 Initially the MASN requirements are obtained by each NU in the supernetwork from the OPTASK LINK message during network initialisation and MASNs are created accordingly and registered in the directory. During Link 22 supernetwork operation the management of MASNs is the responsibility of the DLP of the SNMU under the direction of the OTC. The DLP has the capability to:

a. Create MASNs.

b. Modify the composition of an existing MASN (adding/removing members of a MASN).

c. Delete an entire MASN.

8.2.4.2 Any of the above listed changes to the MASNs are distributed by the DLP of the SNMU to the DLP of all other NUs in the supernetwork by means of a MASN Management tactical management message. On reception of such a message, the DLP will automatically inform the SNC about the change to the MASNs. Also the directory is updated automatically.

8.2.5 Flow Control

The purpose of the flow control capability is to resolve congestion in a supernetwork. The behaviour of the link 22 system is such that congestion will be controlled by first applying rerouting over various alternative routes in the routing protocol performed by the SNC of each NU. If congestion still occurs, the dynamic TDMA capability of the SNC will be

initiated to resolve the congestion by attempting to allocate more capacity to a congested NU. If the congestion is still not resolved, the Flow Control capability is invoked to regulate the amount of traffic in (parts of) the supernetwork.

8.2.5.1 Once re-routing and DTDMA do not resolve the congestion, the SNC of a congested NU will start to analyse the queues with messages scheduled for transmission. In this analysis, the SNC compiles a list of messages, ranked to the total amount of data per originator NU, including its own messages; the Flow Control function of the SNC will pass this list of messages to the DLP. It is the responsibility of the DLP/operator to advise the SNC which of the Tactical messages can be deleted from the queue.

8.2.6 Radio Silence

A link 22 supernetwork is primarily designed as an active supernetwork, i.e., NUs on Link 22 networks and the supernetwork are making transmissions. It is possible for NUs, networks and even the entire supernetwork to be configured in Radio Silent Mode.

8.2.6.1 NUs in Radio Silence

An NU can operate in radio silence on one network while being active on another. It is possible for an NU to initialise in Radio Silence Mode. This will be instructed in the OPTASK LINK Message. During operation, an NU can be instructed by the NMU or the SNMU to enter radio silence mode. The NMU or SNMU will do this by sending a Radio Silence Order tactical management message. On receipt of this message the DLP of the NU will instruct the SNC to go into Radio Silence Mode. The DLP of the NU will inform all other NUs in the supernetwork about this by sending a NU Network Status tactical management message. The Radio Silence Order message also contains the duration of the Radio Silence period. After this period the NU will automatically re-enter the active mode. Once in Radio Silence mode, an NU can still make urgent transmissions without leaving the radio silence mode, although it has to break radio silence for the duration to make the transmission. If the NU has no assigned time slots, it will make the urgent transmission in an interrupt slot.

8.2.6.2 Network in Radio Silence

It is possible for an entire Link 22 network to be in Radio Silence Mode. In that case all NUs participating in that network will be in the radio silence mode. Note that one or more of these NUs can still be active on other networks. It is possible for an entire Link 22 network to initialise in Radio Silence Mode when ‘Short Initialisation’ is employed (see chapter 5). It is not possible to initialise the network in Radio Silence mode while employing ‘Channel Probing’ for network initialisation. During operational mode of a Link 22 network, the NMU of the network or the SNMU can instruct the entire network to enter Radio Silence mode by sending a Radio Silence Order tactical management message to all NUs in the network. On receipt of this message by the DLP of an NU, the DLP will instruct the SNC to enter the Radio Silence mode. The Radio Silence Order message also contains the duration of the Radio Silence period. After this period the NU will automatically re-enter the active mode.

8.2.6.3 Supernetwork in Radio Silence

The SNMU of the supernetwork can instruct the entire supernetwork to enter Radio Silence mode by sending a Radio Silence Order tactical management message to all NUs in the supernetwork. On receipt of this message by the DLP of an NU, the DLP will instruct the SNC to enter the Radio Silence mode. The Radio Silence Order message also contains the duration of the Radio Silence period. After this period the NU will automatically re-enter the active mode.

8.2.7 Security Management

<<To be provided by NILE PMO>>

SECTION 3 - NETWORK MANAGEMENT FUNCTIONS

8.3.1 Network Reinitialisation

When the NMU determines that the performance network does not satisfactorily meet the requirements of the Tactical Commander, he may order a reinitialisation of the network to modify network parameters and/or the network cycle structure. This action will result in a period of interruption of Link 22 data exchange. The NMU must inform all network participants of the intended reinitialisation action. New network data will be generated and automatically transmitted to all NUs via technical message using the current ONCS. At the indicated time, all NUs in the network will perform the reinitialisation. Three forms of reinitialisation are available.

8.3.1.1 Media Parameter Change

With Media Parameter Change, the NMU has the ability to change the media settings of the network. These media settings include frequency or frequency hopset, media fragmentation rate and LLC integrity. Once the new media settings are selected, the DLP of the NMU passes the new settings to the SNC of the NMU together with the timestamp on which the new media settings should become effective. The SNC of the NMU distributes the new settings to the SNC of all NUs in the network by means of technical messages. On reception of these technical messages the SNC of each NU schedules a reinitialisation on the indicated time and inform their DLP about the upcoming reinitialisation. After reinitialisation the same ONCS is used.

8.3.1.2 Short Reinitialisation

In Short Reinitialisation, the NMU has the ability to change the media settings (as with Media Parameter Change), the ONCS and the setting of the DTDMA mode (enabled/disabled). Once the new media settings are selected, the new ONCS is designed and the new DTDMA mode is selected, the DLP of the NMU passes these parameters to the SNC of the NMU together with a timestamp on which the new parameters should become effective. The SNC

of the NMU distributes the new network settings by means of technical messages to the SNC of all other NUs in the network. On reception of these technical messages the SNC of each NU schedules a reinitialisation on the indicated time and inform their DLP about the upcoming reinitialisation. After reinitialisation the same ONCS is used.

8.3.1.3 Reinitialisation with Probing

Reinitialisation with probing is the most extensive form of network reinitialisation. In this case the new media settings are selected in terms of frequency or frequency hopset and a list of Media Setting Numbers. Also a list of NUs is generated which are participating in the probing sequence. Further the new setting of the DTDMA mode is selected. All this information is passed by the DLP of the NMU to the SNC of the NMU together with a timestamp on which the probing sequence should start. The SNC of the NMU distributes the new network settings by means of technical messages to the SNC of all other NUs in the network. On reception of these technical messages the SNC of each NU schedules a reinitialisation on the indicated time and inform their DLP about the upcoming reinitialisation. After the probing sequence starts the reinitialisation is further completed in the same way as network initialisation with probing.

8.3.2 Network Reconfiguration

Network reconfiguration allows the NMU to change the ONCS or the setting of the DTDMA mode without interruption of the Link 22 traffic. Network reconfiguration can be performed in three ways.

8.3.2.1 DLP Specifies the ONCS

With this form of reconfiguration the ONCS is designed by the operator possibly assisted with tools residing in the DLP. Once the ONCS is designed and the new setting of the DTDMA mode is determined, the DLP of the NMU passes the new ONCS and new DTDMA setting to the SNC of the NMU together with a timestamp on which the new settings should become effective. The SNC of the NMU distributes the new ONCS and DTDMA setting to the SNC of all NUs in the network by means of technical messages. On receipt of these technical messages the SNC of the NU schedules a reconfiguration of the ONCS and DTDMA mode accordingly and informs its DLP about the reconfiguration.

8.3.2.2 SNC Specifies the ONCS

In this case the DLP of the NMU requests the SNC of the NMU to design the ONCS and provides the SNC with the capacity and delay requirements of the NUs in the network and also provides the SNC with the new DTDMA setting and a timestamp on which the new ONCS and DTDMA setting should become effective. Once the SNC has designed the ONCS, it passes the ONCS to the DLP of the NMU for approval. After the DLP/operator has approved the ONCS the SNC distributes the new ONCS and DTDMA setting to the SNC of all NUs in the network by means of technical messages. On receipt of these technical messages the SNC of the NU schedules a reconfiguration of the ONCS and DTDMA mode accordingly and informs its DLP about the reconfiguration.

8.3.2.3 DTDMA Change

The DTDMA change allows the DLP of the NMU to change the setting of the DTDMA mode in the network without changing the ONCS. The DLP of the NMU passes the new setting to the SNC of the NMU. The SNC of the NMU distributes the new DTDMA setting to the SNC of all NUs in the network by means of a technical message. On receipt of this technical message the SNC of the NU changes the DTDMA setting accordingly and informs its DLP.

8.3.3 DTDMA

DTDMA, also called Dynamic Capacity Reallocation, may be employed in a Link 22 network to improve the Network Cycle Structure by dynamically shifting the ownership of minislots.

8.3.3.1 The principle of DTDMA is that an NU with an overload of messages to transmit will request capacity (minislots) from other NUs in the network. Each SNC will decide, based on its own traffic load, whether it can offer some of its capacity either temporary or permanent. The requesting SNC will select one or more of the offers to satisfy its capacity requirements.

8.3.3.2 DTDMA is an automatic process performed by the SNC of an NU. DTDMA is either switched on or off for all NUs in a network. The initial setting of DTDMA is specified in the OPTASK LINK Message, and the SNC is configured accordingly during network initialisation. On UHF networks, DTDMA should normally be ordered in the OPTASK LINK Message to be set to 'Disable'.

8.3.3.3 During network operation the NMU has the capability to enable or disable the DTDMA function. The SNC of the NMU will send a DTDMA Enable/Disable technical message to all NUs in the network. On reception of this technical message the SNC will configure the DTDMA function accordingly and will notify the DLP of the new setting. The DTDMA setting can also be changed as part of a network reconfiguration or network reinitialisation.

SECTION 4 - NU MANAGEMENT FUNCTIONS

8.4.1 Congestion Assessment

The SNC of each NU continuously monitors the amount of messages queued for transmission on the supernetwork. The SNC will inform its DLP/operator about the amount of traffic queued for transmission by passing a congestion index values to the DLP. This information is provided by the SNC every Network Cycle Time for each connected network. The values and meaning of the congestion index are listed in Table 8.1.

CV INDEX	Meaning
0	No Congestion
1	Light Congestion
2	Moderate Congestion
3	Severe Congestion

Table 8.1 Congestion Index Values and Meanings

8.4.2 Performance Monitoring

SNC will have the capability to provide the DLP with the performance monitoring information collected by the SNC at the rate specified by the DLP. The SNC will be capable to provide the DLP with the following information:

a. Channel utilisation: percentage of the available slot capacity used for traffic generated by the NU itself and used for relaying traffic from other NUs.

b. Connectivity information: for each Network to which the NU is connected, the SNC will provide the DLP with information on reception quality and connectivity with surrounding NUs.

c. Error rate characteristics: the SNC will provide the DLP information on the percentage of network packets received error free, with recoverable errors, with unrecoverable errors, network packets not received and packets that failed the integrity check.

d. DTDMA participation: the SNC will provide the DLP with information on the number of offers made to other NUs for capacity, the number of offers which were accepted, the numbers of requests the NU made for more capacity to other NUs and the number of requests resulting in capacity offers from other NUs.

8.4.2.1 The DLP of each NU will send an NU Performance tactical management message to the NMU(s) of the network(s) to which the NU is connected, the corresponding standby NMU(s), the SNMU and the standby SNMU. These NU Performance tactical messages contain the following information:

a. Tactical Message Activity.

b. Congestion.

c. Error Rates.

d. Channel Utilisation.

e. Connectivity.

f. DTDMA Activity.

g. End to end delay for received tactical messages.

h. Directory of NILE Addresses held by SNC.

i. Current Network Cycle Structure.

8.4.2.3 Based on the information in these NU Performance tactical messages, the DLPs of the NMUs and the SNMU will establish an overall assessment of the performance of respectively the networks and supernetwork and decide whether the network/supernetwork still meets the tactical operational requirements.

8.4.3 Fault Management

The SNC of an NU will be able to detect and, if possible, to recover from a fault or a fault condition affecting the performance of the SNC in the SN. If the SNC is not able to resolve the fault, recovery of the fault will be passed on to the DLP/operator. The exact procedures for fault management and fault recovery are not yet defined.

SECTION 5 - NETWORK UNIT MANAGEMENT ROLES

8.5.1 Supernetwork Management Unit (SNMU)

The SNMU is able to hand over its responsibilities to another NU at any time. In order to do this the DLP of the current SNMU sends a Network Management Order tactical management message indicating “Assume SNMU Role” to the DLP of the new SNMU.

8.5.1.1 After having assumed its new role, the DLP of the new SNMU will inform all other NUs in the supernetwork by sending an NU Network Status tactical management message with the indication “assuming SNMU Role”. The DLPs of all NUs in the supernetwork, including the DLP of the newly assigned SNMU, will notify their SNC about this change.

8.5.1.2 As part of its operational procedures, the DLP of the standby SNMU is required to monitor that the SNMU is active based on the receipt of NU Performance tactical management messages from the SNMU. If the DLP of the standby SNMU detects that the SNMU has become non-operational (no NU Performance messages are received from the SNMU within a certain time) it will assume the role of SNMU and inform all other NUs in the supernetwork as described above.

8.5.2 Standby Supernetwork Management Unit

The SNMU is able to assign the responsibility of standby SNMU to an NU at any given time. In order to do this the DLP of the SNMU send a Network Management Order tactical management message indicating "Assume Standby SNMU Role" to the DLP of the new standby SNMU.

8.5.2.1 After having assumed its new role, the DLP of the new standby SNMU role will inform all other NUs in the supernetwork by sending an NU Network Status tactical management message with the indication "assuming standby SNMU Role". The DLPs of all NUs in the supernetwork, including the DLP of the newly assigned standby SNMU, will notify their SNC about this change.

8.5.2.2 As part of its operational procedures the DLP of the SNMU is required to monitor that the standby SNMU is active; this is based on the receipt of NU Performance tactical management messages from the standby SNMU. If the DLP of the SNMU detects that the standby SNMU has become non-operational (no NU Performance messages are received from the standby SNMU within a certain time) it will appoint another NU as the standby SNMU using the procedure described above.

8.5.3 Network Management Unit

An NMU is able to hand over its responsibilities to another NU in the same Link 22 Network. In order to do this the DLP of the current NMU sends a Network Management Order tactical management message indicating "Assume NMU Role" to the DLP of the new NMU.

8.5.3.1 As well as the NMU, also the SNMU is able to instruct an NU within a particular Link 22 network to take over the role of the NMU in that network using the same Network Order Management message as described above.

8.5.3.2 After having assumed its new role, the DLP of the new NMU will inform all other NUs in the supernetwork by sending an NU Network Status tactical management message with the indication "assuming NMU Role". The DLPs of all NUs in the supernetwork, including the DLP of the newly assigned NMU, will notify their SNC about this change.

8.5.3.3 As part of its operational procedures, the DLP of the standby NMU is required to monitor that the NMU is active based on the receipt of NU Performance tactical management messages from the NMU. If the DLP of the standby NMU detects that the NMU has become non-operational (no NU Performance messages are received from the NMU within a certain time) it will assume the role of NMU and inform all other NUs in the supernetwork as described above.

8.5.4 Standby Network Management Unit

The SNMU or the NMU of a particular network is able to assign the responsibility of standby NMU for that network to an NU in that network at any time. In order to do this the DLP of the SNMU or the DLP of the NMU will send a Network Management Order tactical management message indicating "Assume Standby NMU Role" to the DLP of the new standby NMU.

8.5.4.1 After having assumed its new role, the DLP of the new standby NMU will inform all other NUs in the supernetwork by sending an NU Network Status tactical management message with the indication "assuming standby NMU Role". The DLPs of all NUs in the supernetwork, including the DLP of the newly assigned standby NMU, will notify their SNC about this change.

8.5.4.2 As part of its operational procedures, the DLP of the NMU is required to monitor whether the standby NMU is active based on the receipt of NU Performance tactical management messages from the standby NMU. If the DLP of the NMU detects that the standby NMU has become non-operational (no NU Performance messages are received from the standby NMU within a certain time) it will appoint another NU as the standby NMU using the procedure described above.

ANNEX A

GLOSSARY OF TERMS AND ACRONYMS/ABBREVIATIONS

A.1 Annex A consists of two Appendices as follows:

a. Appendix 1 - Glossary of Terms and Definitions for Link 22.

b. Appendix 2 - List of Acronyms and Abbreviations used in ADatP-22.

APPENDIX 1 TO ANNEX A

GLOSSARY OF TERMS AND DEFINITIONS FOR LINK 22

Address	A number applied to an interface unit (IU) to associate information and directives with/to own ship/other interface units (IUs) or tracks for both digital and voice communications.
Anti-submarine Warfare	Operations conducted with the intention of denying the enemy the effective use of his submarines. ASW involves the use of military assets to search for, detect, locate, track, classify, and attack/destroy a submarine threat to friendly forces.
Anti-submarine Warfare NU	Antisubmarine Warfare Link 22 Units (ASW NUs) possess organic ASW processing capability, i.e., the capability to collect, coordinate and analyse parametric data and derive product data for reporting in Subsurface Track messages.
ASW AOP	A defined area of probability during an Anti-submarine Warfare evolution.
ASW FIX	A location of a track produced using ASW localisation procedures.
Architecture	The timing structure of the system.
Assignment Slot	Assignment Slot is a transmission time slot assigned to an active unit in a Time Division Multiple Access protocol network. It is constructed of a contiguous number of mini-slots.
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.
Broadcast	Broadcast is the mode of transmission used to send a message to RF neighbours (i.e., no use of routing or relay takes place).
CANTCO	Originator of this response understands but cannot comply with the order. This is a manually generated response by an operator who has received the order and has determined it cannot be executed.
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.
Command	An order given by a commander; that is, the will of the commander expressed for the purpose of bringing about a particular action.
Common Track	A track on which two or more interface units (IUs) are entering local positional information.
Common Local Track	A track on which positional data has been locally derived by a C^2IU but is currently being reported by another C^2IU.

Communications Security	Communications Security is the protection resulting from all measures designed to deny unauthorised persons information of value that might be derived from the possession and study of telecommunications, or to mislead unauthorised persons in their interpretation of the results of such possession and study. Communications security includes: a. crypto security; b. transmission security; c. emission security; and d. physical security of communications security materials and information.
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.
Data Filter	A data filter is that function which inhibits data from transmission on the data link or the process of deleting data received on the data link prior to entry of that data into a unit data base.
Data Forwarding	The process of receiving data on one digital data link and outputting the data, using proper format and link protocols, to another type of digital data link(s). In the process, a message(s) received on one link is translated to an appropriate message(s) on another link. Data forwarding is accomplished by the selected forwarding unit(s) simultaneously participating on more than one type of data link. The data that is forwarded is based on the data received and is not dependent upon the local system data of the data forwarding unit or its implementation of the received message or the forwarded message.
Data Link	Means of communication for digital transmission and receipt of a data message.
Data Link Processor	The set of functions which allow a TDS to interface to the Link 22 SNC. These functions include the formatting and generation of Link 22 format messages, data filters, correlation, determination of Reporting Responsibility etc. In a Data Forwarding unit, the forwarding of data between Link 22 and other tactical data links (Link 16, Link 11) is part of the DLP function.
Data Mile	A standard unit of distance - 6000 feet.
Data Source	A unit to which data can be addressed, and from which data can be identified as to source (i.e., all JUs, NUs, PUs and RUs).
Datum (ASW)	The last known position of a submarine or suspected submarine, after contact has been lost.

Decorrelation	(1) The determination that locally held track data for a given track number (TN) does not represent the same object or point as 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.
Drop Track	An indication from the unit having reporting responsibility for a particular track that the unit will no longer report it. Other units holding an interest in that track may continue to report it.
Dual Designation	The same track is being reported by two or more units using two or more different track numbers.
Duplicate Track Number	The same track number used by two or more units for two or more different tracks.
Dynamic Reallocation	The ability of the TDMA Network to redistribute channel capacity amongst participating units, in response to needs of units. Link 22 uses a fully distributed and automatic set of protocols for Dynamic Reallocation.
Dynamic Time Division Multiple Access	DTDMA is a form of TDMA where ownership of transmission capacity is transferred between NUs. The length of the Network Cycle Time remains unchanged by the dynamic allocation of transmission capacity.
ECM Resistant	Resistant against electronic jamming and electronic deception.
Electronic Counter Measures	Actions taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum. ECM include electronic jamming, electronic deception, manipulative deception, and imitative deception.
Electronic Protective Measures	Actions taken to ensure effective friendly use of the electromagnetic spectrum despite the enemy's use of EW.
Electronic Warfare	Actions involving the use of electromagnetic energy to determine, exploit, reduce, or prevent hostile use of the electromagnetic spectrum, and actions retaining friendly use of the electromagnetic spectrum. There are three divisions of EW: ESM, ECM and EPM.
Electronic Warfare Support Measures	Actions taken to search for, intercept, locate, record, and analyse radiated electromagnetic energy for the purpose of exploiting such radiations in support of military operations. Thus, ESM provides a source of EW information required to conduct ECM, EPM, threat detection, warning, avoidance, target acquisition, and homing.
Engagement Status	The current relationship between a weapon system and a target or the reason for change of a relationship previously reported.
Engineering Mode	A mode of operation in which it is not possible to transmit tactical messages e.g., during Initialisation.
Error Detection and Correction	A method of coding information such that transmission errors can be detected and corrected.

ESM	Electronic Support Measures are actions taken of a passive nature to search for, intercept, locate, record, and analyse radiated electromagnetic energy.
Extranetwork Relay	The retransmission of messages using a different Link 22 network from the one on which they were received.
Extranetwork Relay Unit	A NU having the responsibility to receive messages from one Link 22 network and retransmit these messages on another Link 22 network.
F-Series Messages	The digital message format employed in STANAG 5522.
Fixed (Length) Message Format	A specification of a pre-defined sequence of words that may be composed of an initial word, one or more extension words and one or more continuation words.
Fixed Slot Length Dynamic TDMA	A form of DTDMA which allows automatic transfer of time slot ownership between NUs without changing Time-slot boundaries. FiSLDTDMA uses TOC and Swap protocols.
Fixed Time Division Multiple Access	Fixed Time Division Multiple Access means fixed slot lengths and fixed ownership of slots, i.e., the slot borders will not change nor will slots be reallocated during network operation without manually implementing and reinitialising the network. Slot lengths are determined prior to initialising the network but need not be all of the same length
Flooding	The relay of designated data by each network NU receiving that data. Flooding is used to provide a high probability of reception of specified data by all units in a network.
Force Tell	The process whereby data that are being inhibited by a filter are allowed to be transmitted or received.
Forwarding MIDS Unit	A JU that translates and forwards data among IUs using J-Series messages and M-Series messages. An FJU is either an FJUA, FJUB, or FJUAB.
Forwarding MIDS Unit A	A JU communicating on both Link 11 and Link 16 while forwarding information between Link 11 and Link 16 participants.
Forwarding MIDS Unit B	A JU communicating on both Link 11B and Link 16 while forwarding information between Link 11B and Link 16 participants.
Forwarding MIDS Unit AB	A JU communicating on Link 16, Link 11, and Link 11B while forwarding information among Link 16, Link 11, and Link 11B participants.
Forwarding Link 22 Unit	An NU that translates and forwards data among interface units (IU) using J-series messages, F-series messages and M-series messages. The additional letters refer to the data link involved in data forwarding. A= Link 11, B= Link 11B J= Link 16, e.g., an FJUNA is an NU communicating on Link 22, Link 16 and Link 11 while forwarding information among Link 22, Link 16 and Link 11 participants.
Forwarding Unit	An IU which is operating on multiple links and has the responsibility for transfer of track data between links. The transfer might be a manual or automatic function to ensure all relevant data is reported on the appropriate links.
Forwarding Participating Unit	A PU which has the additional responsibility for transferring data

	between Link 11 and one or more reporting units.
Forwarding Reporting Unit	A reporting unit which has the additional capability of relaying data between two or more reporting units.
Free Text Message	Bit oriented message whose information bits may be used to represent digitised voice, teletype, and other forms of free text information.
Frequency Hopping	Frequency Hopping is an EPM technique in which the instantaneous carrier frequency of a signal is periodically relocated, according to a pre-determined code, to other positions within a frequency spectrum much wider than that required for normal message transmission. The receiver uses the same code to keep in synchronisation with the hopping pattern.
Handover	The passing of control authority of an aircraft or other air vehicle from one control agency to another control agency. Handover action is complete when the receiving controller acknowledges assumption of control authority.
Hop	The dwell time of a frequency hopping system.
Information Security	INFOSEC is the protection of information against unauthorised disclosure, transfer, modification, or destruction, whether accidental or intentional. INFOSEC is comprised of COMSEC, NETSEC, and TRANSEC.
Interface	A boundary or point common to two or more similar or dissimilar command and control systems, subsystems, or other entries against which or at which necessary information flow takes place. (See Link 22 Interface).
Interface Unit	A JU, NU, PU or RU communicating directly or indirectly (i.e., identified as a data source) on the interface.
Intermedia Relay	The relay of messages from a Link 22 network operating on one medium to a network operating on another medium. (See relay).
Interoperability	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 so exchanged to enable them to operate effectively together.
Interrupt Slot	A contiguous group of mini-slots which is available for contention access.
Intranetwork Relay	The relay of messages within a single Link 22 network (see Relay).
J-Series Messages	Formatted digital data messages as defined in STANAG 5516.
Joint	Denotes activities, operations, organisation, etc., in which elements of more than one Service of the same nation participate.
Kilo	A friendly track of special interest to the air defence system, e.g., special mission, etc.
Land Tracks/Points	Tracks or Points reported in the land environment. Similar to Land (Ground) Tracks/Points in Link 16.
Late Network Entry	The procedure required to permit a non participant in an established Link 22 Network to become a member of the network which has no time

	slots allocated to the LNE unit so that the NCS must be changed to provide Assignment Slots for the LNE unit.
Leg	The part of a relay transmission completed by a single transmission.
Link 4A	A time division data transmission link between control station and controlled aircraft. It provides the capability for automatic transmission of orders, status, and other information with standard V- and R-Series message formats. Data exchange is accomplished on a fully automatic link at 5000 bits per second, using serial transmission. Transmission characteristics and standards for Link 4A are set out in STANAG 5504.
Link 11	An automatic HF/UHF data link exchanging picture compilation, command status and control information, using M-Series messages, a Roll Call protocol and either a parallel transmission (kineplex) frame (CLEW) or a single tone waveform (SLEW) characteristics at either 2250 or 1364 bits per second (for CLEW) or 2400 symbols per second (for SLEW). Transmission characteristics for Link 11 are set out in STANAG 5511.
Link 11B	A secure point to point data link utilising serial transmission frame characteristics and standard message formats at a basic speed of 600 or 1200 bits per second. This data link interconnects tactical air defence and air control units. Transmission characteristics and standards for Link 11B are set out in STANAG 5511.
Link 14	Non-automatic computer controlled UHF/MF/HF FSK teletype broadcast of TDS and non-TDS tracks.
Link 16	A secure, jam resistant nodeless data link which utilises the Multifunctional Information Distribution System (MIDS), and the protocols, conventions and fixed word message formats defined by STANAG 5516.
Link 22	A secure nodeless data link which utilises the NILE Communications Equipment (NCE), and the protocols, conventions and fixed word message formats defined by STANAG 5522.
Link 22 Address	A 15 bit reference number of five octal digits used to identify the originator of a message and to address messages to a specific NU or NUs.
Link 22 Interface	The tactical data exchange interface comprised of three basic components: participating NUs, the Link 22 Message Standard, and Voice Coordination Nets/Circuits. The interface may be connected via data forwarder(s) to a NADGE interface (i.e., Link 11 and/or Link 11B).
Link 22 Network	Established when a Link 22 unit becomes active and begins to exchange information with one or more Link 22 units in accordance with the messages and protocols in STANAG 5522 and using a single medium and a unique set of network parameters. The members of a Link 22 network need not be RF neighbours.

Link 22 Supernetwork	Composed of one or more interconnected Link 22 networks. Component networks are connected to provide a data path among all units in the supernetwork.
Link 22 Unit	A unit communicating directly on Link 22. All Link 22 units will have a Command and Control capability.
Local Track	A track on which positional data has been locally derived and is not currently being reported by another C^2IU. Amplifying data associated with the track may be derived locally, from supporting units, or from data links.
Locally Derived Data (Local Data)	Data which was locally derived.
Locally Held Data	Data items established within an IU's data base. Such data may be either locally or remotely derived.
Machine Receipt	See Automatic Acknowledgement. See also Receipt/Compliance. A message automatically transmitted by a unit's computer in response to a message sent from another interfacing unit indicating receipt.
Message Format	A specification of the arrangement of information contained in a message that has a unique message identifier.
Message Originator	The NU which first transmitted a message on a Link 22 supernetwork.
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 among cooperating systems to ensure interoperability.
Message Translation	The process by which a message received on one data link is transformed to the appropriate message(s) required for transmission, in accordance with the transmit rules, of another data link. The translation of messages may vary, based on message content. Therefore, message translation standards include rules for selecting the message(s) to which a received message is to be translated based on the type of message received and, in some cases, on the content of the messages(s). A data forwarder will process the complete received message prior to taking any forwarding action.
Mission Area Sub-network	A group of one or more NUs sharing a common collective address.
M-Series Message	Digital message format employed in STANAG 5511.
Need Factor	The Need Factor corresponds to the priority level of the highest priority data not being supported (i.e., not being transmitted due to lack of transmission capacity). It is assumed that there are four levels of priority that can be assigned to tactical and technical messages. Priority 1 is the highest and priority level 4 is the lowest. The lower the lowest priority level of a NU's transmitted messages, the lower is the NU's need for additional capacity. A unit with a Need Factor equal to zero does not need additional capacity and in fact is probably not using all of its current capacity.
Neighbourcast	Method of transmitting messages to all NUs within RF range of the source unit on the network on which that unit is active.

Netcast	Method of transmitting messages to all NUs on the same network on which the source unit is active.
Network	An organisation of stations capable of communications. (See Link 22 Network)
Network Connectivity	The topological description of a network, which specifies the interconnection of the transmission nodes in terms of circuit termination locations and quantities.
Network Cycle Structure	Network Cycle Structure is the partitioning and allocation of transmission capacity/opportunities in a Time Division Multiple Access network.
Network Cycle Time	NCT is the shortest periodic sequence of time slots during which each IU in a network has had at least one transmission opportunity.
Network Initialisation	The time required to establish satisfactory link communications amongst NUs after the time specified for the start of network operations.
Network Management	An action or activity affecting the relationships, actions, or activities of the various elements of the network.
Network Manager	A participating unit that is designated to employ the required tools to allocate, assign, and manage the network resources.
Network Security	NETSEC provided at the network level to protect network and management information.
NILE Address	A seven bit identifier used to uniquely identify each NU on a Link 22 supernetwork.
NILE Communications Equipment	A communications system to support Link 22. NCE consists of a DLP interface, a System Network Controller (SNC), an Information Security (INFOSEC) subsystem, a Human Computer Interface (HCI), and the appropriate Signal Processing Controller(s)/radio equipment. The NCE is analogous to the Link 16 terminal.
Nonreal-Time Track	A track report is identified as a nonreal-time report with track quality (TQ) = 0 if any of the following conditions are true: a. The track data originate from other than a TDS or Link 16 or Link 22 equipped aircraft; b. The track data have been relayed from another system by other than a real-time data link interface, or; c. The track data have been derived from other than integrated sensors.
Order	A communication which is written, oral, or by signal, which 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.

Overhead[1]	Digital information transferred across the functional interface separating a user and a telecommunications system (or between functional entities within a telecommunications system) for the purpose of directing or controlling the transfer of user information and/or the detection and correction of errors.
Pairing	The establishment of an operational relationship (other than an engagement) between a friendly track and another track or point.
Participating Unit	A unit communicating directly on Link 11.
Point-to-Point	Delivery of a message to a single participating unit.
Protocol[2]	A protocol is an agreed upon rule, procedure, format, data element definition, data item, or other convention for information exchange and related interactions between cooperating systems. A protocol identifies "what" shall be accomplished by a specific interoperability function while the system design identifies "how" the function is accomplished.
Purge	The orderly removal of unwanted and/or obsolete data from a data base in response to internal system criteria.
Radio Silent Mode	A mode of terminal operation where the terminal receives but does not transmit messages.
Receipt/Compliance	The acknowledgement of a message and/or an indication of intent to respond to a message, either by machine acknowledgement or operator action.
Relay	Relay is the retransmission by one NU of data received from another NU. Relay is intended to increase the range coverage of Link 22 and to increase the probability of correct reception by the intended recipient(s). Relay may take the form of: Intranetwork Relay; Extranetwork Relay; Intermedia Relay.
Relaycast	The transmission of data and associated technical information destined for onward transmission by Intranetwork Relay and/or Extranetwork Relay. Relaycast can be used to support point-to-point, point-to-multipoint, netcast and totalcast addressing.
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, but on which no local data is held.

[1] Overhead information originated by the user is not considered as system information. Overhead information generated within the system and not delivered to the user is considered as system overhead. Thus, user throughput is reduced by both overheads while system throughput is only reduced by system overhead.

[2] Protocols may govern portions of a network, types of service, or administrative procedures. For example, a data link protocol is the specification of methods whereby data communication over a data link is performed in terms of the particular transmission mode, control procedures, and recovery procedures.

Reporting Responsibility	The requirement for the IU with the best positional data on a track to transmit track data on the interface.
Reporting Unit	A unit taking part in the exchange or transfer of tactical data on another digital data link to which data can be addressed, and from which data can be identified as to source.
Secure	In the context of communications, security embraces the terms "crypto security", "transmission security", and "emission security" as defined in AMSG 524.
Subsurface Tracks	Tracks reported in the subsurface environment. Similar to Subsurface (maritime) tracks in Link 16.
Subsurface Points	Points reported in the subsurface environment. Similar to Subsurface (maritime) points in Link 16.
Supernetwork	See Link 22 Supernetwork.
Surface Tracks	Tracks reported in the surface environment. Similar to surface (maritime) tracks in Link 16.
Synchronisation	The process of adjusting corresponding significant instants of two signals to obtain a desired fixed relationship between these instants.
System Network Controller	The set of functions required to provide Network Management and Channel Access Control in the Link 22 system.
Tactical Data System	The TDS collects, correlates, displays and stores track information for input to a data link communication system.
Time Division Multiple Access	TDMA is a communication technique that utilises a common channel (multipoint or broadcast) for communications among multiple users by allocating unique time slots to the different users.
Time Slot	A time interval during which messages may be transmitted and received.
Totalcast	Totalcast is the transmission mode where the destination is all the network NUs. If the RF connectivity of the originating NU does not include all of the network NUs then routing (/relay) will be required. Totalcast would be reserved for only particularly important messages.
Track	(1) The graphic and/or alphanumeric representation of successive positions of a moving object, point, or bearing whose position and/or characteristics are collected from sensors and/or other data sources. (2) A collated set of data associated with a track number for the purpose of representing the position and/or characteristics of a specific object, point, or bearing.

Track Quality	A measure of the reliability of the positional information of a reported track. TQ is used by units to: a. Determine which unit has reporting responsibility for that track. b. Limiting the reporting of that track to one unit. c. Provide an automatic means of passing Reporting Responsibility to the unit with best data. d. Indicating the estimated accuracy of the reported position (confidence). Link 22 uses TQ values from 0 to 15, 15 being the highest.
Transmission Security	TRANSEC is the component of information or communications security that results from all measures designed to protect transmissions from interception and exploitation by means other than crypto analysis.
Traveller	A SUSPECT surface track following a recognised traffic route.
Update Rate	A frequency at which a specified category of track is required to be updated on the network.
Variable (Length) Message Format	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 user.
Variable Slot Length Dynamic TDMA	A form of DTDMA which allows automatic transfer of time slot ownership between NUs and which allows Time slot boundaries to be modified. VaSLDTDMA uses the ATH, Swap, TOC and Partial TOC protocols. VaSLDTDMA does not result in a change in the NCT.
WILCO	Originator of this response understands and will comply with the order. This is a manually generated response by an operator who has received the order and has determined it can be executed.
Word	(1) A character string that is convenient for some purpose to consider as an entity. (2) In Link 22 a fixed length bit stream of 72 bits.
Zombie	A Suspect Air Track conforming to Air Traffic Control (ATC) rules or outside NATO airspace following a recognised traffic pattern.

APPENDIX 2 TO ANNEX A

LIST OF ACRONYMS AND ABBREVIATIONS USED IN ADATP-22

AAW	Anti Air Warfare
ACP	Allied Communications Publication
ADatP	Allied Data Processing Publication
AOR	Area of Responsibility
AOP	Area of Probability
ASM	Anti-Surface Missile
AS FRD	Assumed Friend
ASW	Anti-Submarine Warfare
ASWC	Anti-Submarine Warfare Commander
ASW NU	Anti-Submarine Warfare Link 22 Unit
ATC	Air Traffic Control
ATDL-1	Army Tactical Data Link 1
CAP	Combat Air Patrol
C^2	Command and Control
C^2 IU	Command and Control Interface Unit
C^2 JU	Command and Control MIDS Unit
CANTCO	Cannot Comply
CANTPRO	Cannot Process
CAP	Combat Air Patrol
CDO	Change Data Order
CDS	Combat Direction System
CIU	Concurrent Interface Unit
COMSEC	Communications Security
C/S	Course and Speed
CVLL	Cryptovariable Logical Label
DCN	Data Link Coordination Net
DLP	Data Link Processor
DM	Data Mile
DTDMA	Dynamic Time Division Multiple Access
ECM	Electronic Counter Measures
EDAC	Error Detection and Correction
EMCON	Emission Control
EP	Estimated Position
EPM	Electronic Protective Measures
ES	Electronic Warfare support
ESM	Electronic Support Measures
EW	Electronic Warfare
EWC	Electronic Warfare Coordinator
EWNU	Electronic Warfare LINK 22 Unit
FAC	Forward Air Controller
FEBA	Forward Edge of the Battle Area
FINEX	Scheduled and Intended Finish of the Exercise
FiSLDTDMA	Fixed Slot Length Dynamic TDMA
FJU	Forwarding MIDS Unit
FJUA	Forwarding MIDS Unit A (between Links 11 and 16)
FJUAB	Forwarding MIDS Unit AB (between Links 11, 11B and 16)
FJUB	Forwarding MIDS Unit B (between Links 11B and 16)
FJUN	Forwarding LINK 22 Unit (between Link 22 and Link 16)
FJUNA	Forwarding LINK 22 Unit (between Link 22 and Link 16, and Link 11)
FJUNAB	Forwarding LINK 22 Unit (between Link 22 and Link 16, Link 11 and Link11B
FJUNB	Forwarding LINK 22 Unit (between Link 22 and Link 16, and Link 11B)

FNU	Forwarding LINK 22 Unit
FNUA	Forwarding LINK 22 Unit (between Link 22 and Link 11)
FNUAB	Forwarding LINK 22 Unit (between Link 22, Link 11 and Link 11B)
FNUB	Forwarding LINK 22 Unit (between Link 22 and Link 11B)
FRD	Friend
FPU	Forwarding Participating Unit
FRU	Forwarding Reporting Unit
FTC	Force Track Coordinator
FT IND	Force Tell Indicator
FWDA	Friendly Weapon Danger Area
FWF	Fixed Word Format
GENTEXT	General Text (OPTASK LINK paragraph header)
GRU	Gridlock Reference Unit
HAVCO	Have Complied
HCI	Human Computer Interface
HF	High Frequency
HOS	Hostile
HUR	High Update Rate
HWZ	Hostile Weapons Zone
ID	Identity
IFF	Identification Friend or Foe
IFF/SIF	Identification Friend or Foe/Selective Identification Feature
IJMS	Interim JTIDS Message Specification
INCS	Initialisation Net Cycle Structure
INCT	Initialisation Net Cycle Time
INFOSEC	Information Security
INFO MAN	Information Management
IST	Initialisation Start Time
INTEL	Intelligence
IU	Interface Unit
JTIDS	Joint Tactical Information Distribution System
JU	MIDS Unit (JTIDS Unit)
LLC	Link Level COMSEC
LNE	Late Net Entry
LOB	Line-Of-Bearing
LOP	Local Operating Procedures
LOS	Line-Of-Sight
MASN	Mission Area Subnetwork
MC	Mission Correlator
MEZ	Missile Engagement Zone
MIDS	Multifunctional Information Distribution System
MNC	Major NATO Commander
MR	Machine Receipt
MSC	Major Subordinate Commander
MSN	Mission Subnetwork
MTF	Message Text Format
NATO	North Atlantic Treaty Organization
NCE	LINK 22 Communications Equipment
NCS	Network Cycle Structure
NCT	Net Cycle Time
NETSEC	Network Security
NEU	Neutral
NILE	NATO Improved Link Eleven
nm	Nautical Mile
NMU	Network Management Unit
nonC^2 JU	Non-Command and Control MIDS Unit
NonEWNU	Non-Electronic Warfare Link 22 Unit
NON IU	Non-Interface Unit
NOTACK	No Attack

NPS	Network Participation Status
NPS IND	Network Participation Status Indicator
NU	LINK 22 Unit
(NU)	NATO Unclassified
OCC	Operational Contingency Constraints
OM	Original Message
ONCS	Operational Net Cycle Structure
ONCT	Operational Net Cycle Time
OPCON	Operational Control
OPTASK LINK	Operational Tasking Data Links
ORBAT	Order of Battle
OST	Operational Start Time
OTC	Officer in Tactical Command
PEN	Pending
PIM	Position and Intended Movement
PLI	Participant Location and Identification
PPLI	Precise Participant Location and Identification
PRF	Pulse Repetition Frequency
PRI	Pulse Repetition Interval
PRNU	Potential Relay LINK 22 Unit
PSC	Principle Subordinate Commander
PU	Participating Unit
R/C	Receipt/Compliance
R2	Reporting Responsibility
RDF	Radio Direction Finding
RF	Radio Frequency
RI	Request Indicator
ROE	Rules of Engagement
RU	Reporting Unit
RX	Receive
SAM	Surface-to-Air Missile
SAMSR	Surface-to-Air Missile Short Range
SFJU	Standby FJU
Sim	Simulated/Simulator
SIM	Submarine Position and Intended Movement
SNC	System Network Controller
SNMU	Supernetwork Management Unit
SOP	Standard Operating Procedures
SPC	Special Processing Controller
SPI	Special Processing Indicator
SSM	Surface-to-Surface Missile
STANAVFORLANT	Standing Naval Forces Atlantic
STANAVFORMED	Standing Naval Forces Mediterranean
SU	Supporting Unit
SUS	Suspect
SUR	Standard Update Rate
TACOM	Tactical Command
TBD	To Be Determined
TDMA	Time Division Multiple Access
TDC	Track Data Coordinator
TDS	Tactical Data System
TN	Track Number
TOD	Time of Day
TQ	Track Quality
TRANSEC	Transmission Security
TSN	Track Supervision Net
TX	Transmit
UHF	Ultra High Frequency
UNK	Unknown

UTC	Universal Time Coordinated
VaSLDTDMA	Variable Slot Length Dynamic TDMA
WILCO	Will Comply
WPNS	Weapons

ANNEX B

LINK 22 MESSAGE/WORD LIST

NUMBER	TITLE	PURPOSE
	NETWORK MANAGEMENT MESSAGES	
F00.0	NU Performance	Used to exchange individual NU Performance statistics.
F00.7-0	Frequency Allocation	Used to pass new frequencies to NUs.
F00.7-1	Network Media Parameters	Used, with the F00.7-2, to distribute initialisation parameters for a new Link 22 Network.
F00.7-2	Network Media Parameters	Used, with the F00.7-1, to distribute initialisation parameters for a new Link 22 Network.
F00.7-3	Network Management Order	Used, with the F00.7-4, to distribute Network and Supernetwork Management orders.
F00.7-4	Network Management Order	Used, with the F00.7-3, to distribute Network and Supernetwork Management orders.
F00.7-5	Radio Silence Order	Used to distribute orders to go to or from Radio Silence.
F00.7-6	NU Network Status	Used to distribute changes in the Network status of NUs.
F00.7-7	Mission Area Subnetwork (MASN) Management	Used, with the F00.7-8 and F00.7-9, to distribute changes to MASNs.
F00.7-8	MASN Management	Used, with the F00.7-7 and F00.7-9, to distribute changes to MASNs.
F00.7-9	MASN Management	Used, with the F00.7-7 and F00.7-8, to distribute changes to MASNs.
	ELECTRONIC WARFARE	
F00.1-0	EW Bearing Initial	
F00.1-1	EW Fix Initial	
F00.1-2	EW Position	
F00.1-3	EW Amplifying	
F00.2-0	EW Area of Probability Initial	
F00.2-1	EW Area of Probability	
F00.3-0	EW Emitter and ECM	
F00.3-1	EW Frequency	
F00.3-2	EW PD/PRF/Scan	
F00.3-3	EW Platform	
F00.4-0	EW Coordination Initial	

F00.4-1	EW Association	
F00.4-2	EW Coordination ECM	
F00.4-3	EW Coordination Emission Control	
F6	EW Emergency	Used to transmit initial EW information on emissions that represent an imminent threat.

ANTISUBMARINE WARFARE

F01.4-0	Acoustic Bearing/Range (Resolved)	Used to report acoustic bearing and range of subsurface contacts where the data have been resolved.
F01.4-1	Acoustic Bearing/Range (Ambiguous)	Used to report acoustic bearing and range of subsurface contacts where the data are ambiguous.
F01.5-0	Acoustic Bearing/Range Amplification	
F01.5-1	Acoustic Bearing/Range Sensor	
F01.5-2	Acoustic Bearing/Range Frequency	

PARTICIPANT LOCATION AND IDENTIFICATION (PLI)

F1-0 F02.0-0	Indirect PLI Position Indirect PLI Amplification	Provides PU/RU information on Link 22 when identification and positional information is forwarded from a Link 11/Link 11B interface.
F1-1	PLI Position	Used by NUs to report own positional information.
F02.1	PLI IFF	Used by NUs to report own IFF information.
F02.2-0 F02.2-1	Air PLI Course & Speed Air PLI Additional Mission Correlator	Used by airborne NUs to report own network participation status and identification information to the Link 22 interface.
F02.3-0 F02.3-1	Surface PLI Course & Speed Surface PLI Mission Correlator	Used by surface NUs to report own network participation status and identification information to the Link 22 interface.
F02.4-0 F02.4-1	Subsurface PLI Course & Speed Subsurface PLI Mission Correlator	Used by subsurface NUs to report own network participation status and identification information to the Link 22 interface.
F02.5-0 F02.5-1	Land Point PLI Continuation Land Point PLI Mission Correlator	Used by stationary land NUs to report own network participation status and identification information to the Link 22 interface.
F02.6-0 F02.6-1	Land Track PLI Course & Speed Land Track PLI Mission Correlator	Used by mobile land NUs to report own network participation status, identification and positional information to the Link 22 interface.

SURVEILLANCE

F01.0-0	IFF	Used to report IFF/SIF data associated with an air, surface or subsurface surveillance track.
FJ3.0	Reference Point	Used to report tactically significant pertaining to geographical points, lines or areas.
FJ3.1	Emergency Point	Used to report the location and type of an emergency that requires search and rescue.
F2	Air Track Position	Used to report tactical surveillance information on air tracks.
F5-0	Air Track Course & Speed	
F3	Surface Track Position	Used to report tactical surveillance information on surface tracks.
F5-1	Surface Track Course & Speed	
F4-0	Subsurface Track Position	Used to report tactical surveillance information on subsurface tracks.
F4-1	Subsurface Track Course & Speed	
F03.4-0	ASW Contact Information	Used to report ASW contacts which have not been reported in a F01.4 message.
F03.4-1	ASW Contact Confirmation	Used to report that a unit holds contact with an ASW contact which has been reported by another unit.
F03.5-0	Land Track/Point Initial	Used to report tactical surveillance information on land points and tracks.
F03.5-1	Land Track/Point Position	
F03.5-2	Land Nonreal-Time Track	
F03.5-3	Land Track/Point IFF	
FJ3.6	Space Track	Used to report space and ballistic missile surveillance data.
FJ15.0	Threat Warning	Used to report threat warning information to targeted friendly platforms; to include threat type, threat posture, position, altitude and speed.

INTELLIGENCE

FJ6.0	Intelligence Information	Used to report amplifying data concerning threat information, nationality, platform, activity and activity amplification on the Link 22 interface.

INFORMATION MANAGEMENT

FJ7.0	Track Management	Used to transmit information necessary to effect management actions on tracks being reported on the Link 22 interface. Management actions include dropping tracks, category, identify and IFF/SIF conflict resolution, changing alert status, changing strength and changing exercise status.
FJ7.1	Data Update Request	Used to request tactical information that has been locally generated by NUs participating on the Link 22 interface.

FJ7.2	Correlation	Exchanged to resolve dual designations by identifying the TN to be retained and the TN to be dropped.
FJ7.3	Pointer	Used to transmit a geographic position to an addressed unit operating on the Link 22 interface.
FJ7.4	Track Identifier	Transmitted to identify the track number(s) used to report an object on other data link(s) in a multilink interface.
FJ7.5	IFF/SIF Management	Used to transmit information necessary to effect IFF/SIF management actions on tracks being reported on the Link 22 interface. Management actions include changing, clearing, or requesting updates on IFF/SIF data exchanged among NUs.
FJ7.6	Filter Management	Used to report Link 22 transmit filter descriptions, and to request Link 22 transmit filter implementations and deletions.
FJ7.7	Association	Used to report/terminate an association between two or more TNs being reported on the Link 22 interface, where these are deemed to pertain to the same object.
FJ8.1	Mission Correlator Change	Used by controlling units to add, delete or change mission correlators of TNs under their aircraft.

WEAPONS COORDINATION AND MANAGEMENT

F01.6-0 F01.6-1 F01.6-2	Basic Command Command extension Air Coordination	Used to transmit track update rate orders, threat warning conditions, alert states, and weapons condition orders, to manage track update rates, direct weapon system engagement for air defence/air support, and to direct antisubmarine warfare and antisurface warfare operations.
FJ10.2	Engagement Status Change	Used to report the status of an engagement between a friendly weapon system and its assigned target.
FJ10.3	Handover	Transmitted to coordinate the transfer of control of aircraft between controlling units.
FJ10.5	Controlling Unit Report	Used to identify the controlling unit of aircraft and provide mission correlator and/or voice call sign if applicable.
FJ10.6	Pairing	Used to report a pairing (not engagement status) between a friendly track and another track or point.

J12.4	Controlling Unit Change	Used to provide new control agency information to an aircraft prior to hand-off to the new control agency. Also used by a tactical aircraft to initiate control procedures with a new controlling unit or to effect a change of controlling unit in response to a controlling unit change order, or by an NU to initiate control by own unit.
FJ13.0	Airfield Status	Used to report operational status of airfields, runways and airfield facilities.
FJ13.2	Air Platform & System Status	Used to report current status of an air platform; ordnance load, fuel, operational status and on-board system status.
FJ13.3	Surface (Maritime) Platform & System Status	Used to report current status of a surface (maritime) platform; ordnance load, operational status and on-board system status.
FJ13.4	Subsurface (Maritime) Platform & System Status	Used to report current status of a subsurface (maritime) platform; operational status and on-board system status (TBD).
FJ13.5	Land (Ground) Platform & System Status	Used to report current operational weapons and equipment status of a land (ground) platform.

TEXT MESSAGE

FJ28.2	Text Message	Provides the means to convey alphanumeric text information via data link.

RECEIPT COMPLIANCE

F01.7	Response Message	Provides responses to R/C messages.

ANNEX C

LINK 22 AMPLIFICATION DATA

C.1 Annex C contains details of operational amplification data available for transmission on the Link 22 interface. Not all NUs implement all values shown. For specific national/NATO implementation details, reference should be made to Annex E.

C.2 Annex C consists of the following two Appendices:

a. Appendix 1: Commands Available For Use on the Link 22 Interface. (As used in the Command message).

b. Appendix 2: Engagement Statuses Available For Use on the Link 22 Interface. (As used in the Engagement Status message).

APPENDIX 1 TO ANNEX C

TABLE OF COMMANDS AVAILABLE FOR USE ON THE LINK 22 INTERFACE

Link 22 Command	Description
Weapons Free	Fire only at targets not recognised as friendly in accordance with current Rules of Engagement (ROE).
Weapons Tight	Fire only at targets positively identified as Hostile in accordance with current ROE.
Engage	Engage the target specified in Objective TN to destruction with weapon specified in Weapon Type and weapon system platform indicated in Friendly Weapon TN.
Assign	Perform all functions of engagement of objective TN but do not until ordered or Objective TN becomes eligible for destruction under existing doctrine and/or ROE.
Cease Engage	Break engagement on target specified in Objective TN with weapon specified in Weapon Type and weapon system platform indicated in Friendly Weapon TN.
Hold Fire	Emergency Order - do not fire at target specified in Objective TN. If firing has occurred, prevent missiles in flight from intercepting, if technically possible.
Cease Fire	Do not fire at target specified in Objective TN.
Cover	Cover Objective TN which is being engaged by another weapon system or has not yet become a significant threat. Assume posture that will allow engagement of Objective TN if directed.
Salvo/Clear Aircraft	Clear Friendly Weapon TN from vicinity of Objective TN.
Assume Control	Assume control of Objective TN or direct Friendly Weapon TN indicated to assume control of Objective TN.
Engage Objective TN with Weapon Specified	Engage Objective TN with the specified weapon system or direct Friendly Weapon TN indicated to engage Objective TN with the specified weapon system. Prosecute to destruction or weapon exhaustion in accordance with current doctrine.
Break Engagement with Objective TN with Weapon Specified	Break engagement of Objective TN with the specified weapon system or direct Friendly Weapon TN indicated to break engagement of Objective TN with the specified weapon system. Destroy all missiles of specified type in flight towards Objective TN.
Proceed to Point	Proceed to point designated by Objective TN or direct Friendly Weapon TN indicated to proceed to point designated by Objective TN.
Cease Proceeding to Point	Cease proceeding to point designated by Objective TN or direct Friendly Weapon TN indicated to cease proceeding to point designated by Objective TN.
Conduct Procedures Indicated	Conduct procedures indicated by Command Mission or direct Friendly Weapon TN indicated to conduct procedures indicated by Command Mission.

Link 22 Command	Description
Cease Conducting Procedures Indicated	Cease conducting procedures indicated by Command Mission or direct Friendly Weapon TN indicated to cease conducting procedures indicated by Command Mission
Assume Duties Indicated	Assume duties indicated in Duty Assignment Functional Area/ Duty Assignment or direct Friendly Weapon TN to assume duties indicated in Duty Assignment Functional Area/ Duty Assignment.
Cease Duties Indicated	Cease performance of duties indicated in Duty Assignment Functional Area/ Duty Assignment or direct Friendly Weapon TN to cease performance of duties indicated in Duty Assignment Functional Area/ Duty Assignment.
Transfer Control	Transfer control of Friendly Weapon TN to Objective TN.
Return To Base	Return to base which is Objective TN or direct Friendly Weapon TN to return to base which is Objective TN.
Launch Alert Aircraft	Launch alert aircraft to Objective TN or direct Friendly Weapon TN to launch alert aircraft to Objective TN. Objective TN may designate a target, point or aircraft controller.
Investigate/Interrogate	Engage the target specified in Objective TN with the aircraft specified in Friendly Weapon TN. Do not fire until ordered or Objective TN becomes eligible for destruction under existing doctrine and/or ROE.
Intervene	Order aircraft indicated in Friendly Weapon TN to take action to divert target designated by Objective TN from its intended flight path.
Shadow	Order platform indicated in Friendly Weapon TN to maintain surveillance on target designated by Objective TN.
Formal Alert/Counter Surprise	Promulgates values of Formal Alert and Counter Surprise State.
Engage Target with Specified Number of Air-to-Surface missiles (ASM)/Surface-to- Surface missiles (SSM) to Meet Impact Time	Engage target specified in Objective TN with number of ASM/SSM specified in Number of Missiles to meet impact time indicated in Time Discrete/Hour/Minute, or direct Friendly Weapon TN indicated to engage Objective TN with number of ASM/SSM specified in Number of Missiles to meet impact time.
Start High Update Rate Reporting	NU with R^2 for Objective TN start HUR reporting on Objective TN.
Cease High Update Rate Reporting	NU with R^2 for Objective TN cease HUR reporting on Objective TN.

APPENDIX 2 TO ANNEX C

TABLE OF ENGAGEMENT STATUSES AVAILABLE FOR USE ON THE LINK 22 INTERFACE

Link 22 Engagement Status	Description
Weapon Assigned	The specified weapon reported in the Weapon System field has been allocated to the target.
Tracking/Locked On/Ready to Fire/Bird Affirm	The Reference TN's tracking radar is locked-on to the target. Unit is ready to fire as soon as the target is within weapon range and the target is eligible for destruction.
Firing/Missile in Flight/Engaging to Destroy/ Decoy Launched	a. MISSILE: - If the weapon system is any missile, the Reference TN's missile has been launched and is en route to the target. b. AIRCRAFT: - If the weapon system is any aircraft, the Reference TN is engaging the target with intention to destroy. c. DECOY: - If the weapon system is any decoy, the Reference TN has launched the type of decoy indicated.
Effective/Target Destroyed/ Grand Slam	The target has been completely destroyed by the Reference TN. The engagement previously reported is broken.
Partially Effective	All targets associated with the Target TN have not been destroyed; the engagement is continuing.
Not Effective	Miss or abort. The target is not destroyed; the engagement is continuing.
Engagement Broken	The Reference TN is terminating the action previously reported or ordered against the target with the weapon specified.
Heads Up	The target constitutes a threat to friendly forces. The data source is unable to assure complete destruction of the target. This value does not report either an engagement or the breaking of an engagement.
Engagement Interrupted	Defined as a NATO nation national requirement. Some systems will not originate this value and will interpret as engagement broken.
Investigating/Interrogating	The Reference TN is not yet tracking the target. If the weapon system is aircraft, the target is being investigated by the aircraft indicated in Reference TN. The aircraft will not fire until ordered or the target becomes eligible for destruction under existing doctrine and/or ROE.
Shadowing	The Reference TN is maintaining surveillance on the designated target.

Link 22 Engagement Status	Description
Intervening	The Reference TN is taking action to divert the designated target from its intended flight path.
Covering	The Reference TN is maintaining a position relative to a designated target from which a successful intercept can take effect if needed.

ANNEX D

LINK MANAGEMENT CODES

D.1 Link Management Codes. Link Management Codes (LMC) are letter groups used for voice coordination of link management actions on uncovered voice nets. Table D.1 provides Brevity Words from APP 7/MPP 7. Table D.2 provides the List of Indicators, Table D.3 provides the List of Subjects, and Table D.4 provides the NATO LMCs for all links. The Tactical Commander should specify any exceptions to the procedures in the OPTASK LINK in the 1MANCODE set.

D.2 Security. The LMCs 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, which requires security protection, is to be encrypted as specified by the Tactical Commander.

D.3 LMC String. LMCs consists of three letters and may be amplified with one numeric and/or a proword, as follows:

proword	1st letter	2nd letter	3rd letter	numeric	proword
proword*	Indicator*	subject	descriptor	amplifier*	proword*

(* Only when required.)

a. Indicator. The indicator specifies the data link to which the code applies, the experimental or temporary status of the code or whether the code is a National Code. Table D.2 provides the list of indicators.

b. 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 D.3.

c. Descriptor. The descriptor defines a specific part of the subject or main functional area.

d. Amplifier. The amplifier subdivides or amplifies the descriptor.

Note: National Codes may be used by other than the originating nation or command, subject to originators' approval. 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.4 Prowords. Prowords are words used and easily understood by all nations. A proword may be a prefix or a suffix to the code string.

D4.1 List of Prowords. The following words are recognised as Prowords that are used with NATO LMCs:

- 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 APP 1.

Word	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 is to be followed by a frequency or station designator.
Dirty	Link is not encrypted. May be used as a report or order and is to be followed by a frequency or station designator.
Elfin	Link 22 A secure nodeless data link, which utilises 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.)
Jamboree	IJMS
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 (TDS) Computer.
Phase	Send a 1,000 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.

Word	Meaning
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 is to 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 synchronisation 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 is to be followed by a frequency station designator.
Timber	Link 16 A secure, jam resistant nodeless data link which utilises 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 computerised tactical data systems (Link 11B).
Note: These words may be used as statements, orders, or requests. They may be preceded by a station designation in case of ambiguity.	

Table D.1 Brevity Words

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 D.2 Indicators for NATO Link Management Codes

JU/PU/RU/NU Address or Terminal Address	A
Breakdown/Assistance	B
Crypto	C
Data Exchange	D
Net Establishment	E
Filter	F
Geo-Positioning/Updating	G
Satellite	K
Link Monitoring System	L
Net Mode/Work	N
Transmission Orders	0
Picture Compilation/Track Management	P
Radio/Communications	R
Station Mode	S
Data Terminal	T
Gateway/SSSB operations	U
Warning/Conflicts	W
Link Exercises	X
Weapon Assignments	Y
Electronic Warfare	Z

Table D.3 List of Subjects for Link Management Codes

Table D.4 Link Management Codes

LMC				MEANING:
Indicator[1]	Subject	Description	Amplifier	(....) : Indicates optional transmission. .... : Indicates mandatory transmission.
	A			Subject: **JU/PU/RU/NU Address or Terminal Address**
A	A	A		Switch (Add) dummy Terminal Address between all Terminal Addresses.
A	A	B		Terminal Address .... not activated.
A	A	C		Set Terminal Address .... in window.
M	A	D		Callsign …. is JU/PU/RU/NU Address ….
M	A	E		Change Terminal Address to day .... (at time ....).
E	A	M		Mission Area Sub-Network (MASN) number of Callsign .... is ....
M	A	O		Do not receive data (from IU/Callsign ....).
M	A	T		Callsign …. is Terminal Address ….
E	A	U		(Callsign ....) Dedicated Assignment slot is ....
T	A	V		Hold your Precise Participant Location and Identification (PPLI)/not your Tactical Data System (TDS).
	B			Subject: **Breakdown/Assistance**
M	B	A		Assistance - Require your Link Technician on this circuit (or Line/Frequency/Number …)
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
	B	D		Breakdown.
M	B	D		Breakdown - System.
M	B	D	1	System breakdown, wait (approximately .... minutes).
M	B	D	2	Breakdown – Crypto equipment
M	B	D	3	Check crypto device breakdown
M	B	D	4	Breakdown – TDS Computer
M	B	D	5	Breakdown – TDS
M	B	D	6*	Breakdown – Radio equipment.
M	B	D	7*	Breakdown - UHF equipment.
M	B	D	8*	Breakdown - HF equipment. (Transmitter or receiver.)
M	B	D	9	Breakdown – UHF Fixed Frequency Radio equipment.
M	B	D	10	Breakdown – HF Fixed Frequency Radio equipment.
E	B	D	11	Breakdown – UHF Hopping Radio equipment.
E	B	D	12	Breakdown – HF Hopping Radio set.
T	B	D	13	Link 16/DAPG breakdown/not connected
M	B	D	14*	Breakdown - Data Terminal.
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	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.)

LMC				MEANING:
Indicator[1]	Subject	Description	Amplifier	(....) : Indicates optional transmission. .... : Indicates mandatory transmission.
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.)
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.
A	C	F	1	AKAI 17 - (Callsign ….) your line number is ....
A	C	F	2	AKAI 6 - (Callsign ….) your line number is ....
M	C	G		Crypto net (Number ....).
M	C	H	1	Cryptovariable Logical Label (CVLL) - (Designator/short title ....).
M	C	H	2	CVLL – Transmission Security (Tsec) (Number ....).
M	C	H	3	CVLL – Message Security (Msec) (Number ....).
M	C	H	4	CVLL – Unique (Number ....).
M	C	M	1	(Re) Initialise with Crypto Integrity Mode On.
M	C	M	2	(Re) Initialise with Crypto Integrity Mode Off.
T	C	N		Received Secure Data Unit (SDU) alarm.
A	C	R		Confirm Link 11 Keymat in use is ….
A	C	R	1	AKAT A5517.
A	C	R	2	ASAT A5517.
A	C	R	3	CCT A16.
A	C	R	4	USKAT A5503.
A	C	R	5	A5520.
A	C	R	6	USKAT 5520.
A	C	R	7	AKAT A5511.
	D			Subject: **Data Exchange**
-	D	A		Quality of Data.
M	D	A	1	Quality of Data – Good (from IU/Callsign ....). (Receiving good data from IU/Callsign ....)
M	D	A	2	Quality of Data – Intermittent (from IU/Callsign....).
M	D	A	3	Quality of Data – No receipt (from IU/Callsign....).
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/Callsign ....).
A	D	B	2	Error data – Transmitting Data Error.
A	D	B	3	Error code – Receiving code error (from PU/Callsign ....).
A	D	B	4	Error code - Transmitting code error.

LMC				MEANING:
Indicator[1]	Subject	Description	Amplifier	(....) : Indicates optional transmission. .... : Indicates mandatory transmission.
A	D	B	5	Transmit Control Codes only.
M	D	B	6	High error rate indication (from IU/Callsign ....).
-	D	C		Codes/Call-up.
A	D	C	1	Codes – Receiving control codes only (from PU/Callsign ....).
A	D	C	2	Codes – Transmitting stop code.
A	D	C	3	Codes – Missing stop code.
A	D	C	4	Call-up – Missing call up/Hold you inactive.
A	D	C	5	Call-up – Receiving permanent missed call from (PU/Callsign ....).
-	D	D		Data.
A	D	D	1	Data – Transmit M.1 only.
A	D	D	2	Data – Transmit M.1 + data.
T	D	F		Reception J0.0 message.
T	D	G	1	(JU/Callsign ....) Response to interrogation messages.
T	D	G	2	(JU/Callsign ....) Indication of Conditional Radio Silence (MUM).
T	D	G	3	(JU/Callsign ....) Indication Polling.
T	D	G	4	(JU/Callsign ....) Fine synchronisation.
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			Subject: **Net Establishment**
M	E	A		Enter the net. (Permission granted)
M	E	A	1	Request permission to enter net.
A	E	A	2	Request permission to enter net in Gridlock, w/no duals.
M	E	B		Leave the net. (Permission granted)
M	E	B	1	Request permission to leave net.
M	E	C		Net set-up IAW OPTASK LINK/Table ....
T	E	C	1	JTIDS/MIDS Network is ....
T	E	D	1	Initialise as primary user.
T	E	D	2	Initialise as secondary user.
E	E	D	3	Execute Short Initialisation.
E	E	D	4	Execute Channel Probing.
T	E	E		Initial Entry JU.
E	E	E	1	Execute Late Entry.
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/Terminal Address.
A	E	H	1	Enter PU/Terminal Address ....
A	E	H	2	Delete PU/Terminal Address ....
A	E	H	3	Recycle PU/Terminal Address ....
Z	E	I		Activate Limited Transmission of Data (LTD) mode.
Z	E	J		Activate Full Transmission of Data (FTD) mode.
M	E	K		Data Forwarding Unit is Callsign ....
T	E	L		Net Time Reference (NTR) is Callsign ....
T	E	M		Start/Reset Net Entry.

LMC				MEANING:
Indicator[1]	Subject	Description	Amplifier	(....) : Indicates optional transmission. .... : Indicates mandatory transmission.
	F			Subject: **Filter**
	F	A		Filter settings.
M	F	A	1	Filter settings - Transmit and Receive. (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 – Transmit.
M	F	A	3	Filter settings - Receive.
M	F	A	4	Filter settings – Data forwarding (Link …. to Link ….).
M	F	A	5	Close all transmit filters.
M	F	B		Range – .... miles (own unit: range = 0).
	F	C		Environment/Category.
M	F	C	1	Environment/Category – All.
M	F	C	2	Environment/Category – Air.
M	F	C	3	Environment/Category – Surface.
M	F	C	4	Environment/Category – Subsurface.
M	F	C	5	Environment/Category – Land/Ground.
M	F	C	6	Environment/Category – Space.
M	F	C	7	Environment/Category – Points.
M	F	C	8	Environment/Category – Electronic Warfare (EW).
M	F	C	9	Environment/Category – Sonobuoy.
	F	D		Identity.
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 .... from IU/Callsign .... out to .... nautical miles.
M	F	E	5	TPA start bearing .... stop bearing.... out to .... nautical miles from IU/Callsign ....
M	F	E	6	Filter inside defined area/sector.
M	F	E	7	Filter outside defined area/sector.
M	F	F		Exercise tracks/data.
M	F	F	1	Simulated tracks.
	G			Subject: **Geo-Positioning/Updating**
A	G	A		Data Link Reference Position (DLRP).
A	G	A	1*	DLRP - In force .... [latitude/longitude or name].
A	G	A	2*	DLRP – Shift to .... [latitude/longitude or name] (at time ....).
A	G	A	3*	DLRP - Next is .... [latitude/longitude or name] (at time ....).
	G	B		Gridlock
A	G	B	1	Gridlock – Grid Reference Unit (GRU) is IU/Callsign ....
A	G	B	2*	Gridlock – On TN .... (Carry out gridlock on TN ....)
A	G	B	3*	Gridlock – Hold (IU/Callsign ....) in good gridlock.

LMC				MEANING:
Indicator[1]	Subject	Description	Amplifier	(....) : Indicates optional transmission. .... : Indicates mandatory transmission.
M	G	B	4*	Grid – Reference Unit.
M	G	B	5*	Grid – Correction (on TN ....) (Method).
A	G	C		Pads.
A	G	C	1	Pads - Zero.
M	G	C	2	Verify Relative Grid.
A	G	C	3	Shipboard Gridlock System (SGS) (STARWARS) is up.
A	G	C	4	SGS is down.
A	G	D		Enable SGS with IU/Callsign .... as GRU.
	K			Subject: **Satellite**
M	K	A		Gateway unit is IU/Callsign ....
M	K	A	1	IU/Callsign .... 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 ….
A	K	E	1	Select normal Time Out for PU/Callsign ....
M	K	F		Not receiving satellite data.
M	K	G		Receiving intermittent satellite data.
M	K	H		Receiving good satellite data.
M	K	I		Configure for satellite operations.
M	K	J		Confirm offset is ....
M	K	K		Confirm radio mode is Phase Shift Keying (PSK) 2400 baud.
M	K	M		Uplink frequency is Line/Frequency/Number ....
M	K	O		Downlink frequency is Line/Frequency/Number ....
M	K	P		Configure for Time Domain Multiple Access (TDMA) Operations (DAMA).
M	K	Q		Configure for non-TDMA Operations (non-DAMA).
	L			Subject: **Link Monitoring System**
A	L	A		Signal-to-Noise (S/N) Ratio. Request S/N Ratio for PU/Callsign ….
A	L	A	1	PU/Callsign .... has good S/N Ratio (S/N Ratio is ….)
A	L	A	2	PU/Callsign .... has low S/N Ratio.
A	L	A	3	PU/Callsign .... has transmitter level set too high.
A	L	A	4	PU/Callsign .... 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/Callsign....)
A	L	B	1	PU/Callsign .... has high Bit Error Rate.
A	L	B	2	PU/Callsign .... has normal Bit Error Rate based on Signal-to-Noise ratio.
A	L	B	3	PU/Callsign .... Bit Error Rate is ....
A	L	C		Radio Frequency Error (Request Radio Frequency Error for PU/Callsign.…)
A	L	C	1	PU/Callsign .... has large Radio Frequency Error.
A	L	C	2	PU/Callsign .... radio frequency is accurate.
A	L	C	3	Request carrier suppression test on PU/Callsign....
A	L	C	4	PU/Callsign.... carrier suppression is (good/poor).
A	L	D		Tone Level-Request relative tone levels for PU/Callsign ....

LMC				MEANING:
Indicator[1]	Subject	Description	Amplifier	(....) : Indicates optional transmission. .... : Indicates mandatory transmission.
A	L	D	1	PU/Callsign .... relative tone levels are correct.
A	L	D	2	PU/Callsign .... tone levels are out of calibration.
A	L	D	3	PU/Callsign .... have/has low power.
A	L	D	4	PU/Callsign .... tone number .... is (high/low).
A	L	D	5	PU/Callsign .... has (high/low) frequency rolloff.
A	L	E		Phase Error - PU/Callsign .... has large phase errors.
A	L	E	1	Upper Sideband (USB) has large phase errors.
A	L	E	2	Lower Sideband (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/Callsign .... transmits.
A	L	I	2	Net hangs up occasionally when PU/Callsign .... transmits.
A	L	I	3	Net hang-up is random.
A	L	I	4	Net hang-up is due to Data Net Control Station (DNCS) receive errors.
A	L	K		DNCS (Dual) - Two units acting as DNCS simultaneously.
A	L	K	1	DNCS has PU/Callsign .... entered twice.
A	L	K	2	DNCS fails to re-poll non-responding PUs.
A	L	K	3	DNCS not polling PU/Callsign ....
A	L	K	4	DNCS is polling dummy Terminal Addresses .... (, ...) (, ...) (, ...).
A	L	K	5	DNCS polling inactive PUs (....) (, ...) (, ...) (, ...).
A	L	L		PU Response – Report non-responding PUs/Callsigns.
A	L	L	1	PU/Callsign .... not responding.
A	L	L	2	PU/Callsign .... responding with no data frames.
A	L	L	3	PU/Callsign .... responding with single data frame.
A	L	L	4	PU/Callsign .... responding intermittently.
A	L	L	5	Several PUs not responding.
A	L	L	6	PU/Callsign .... responding, DNCS not receiving.
A	L	L	7	Dual Response – PU/Callsign .... responding to two different Terminal Addresses.
A	L	M		Part of transmission from PU/Callsign .... is lost.
A	L	N		Broadcast – No data received in broadcast mode.
A	L	P		TDS 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 Mode – Full Roll Call.
A	N	A	2	Roll Call Mode – Partial Roll Call.
A	N	A	3	Roll Call Mode – Roll Call broadcast.
A	N	B		Broadcast. (Switch to Broadcast).
A	N	B	1	Transmit Broadcast (buffers – every .... minutes).
A	N	B	2	Transmit Short Broadcast (SBC) (every.... minutes).
M	N	C		Silence. (Switch to radio silence.)
A	N	C	1	Silence - Use of SBC authorized.
A	N	C	2	Silence - Use of SBC not authorized.
T	N	D		Network (Participation Group Number/Description ....).
E	N	D	1	MASN (number/participant....).
T	N	E		Needline (Participation Group Number/Description ....).
T	N	F		Net Operation.
T	N	F	1	Net Operation – Single net.
T	N	F	2	Multi-net operation coordinated/stacked net.
T	N	F	3	Multi-net operation non-coordinated.

LMC				MEANING:
Indicator[1]	Subject	Description	Amplifier	(....) : Indicates optional transmission. .... : Indicates mandatory transmission.
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	Interference Protection Feature (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.
M	N	I		Signal Processor Controller (SPC) Fragmentation Rate.
	O			Subject: **Transmission Orders**
M	O	A		Transmit - .... (datum, air track, bearing, etc.).
M	O	B	*	Cease reporting (TN ....)(Environment/Category....)(Identity ....).
M	O	C		Drop track TN ....
	P			Subject: **Picture Compilation/Track Management**
M	P	A	*	Reporting Responsibility (R2) - (for TN ....).
M	P	A	2	Take R2 for TN .... Report when ready.
M	P	A	3	Am holding R2 for TN ....
M	P	B		Force Track Coordinator (FTC) (Callsign ....).
M	P	B	1	FTC – Air (FTC-A) (Callsign ....).
M	P	B	2	FTC – Surface (FTC-S) (Callsign ....).
M	P	B	3	FTC – Subsurface (FTC-SS) (Callsign ....).
	P	D		Verify.
M	P	D	1*	Verify – Identity 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 ....).
M	P	F		Pointer – Transmit to IU/Callsign…..
M	P	F	1	Pointer - (IU/Callsign ….) indicates….
M	P	G		TN .... is Force TN ....
	P	H		Personal Identification Feature (PIF)/Discrete Identifier (DI) Code.
M	P	H	1	Assign PIF/DI code for TN ....
M	P	H	2	Verify PIF/DI code for TN ....
M	P	I	1	Auto Identity is up.
M	P	I	2	Auto Identity is down.
M	P	J	1	Variable Track Quality (VTQ) / Set VTQ to ....
M	P	J	2	Inhibit all IFF doctrine around IU/Callsign ….
M	P	J	3	Inhibit all IFF challenge doctrine.
M	P	J	4	Reset IFF challenge doctrine.
	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/Number ....).

LMC				MEANING:
Indicator[1]	Subject	Description	Amplifier	(....) : Indicates optional transmission. .... : Indicates mandatory transmission.
M	R	A	3*	Voice Frequency – HF (Line/Frequency/Number ....).
M	R	A	4*	Voice Frequency – Secure voice.
M	R	B		Data Frequency.
M	R	B	1*	Data Frequency (Line/Frequency/Number ....).
M	R	B	2*	Data Frequency – UHF (Line/Frequency/Number ....).
M	R	B	3*	Data Frequency – HF (Line/Frequency/Number ....).
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 – USB. (Switch to USB.)
A	R	C	3	Sideband selection – LSB. (Switch to LSB.)
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 – Maximum power.
M	R	D	2	Transceiver – Minimum power.
M	R	D	3	Transceiver – Switch to voice.
M	R	D	4	Transceiver – Switch to data.
M	R	D	5	Transceiver – Switch to Continuous Wave (CW).
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).
	R	H		Range Mode
T	R	H	1	Range Mode – Normal.
T	R	H	2	Range Mode – Extended.
A	R	I		Frequency Lock on frequency .... (at time ....).
M	R	J		Shift frequency to Line/Frequency/Number ....
M	R	K		Do not receive you on Line/Frequency/Number ....
M	R	L		Am calling your on Line/Frequency/Number ....
M	R	M		Control Net is Line/Frequency/Number ....
M	R	N		Voice Net 1 is Line/Frequency/Number ....
M	R	O		Voice Net 2 is Line/Frequency/Number ....
	R	P		Link Configuration
A	R	P	1	Link configuration – Single HF/UHF frequency.
A	R	P	2	Link configuration – HF/UHF Multi-frequency.
A	R	P	3	Link configuration – HF or UHF Re-Key.
A	R	P	4	Link configuration – UHF Autocat relay.
	R	Q		UHF/HF Multi-Frequency Link (MFL) Frequencies
A	R	Q	1	UHF/HF MFL: UHF/HF - Alfa frequency is Line/Frequency/Number ….
A	R	Q	2	UHF/HF MFL: UHF/HF - Bravo frequency is Line/Frequency/Number …
	R	R		UHF Autocat Frequencies
A	R	R	1	UHF Autocat uplink frequency is Line/Frequency/Number ....
A	R	R	2	UHF Autocat downlink frequency is Line/Frequency/Number ....

LMC				MEANING:
Indicator[1]	Subject	Description	Amplifier	(....) : Indicates optional transmission. .... : Indicates mandatory transmission.
	S			Subject: **Station Mode**
A	S	A		DNCS. (Act as DNCS)
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.)
A	S	B	1	Passive Picket
A	S	C	*	Broadcasting Unit. (Act as Broadcast Unit.)
M	S	D	1	Unit reporting – Normal Mode.
T	S	D	2	Unit not fully reporting – Polling Mode.
T	S	D	3	Unit not fully reporting – Limited Status.
M	S	E		Unit not reporting (Silent).
M	S	E	1	Unit not reporting – Listen-Only Mode.
M	S	E	2	Unit not reporting – Inactive.
M	S	E	3	Unit not reporting – Conditional Radio Silence.
E	S	E	4	Unit not reporting – Engineering Mode.
T	S	F		(Select) Network Time Reference.
T	S	G		Position Reference.
T	S	H		Navigation Controller is IU/Callsign ....
T	S	I		Navigation Reset.
T	S	J		(IU/Callsign ....) Assume Navigation Controller.
	T			Subject: **Data Terminal**
M	T	A		Start/repeat net synchronisation.
M	T	A	1	Synchronisation – Successful.
T	T	A	2	Synchronisation – Coarse.
T	T	A	3	Synchronisation – Fine passive.
T	T	A	4	Synchronisation – Fine active.
T	T	A	5	Synchronisation (State of) (Callsign/JU ....).
A	T	A	6	Net Sync – Intermittent (from Callsign ....).
T	T	A	7	My synchronisation status is pending.
T	T	A	8	My synchronisation status is coarse sync.
T	T	A	9	My synchronisation status is fine sync.
A	T	A	10	Net Sync unsuccessful.
A	T	A	11	Net Sync successful.
E	T	A	12	Synchronisation – TBD.
E	T	A	13	Synchronisation – TBD.
E	T	A	14	Synchronisation – 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).

LMC				MEANING:
Indicator[1]	Subject	Description	Amplifier	(....) : Indicates optional transmission. .... : Indicates mandatory transmission.
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	1	Terminal Initialisation.
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 .... minutes and/or .... seconds).
M	T	G	2	System time adjustment (subtract .... minutes and/or .... seconds).
	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.
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.

LMC				MEANING:
Indicator[1]	Subject	Description	Amplifier	(....) : Indicates optional transmission. .... : Indicates mandatory transmission.
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.
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).
	T	R		Operating Mode
A	T	R	1	My operating mode is Link 11 only.
Z	T	R	2	My operating mode is Link 11B only.
T	T	R	3	My operating mode is Link 16 only.
E	T	R	4	My operating mode is Link 22 only.
M	T	R	5	My operating mode is data forwarder (Link …. To Link ….)
	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 net.
M	W	B	1	Jamming on net – Noise/pulse, etc.
M	W	B	2	Jamming on net – Fake Data.
M	W	B	3	Jammed – Net is jammed.
A	W	B	4	USB is jammed.
A	W	B	5	LSB is jammed.
	W	C		Identity Conflict.
M	W	C	1	Identity conflict – Exists (for TN ....).
M	W	C	2	Identity conflict – Initiate (for TN ....).
M	W	C	3	Identity conflict – Solve (for TN ....).
	W	D		Environment/Category Conflict
M	W	D		Environment/Category conflict – Exists (for TN ....).
M	W	D	1	Environment/Category conflict – Initiate (for TN ....).
M	W	D	2	Environment/Category conflict – Solve (for TN ....).
	W	E		EW Information Conflict
M	W	E		EW information conflict - Exists (for TN ....).
M	W	E	1	EW information conflict – Initiate (for TN ....).
M	W	E	2	EW information conflict - Solve (for TN ....).
	W	F		TN Conflict.
M	W	F	1	TN conflict – Dual designation (TN ....).
M	W	F	2	TN 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 ....).

LMC				MEANING:
Indicator[1]	Subject	Description	Amplifier	(....) : Indicates optional transmission. .... : Indicates mandatory transmission.
	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 – SSM/ASM (to TN ....).
M	Y	A	5	Assign Weapon – Torpedo (to TN ....).
M	Y	A	6	Assign Weapon – Fighter (to TN ....).
M	Y	B		Received engagement/weapon assignment data on TN ....
	Z			Subject: **Electronic Warfare**
	Z	A		ESM Data.
M	Z	A	1	ESM Data - Data (TN ....).
M	Z	A	2	ESM Data - Receive data (TN ....).
	Z	B		ESM Bearing
M	Z	B	1	ESM Bearing – (TN ....).
M	Z	B	2	ESM Bearing - Received bearing (TN ....).
	Z	C		ESM Fix.
M	Z	C	1	ESM Fix – Received Fix (TN ....).
	Z	D		ECM Data.
M	Z	D	1	ECM Data - Data (TN ....).
M	Z	D	2	ECM Data – Received data (TN ....).
M	Z	D	3	ECM Bearing - (TN ....).
M	Z	D	4	ECM Bearing – Received bearing (TN ....).
	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 NATO Standard Voice Reporting Procedures contained in APP-1 are to be used.

[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 replace the letter "M" with the letter of a specific Link (e.g., A, T, Z, etc).

ANNEX E

NATIONAL/NATO SYSTEMS MESSAGE IMPLEMENTATION

E.1 Annex E contains message implementation data for national and NATO Link 22 equipped units. This information is provided to enable operators to identify significant differences between platforms (in terms of Link 22 capability) which could impact adversely on overall Link 22 interoperability. Implementation data are presented in a structured series of look-up tables, based on Link 22 functional areas, to facilitate easy access to required information.

E.2 Appendix 1 contains a Link 22 functional area overview, indicating individual unit participation for each functional area. Further Appendices will be to show individual unit implementation at message and, where appropriate, message action level, for each functional area.

E.3 The notations used to record national implementations within each Appendix are as follows:

Transmission Notations:

T	Transmit	- The system will transmit the indicated message.
NT	Not Transmit	- The system will not originate the indicated message, but will perform required WILCO, HAVCO, CANTCO or CANTPRO responses.
RT	Retransmit	- The system will not originate the message but will retransmit it.

Reception Notations:

R	Receive	- The system will process the indicated message.
R_n	Receive as n	- The system will process the indicated value as if it were value “n”.
DM	Discard Message	- The system will discard the entire message upon receipt, but will perform required CANTPRO responses.

$T_{(n)}$ or $R_{(n)}$ indicates that explanatory notes are provided on Supplementary Information pages, which accompany each Appendix.

APPENDIX 1 TO ANNEX E

NATIONAL/NATO SYSTEMS LINK 22 UNITS FUNCTIONAL OVERVIEW

Unit Name	Type	Functional Area Participation													Interface with other Links
		EW	ASW	PLI	Surveillance						Intel	Info Man	Wpns Coord & Man	Text Message	
					Air	Land	Surf	Sub-Surf	Space	Point					
Nation 1:															
Nation 2:															
Nation 3:															

LIST OF EFFECTIVE PAGES

PAGE NUMBERS	CLASSIFICATION	AMENDMENT STATUS
I to III (All rb)	NATO UNCLASSIFIED	ORIGINAL
IV to VI(rb)	NATO UNCLASSIFIED	ORIGINAL
VII(rb)	NATO UNCLASSIFIED	ORIGINAL
VIII to XIV(rb)	NATO UNCLASSIFIED	ORIGINAL
1-1 to 1-3 (rb)	NATO UNCLASSIFIED	ORIGINAL
2-1 to 2-8	NATO UNCLASSIFIED	ORIGINAL
3-1 to 3-3 (rb)	NATO UNCLASSIFIED	ORIGINAL
4-1 to 4-10	NATO UNCLASSIFIED	ORIGINAL
5-1 to 5-13(rb)	NATO UNCLASSIFIED	ORIGINAL
6-1 to 6-70	NATO UNCLASSIFIED	ORIGINAL
7-1 to 7-5(rb)	NATO UNCLASSIFIED	ORIGINAL
8-1 to 8-13 (rb)	NATO UNCLASSIFIED	ORIGINAL
A-1 (rb)	NATO UNCLASSIFIED	ORIGINAL
A-1-1 to A-1-11 (rb)	NATO UNCLASSIFIED	ORIGINAL
A-2-1 to A-2-4	NATO UNCLASSIFIED	ORIGINAL
B-1 to B-5(rb)	NATO UNCLASSIFIED	ORIGINAL
C-1(rb)	NATO UNCLASSIFIED	ORIGINAL
C-1-1 to C-1-2	NATO UNCLASSIFIED	ORIGINAL
C-2-1 to C-2-2	NATO UNCLASSIFIED	ORIGINAL
D-1 to D-17(rb)	NATO UNCLASSIFIED	ORIGINAL
E-1(rb)	NATO UNCLASSIFIED	ORIGINAL
E-1-1(rb)	NATO UNCLASSIFIED	ORIGINAL
LEP 1(rb)	NATO UNCLASSIFIED	ORIGINAL