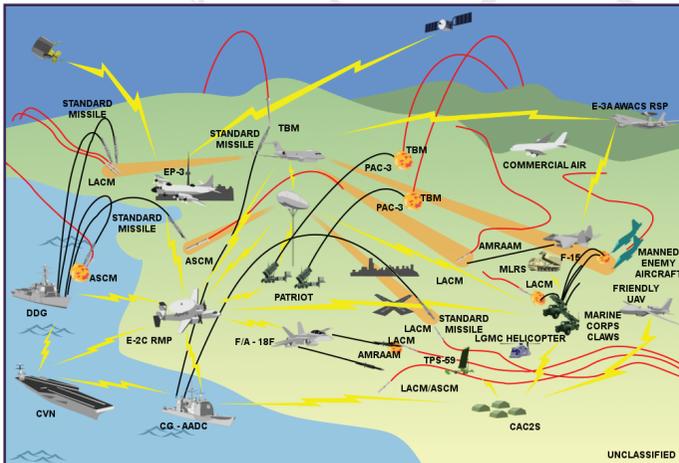


● Interoperability

Interoperability describes the ability for assets to provide services to and from other assets, utilising common standards to facilitate effective data exchange and system operation.

Interoperability is a key factor in the entire TDL life cycle and impacts a number of levels: RF, Data, Protocol and Human Computer Interface (HCI). These levels describe the physical transfer of messages, the message, conformity to defined protocols and that information is displayed and interpreted correctly by the receiving operators. Bit level implementation of the message formats have a direct impact on the fidelity and detail of data exchanged.

Maintaining accurate records of each platforms bit level implementation is essential to understanding and managing the capabilities and limitations of each TDL equipped platform.



Acronym List

BLOS	Beyond Line Of Sight
BPS	Bits Per Second
CCR	Concurrent Contention Receive
CMN4	Concurrent Multi-Net 4
ECM	Electronic Counter Measures
EPLRS	Enhanced Position and Location Reporting System
EW	Electronic Warfare
FBCB2	Force XXI Battle Command Brigade and Below
HCI	Human Computer Interface
HF	High Frequency
IDLs	Initialization Data Loads
IERs	Information Exchange Requirements
JDN	Joint Data Network
JU	JTIDS Unit
LOS	Line Of Sight
NATO	North Atlantic Treaty Organisation
NCS	Net Control Station
PPLI	Precise Participant Location and Identification
RF	Radio Frequency
SADL	Situational Awareness Data Link
SHF	Super High Frequency
TCP/IP	Transmission Control Protocol / Internet Protocol
TDMA	Time Division Multiple Access
TDS	Tactical Data System
UDP	User Datagram Protocol
UHF	Ultra High Frequency
VHF	Very High Frequency

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International Data Links Society's guide to:

TACTICAL DATA LINKS (TDLs)



● TDLs Defined

TDLs are standardized digital communication links, developed for the exchange of tactical information between participants using secure transmission protocols and bearer characteristics.

● TDL Characteristics

TDLs are secure, ECM-resistant, high capacity communication links between military assets providing real time situational awareness at the tactical level and extended connectivity to centralized assets that are Beyond Line-of-Sight (BLOS).

● TDL Employment

TDLs are used by military operators to exchange critical information that is optimized to meet the mission objectives of TDL equipped platforms and their respective Information Exchange Requirements (IERs).

● Multi-Link Operations

Many platforms are able to operate on several links concurrently, and as a result form a more comprehensive situational awareness picture. Some platforms are designated as Forwarders, or Gateways, able to transfer data from one data-link to another. Multi-link operations allow for a dramatic increase in the number of interconnected units and systems. The Joint Data Network (JDN) complexity is therefore increased and requires rigorous planning and management of the network.

● Link - 11A

Link-11 is a half duplex data link that uses the M-series message format. It's history has seen it employed across multiple platforms and nations.

It is a nodal system that operates either in roll call or broadcast modes. Roll call operation utilizes a Net Control Station that polls each participant, called Pickets, stimulating their data transmission. This cycle is repeated through a polling sequence, as per the NCS configuration. Operation in broadcast mode allows a single source either a one time data transmission, or series of single data transmissions.

Link-11A operates in the HF and UHF bands, offering the flexibility of BLOS and LOS ranges.

Link-11B is a ground-to-ground implementation of a subset of the M-series message catalogue. This full duplex link is a point-to-point system employs serial transmission, often referred to as Serial Link-11.

● Link - 16

Link-16 describes the J-series messages format optimized for use within the MIDS/JTIDS TDMA architecture. Link-16 use a time slot structure and allows the simultaneous operation of up to 127 nets using discrete frequency hopping patterns. Network design is an essential element of Link 16. IDLs (formally known as NDLs) are required to provide the terminal initialization parameters that meet platform IERs and help achieve overall mission objectives.

The J-series message format supports wide selection of data types including: surveillance, EW, Mission Management, weapons assignments and air control, plus voice, text and imagery. These message are grouped by function into Network Participation Groups (NPGs) and are assigned to participants as transmit, receive, and relay for the associated data. Links 16 units transmit Precise Participant Location Identification (PPLI) messages establishing their position and providing essential status messages that greatly enhance overall situational awareness. The architecture promotes network survivability and range flexibility is improved by time slot relay, increasing the area of data distribution.

● Link - 22

NATO Improved Link Eleven (NILE), also commonly known as Link 22 is the follow on to Link 11. The purpose of Link 22 is to overcome the shortfalls in Link 11, by providing improved tactical data exchange between Air, Land, Surface and Subsurface units using HF and UHF waveforms.

Link 22 is designed to complement and interoperate with Link 16 using a flexible and dynamic network architecture and with an automatic network management approach. It has more robust LOS and BLOS capabilities enabling a direct connection between units over a distance of 1000 Nm. Link 22 Units are able to operate in multiple different networks in both HF and UHF at the same time, allowing for subnetwork partitioning to meet data exchange and connectivity requirements.

● Joint Tactical Information Distribution System (JTIDS)

JTIDS is a secure, high capacity, ECM-resistant communication system operating within the UHF band between 960-1215 MHz (L-band). It's design is based on a node-less TDMA architecture, currently utilizing rapid frequency hopping over 51 discrete frequencies. These terminals are commonly referred to as Class II or Class IIIH when equipped with high power amplifier.

● Multifunctional Information Distribution Systems (MIDS)

MIDS is a compact terminal built to US and NATO Standards. The MIDS family of terminals support a wide variety of platforms, services and nations with over 10,000 terminals fielded. Service life and functional improvements are maintained through Block Upgrades and Block Cycle updates. MIDS is currently migrating to Block Upgrade 2 which adds Crypto Modernization, Frequency Re-Mapping, and Enhanced Throughput. These upgrades provide greater security, frequency clearance flexibility, and increases the amount of available data within an assigned time slot from 12 data words maximum to 40+ words, dependent on mode assigned.

● Joint Tactical Radio System

The JTRS terminal is a 4-channel software-programmable radio for Link 16, TACAN, and advanced networking waveforms. Widely used in the MIDS-J configuration, JTRS can support CMN4 and CCR allowing the reception of 4 nets simultaneously and greatly improving reception of data transmitted in the contention access mode.

● Joint Range Extension Application Protocol (JREAP)

JREAP provides multiple ways to achieve BLOS data exchanges. The protocols and message structures are defined MIL-STD-3011C / NATO STANAG 5518.

JREAP is employed in three different protocols, JREAP-A – Multiple terminals share the same JREAP media and transmit data when queued by the Network Controller. JREAP-A uses an announced token passing protocol for half-duplex communications.

JREAP-B – Uses a synchronous or asynchronous point-to-point full duplex mode, over secure phone lines, SHF SATCOM or other point to point media connections.

JREAP-C – uses TCP/IP or UDP network protocols over any compatible secure IP media connection.

● Situational Awareness Data Link (SADL)

SADL facilitates the integration of the digitized battlefield via the EPLRS radio providing fight-to-fighter, air-to-ground and ground-to-air communication. Since EPLRS is part of FBCB2, friendly troops are able to receive aircraft position data. SADL participants are able to conduct Link-16 interaction through gateways and can participate in the Link 16 network as Indirect PPLIs.

● Variable Message Format (VMF)

VMF uses the K-series binary variable message format and is platform independent. Therefore, standards are required to define the message headers appropriate to particular bearers. The VMF message format is a bit-oriented digital information standard incorporating a variable message length and providing a common means of exchanging data among combat units at different organizational levels. Since the message format is variable, this provides the functionality to transmit only the information required making VMF a viable solution for bandwidth limited environments.