The OASD(NII), DISA, Joint Staff led JTMT is a forum that promotes information sharing, issue exploration, and activity resolution regarding portfolios within the purview of the C2 and Net Centric CPMs. Specifically, the JTMT examines data link, (e.g., TDL, MADL, CDL), waveform, gateway, and Joint Networking, (e.g., ground, air, and maritime), development. This forum includes participation by DoD Agencies, Services, and COCOMs while encouraging issue and activity endorsement through the JCIDs, Acquisition, and PA&E Approval Processes for Joint, Allied, and Coalition partners.
Tactical Data Enterprise Services (TDES) Migration

1990s Baseline
Joint Warfighter Data Link Capabilities

Migration
Data Links moving into Networking

Desired Future State:
Net Centric, JTRS, IPv6, MANET, XML, Open Systems Architecture, Metadata Registration, Networking Waveforms, Scalable, Low Latency…

Joint TDL Family
Link 16, Link 22, VMF, & IBS

TDES for the GIG Enterprise
Net-Centric Ops & Warfare

Expanded Data Links
IFDL, MADL, EPLRS, CDL, & Gateways

Technology Insertion
Allied & Coalition Interoperability

Migration | Joint Vision | Transformation
---|---|---
Spectral Coverage | Segmented Coverage, Separated By System | Networking Waveforms
Message Processing | Multiple Standards, Exchange Protocols, & Processors | Common Enterprise Services
Networking | Stovepiped Protocols, Platform, System Based | IP-Based Networking
TDES Migration Goals

**Transform**
- TDES part of Power to the Edge for Warfighters
- Migration in process, 1st step

**Sustain**
- Joint Force effectiveness
- Allied/Coalition interoperability

**Enhance**
- Technical advancements for edge users
- Build wireless foundation for Net-Centric Operational Environment (NCOE)

Regarding Joint Force Warfighting Capability
*Primum non nocere … First do no harm*
Joint Tactical Data Enterprise Services Migration Plan (JTMP) 2010 Update

**JTMP 2010 Update Development**
- Current JTMP signed November 2008
- 2008 JTMP updated the 2000 Joint Tactical Data Link Management Plan (JTDLMP)
- Guidance directed document update every two years
- Next JTMP scheduled for publication November 2010

**JTMP Topics: Key TDES Initiatives**
- Advanced Tactical Data Link (ATDL) Studies
- Common Data Link (CDL) Specification Revision
- Gateway Development (e.g., BACN, CABLE)
- Interoperability Enhancement Process (IEP)
- Digitally-Aided Close Air Support Effort (Digital)
- Joint Aerial Layer Network (JALN) ICD
- Link 16 Enhancements Implementation
- MADL for Low Observable (LO) Development
- NATO TDES Data Enterprise
- Network Enabled Weapons (NEW)
- Unmanned Aircraft Systems (UAS)
- Services Path Ahead - Strategic Updates

**Schedule**
- Jun/Jul 09 - Initiate Plan to Update JTMP (2010)
- Sep 09/Jan 10 – Develop 2010 JTMP w/ Data Call
- Feb/May 10 – Complete Draft 2010 JTMP
- Jun/Sep 10 – Staff (AO, Planner, SES/GO Level) 2010 JTMP
- Oct/Nov 10 – Obtain NII, DISA, & Joint Staff Signatures
Current lack Airborne Networking Waveform (ANW) standards, Joint Mission Threads (JMTs), and Joint Concepts of Operations

- Maintain Joint/Allied/Coalition interoperability

- Establish airborne High-bandwidth Backbone Network (HBN) capability for C2 and Intelligence, Surveillance, and Reconnaissance (ISR)

- Provide a Joint Gateway (GW) functionality

- Develop open systems that are capable of supporting spiral development and service life technology insertion

- Incorporate recommendations from Tactical Ground Networking (USA/PA&E/NII) and Aerial Layer Contribution Studies (USSTRATCOM)

- Designate a formal management structure to guide and sustain JAN

- Conduct comprehensive force-wide JAN Assessment
Four-week technical analysis of Link 16, Link 16 Enhancements, Flexible Access Secure Transmission (FAST), Tactical Targeting Network Technology (TTNT), F-22 In-Flight Data Link (IFDL), and F-35 Multifunction Advanced Data Link (MADL)

Each waveform characterized using a common approach to provide insight into its utility for airborne network applications

Each waveform is matched to the particular mission needs for which it was designed, with limited flexibility for additional application(s)

- **Link 16 and Enhancements**
  - Most mature and optimized but relies on high degree of pre-planning
  - Best for use with legacy platforms and communicating with optimized J messages

- **FAST**
  - Least mature
  - Extension of capabilities in Link 16

- **TTNT**
  - Low-latency time-sensitive targeting application
  - Inherent receiver complexity

- **IFDL**
  - Designed for connectivity among small flight of F-22s

- **MADL**
  - Designed for connectivity among small network of F-35s
2008 Advanced Tactical Data Link (ATDL) - Executive Summary

- No single waveform can meet all requirements
- MADL should be the Joint Stealth Waveform
- Incorporate Link 16 Enhancements
  - Frequency Remapping (FR)
  - Cryptographic Modernization (Crypto Mod)
  - Dynamic Network Management (DNM)
  - Enhanced Throughput (ET)
  - Concurrent Multi-Netting (CMN)
- Assess and define the Joint requirements for ATDL capabilities
  - Requires additional Modeling and Simulation work
  - Requires Joint Architecture work
- None of the assessed waveforms (FAST, TTNT, or Omni-directional MADL (concept waveform)) meet the proposed ATDL requirements
2008/2009 Efforts

- Tactical Air-to-Ground and Ground-to-Air Study
  - Joint Close Air Support (JCAS) mission
  - Looking at Link 16, Wideband Networking Waveform (WNW), Soldier Radio Waveform and Variable Message Format (VMF) over Combat Net Radio (CNR)
- High Bandwidth Air-to-Air and Air-to-Ground Study
  - Assessing Common Data Link (CDL) and High-bandwidth Networking Waveform (HNW)
- Diversity Study
  - Assessing the right mix of Space, Air, and Terrestrial Communications
- Advanced Tactical Data Link (ATDL) Requirements development
- Multifunction Advanced Data Link (MADL) Joint Specifications development
- Networking CDL development
- Digital Joint Close Air Support (JCAS)
Focus on Anti-Jam (AJ) performance

Assessed Link 16, Link 16 Enhancements, TTNT, MADL, High bandwidth Networking Waveform (HNW), and Directional Networking Waveform (DNW)

No waveform offered significant capability benefit

Directional waveforms (HNW & DNW) offered some benefits in AJ performance

TTNT was marginally better than Link 16

Additional follow-on in works
Requirements - JROCM 163-08

- Multifunction Advanced Data Link (MADL)
  - Approved for all LO platforms (F22, B-2, F-35)
  - MADL Defense Advisory Board (DAB), late Jan 2009
  - USAF and USN developing MADL Enterprise
    - Ensure Joint standards
    - DISA

- Link-16
  - Continued employment
  - Selective deployment of Enhanced Link-16

- Advanced Tactical Data Link (ATDL) requirements
  - USAF, USN, JCS and OSD(NII) tasked to update
  - USAF and USN Modeling &Simulation to update Tactical Data Link - Transformation (TDL-T) Capability Description Document (CDD) or other new JCIDS
Requirements - PDM III

- Link 16 Enhancements
  - Crypto Modernization
  - Frequency Remapping
  - Enhanced Throughput
  - Prototyping of Concurrent Multi-Netting & Enhanced 1553 development

- Advanced Tactical Data Link (ATDL)
  - Directed PA&E, DDR&E, OSD NII, USD(P), JCS and Services study
    - Effectiveness of candidate airborne TDL’s
    - JCS provide requirements to assessment team by 1 April 2009
    - Focus on operational scenarios in jamming environment
    - MIDS-JTRS and MIDS-LVT decisions.
  - DEPSECDEF’s Advisory Working Group (DAWG) was briefed on the ATDL study 16 Oct 09
Joint Airborne Layer Networking (JALN) Initial Capability Document (ICD)

- The following national level strategy documents state the need for the capability which this ICD proposes:
  - US Joint Warfare and Crisis Resolution In the 21st Century
  - Joint Vision 2020
  - Capstone Concept for Joint Operations, Version 3.0
  - Guidance for Development of the Force
JALN, when employed, supports net-centric, Command & Control (C2) and Battlespace Awareness requirements for National and Defense senior leaders, COCOMs, and joint forces at all echelons.

The JALN will:
- Integrate with space and surface layers
- Increase communications access for the joint force at all levels
- Enable on-the-move (OTM) and over-the-horizon (OTH) / beyond line of sight (BLOS) communications
- Provide modular, scalable, and flexible operational capabilities
- Provide “mission persistent” connectivity as specified by the commander

Three core functions:
- Distribution/Access/Range Extension capability
- Transition capability
- High capacity backbone capability

Capability Gaps
- Connectivity
- Capacity
- Share Information & Data
- Network Management
Radio/Waveform Cost

<table>
<thead>
<tr>
<th>Waveform Software</th>
<th>JTRS Hardware</th>
<th>F/A-18E/F Integration NRE</th>
<th>F/A-18E/F Aircraft “A Kit”</th>
<th>F/A-18E/F Radio “B Kit”</th>
</tr>
</thead>
<tbody>
<tr>
<td>x 1</td>
<td>x 1</td>
<td>x 1</td>
<td>x # of Aircraft</td>
<td>x # of Aircraft</td>
</tr>
<tr>
<td>SCA</td>
<td>F/A-18E/F</td>
<td>AH-64D Integration NRE</td>
<td>AH-64D Aircraft “A Kit”</td>
<td>AH-64D Radio “B Kit”</td>
</tr>
<tr>
<td>Waveform Hardware</td>
<td>Integration</td>
<td>“A Kit”</td>
<td>“A Kit”</td>
<td>“B Kit”</td>
</tr>
<tr>
<td></td>
<td>NRE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-22</td>
<td>F-22</td>
<td>F-22</td>
<td>F-22</td>
<td>F-22</td>
</tr>
<tr>
<td>ICNIA Hardware</td>
<td>Integration</td>
<td>Aircraft</td>
<td>Aircraft</td>
<td>Radio</td>
</tr>
<tr>
<td></td>
<td>NRE</td>
<td>“A Kit”</td>
<td>“A Kit”</td>
<td>“B Kit”</td>
</tr>
<tr>
<td>F-35</td>
<td>F-35</td>
<td>F-35</td>
<td>F-35</td>
<td>F-35</td>
</tr>
<tr>
<td>ICNIA Hardware</td>
<td>Integration</td>
<td>Aircraft</td>
<td>Aircraft</td>
<td>Radio</td>
</tr>
<tr>
<td></td>
<td>NRE</td>
<td>“A Kit”</td>
<td>“A Kit”</td>
<td>“B Kit”</td>
</tr>
</tbody>
</table>

Joint Cost = Waveform Software + Integration + Installation

SCA = Software Communication Architecture
JTRS = Joint Tactical Radio System
NRE = Non-Recurring Engineering
A Kit = Recurring Aircraft Modifications
B Kit = Cost of the Radio Terminal
ICNIA = Integrated Communications, Navigation, and Identification Avionics
Levels of Integration

**Level 0**
- **Computer Equivalent:** Using Computer as a Word Processor
- **Example:** Link 16 Track from Link 16
- **What You Get:**
  - Legacy Information
  - JTRS Policy Compliance

**Level 1**
- **Computer Equivalent:** Send/Receive Word Documents from Net
- **Example:** Link 16 Track from Link 16 and Global Information Grid (GIG)
- **What You Get:**
  - Legacy Information
  - Man to Machine GIG Connected

**Level 2**
- **Computer Equivalent:** Internet Explorer on Laptop computer
- **Example:** Laptop Capability (e.g. E-mail, web surfing)
- **What You Get:**
  - Man-in-the-loop GIG Connected

**Level 3**
- **Computer Equivalent:** “Sharing” a Word Document with your workgroup
- **Example:** Advanced Collaboration and Targeting
- **What You Get:**
  - Integrated Man to Machine targeting collaboration
Level 4
(Full Integration)

<table>
<thead>
<tr>
<th>Level 4</th>
<th>Computer Equivalent</th>
<th>Example</th>
<th>What You Get</th>
</tr>
</thead>
<tbody>
<tr>
<td>JTRS</td>
<td>Some Level of Bill Gates’ House</td>
<td>Target Video</td>
<td>Fully integrated Man to Machine Network enabled data exchange</td>
</tr>
<tr>
<td>Net</td>
<td>Integrated Data/Imagery/Video</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Existing Displays (and Kneeboard/Laptop) “Sees” Network from MIDS-JTRS using Network and Link 16 RF
Host Operational Flight Program “Thinks” Network using a Gateway/Translator functionality

Interoperable with Joint and Allied and access Network through integration in Host (and additional Stand Alone if required)
Interoperability Enhancement Process (IEP)  
Joint Vision

- Improve Joint Warfighting by:
- Enabling Joint Mission Thread (JMT) interoperability assessments early-on in a program’s life cycle.
- Providing:
  - Joint planners and operational users information on the interoperability of tactical data systems in a joint networked environment.
  - Operationally relevant technical workarounds for joint data systems enabling the warfighter to operate in a seamless data sharing environment.
Interoperability Enhancement Process (IEP) Components

- IEP consists of two components:
  - Joint System engineering approach at the “bit-level” to achieve effective interoperability in a cost-effective manner
    - Tools include the interoperable Systems Management and Requirements Transformation (iSMART)
  - Joint Capabilities and Limitations (JC&L)
    - Provides warfighters in operational terms how net-enabled platforms interoperate
- IEP is a collaborative process with the Services
  - Goal is to enhance and synchronize current Service capabilities
    - Improve Joint Mission Area effectiveness
  - Guided by NII and J6 and implemented by DISA, JFCOM, and the Joint Services

IEP is “technical details” to support capability definition, acquisition, implementation & test/certification. JC&L is “operational speak” in warfighter terms.
Digitally-Aided Close air Support (DACAS) Benefits of Coordinated Implementation

- Improves/Permits interoperability between systems.
- Reduce risk of misinterpretation of targeting information.
- Permits automatic set up of digital communications.
- Community is aware of each other’s detailed capabilities and implementation plans.
- Provides means for common RF network, which supports synchronized attacks.
- Simplify TTP for users, which will cause operators to use digital means more often.
Digitally-Aided Close air Support (DACAS) Decision Group Responsibilities

**DACAS Change Control Board (CCB)**
- Approve engineering changes and Trouble Report descriptions/priorities; build consensus w/Service HQ on funding changes (CCB)
- Members: SPMs, Acq Authorities

**Technical Review Board (TRB)**
- Develop standards profile; build technical & system implementation change consensus (TRB)
- Members: SPMs, SMEs, & technical
- ECP Teams comprise TRB

**DACAS Engineering Change Process Group (ECPG)**
- Refine process and organizational responsibilities (ECPG)
- Members: SPMs, JITC, JFIIT, STOs

**Engineering Change Implementation Group (ECIG)**
- Refine schedule; synchronize development, testing, fielding, and certification of block upgrades (ECIG)
- Members: SPMs, Acq Auth, JITC, JFIIT, and STOs
Digitally-Aided Close air Support (DACAS) ECP Teams and Facilitators

- **ECP#1 Baseline Digitally-aided CAS messaging and RF Network**
  - Doug Robbins (USAF ESC/BAO kit)
  - Scott Winter (NAVAIR/F/A-18)

- **ECP#2 Designated Ground Target /Sensor Point of Interest**
  - Adam Grimm (USAF/A-10)

- **ECP#3 Exchange of Marked Still Imagery**
  - Mark Wilbur (F-35)

- **ECP#4 Exchange of Network Parameters**
  - Chris Beattie (Army/CECOM/F-35)

- **ECP#5 Common Platform/System Mission Data Loading**
  - Ike Heyward (USAF/Net Enabled Weapons)
  - Steve Schlembach (USAF/Net Enabled Weapons)
Summary

- JALN ICD is a 1\textsuperscript{st} - A major step forward in Joint networking capability development

- Making progress in indentifying, developing, and selecting waveforms appropriate to specified battle conditions – We understand multiple waveforms are required to support the warfighter

- A thought about radios …

- A thought about waveforms …

- A thought about Joint, Allied, and Coalition Interoperability ….
Questions?
# Evolution of Fighters and Tactical Communications

<table>
<thead>
<tr>
<th>Generation</th>
<th>Period</th>
<th>Key Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen 1</td>
<td>1944-1953</td>
<td>Subsonic Guns, IR Missiles, Rockets/Bombs, Visual</td>
</tr>
<tr>
<td>Gen 2</td>
<td>1953-1960</td>
<td>Supersonic IR Missiles, Radar Missiles, Rockets/Bombs, 1st Radar</td>
</tr>
<tr>
<td>Gen 4</td>
<td>1970-1990</td>
<td>Supersonic BVR Missiles, PGMs, Multi Sensor, Advanced Sensors</td>
</tr>
<tr>
<td>Gen 4.5</td>
<td>1990-2000</td>
<td>Stealth &amp; Supersonic BVR Missiles, PGMs, Integrated Sensors</td>
</tr>
<tr>
<td>Gen 5</td>
<td>2000+</td>
<td>Stealth &amp; Supersonic BVR Missiles, PGMs, Integrated Sensors</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Generation</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen 1</td>
<td>LOS, Analog Voice</td>
</tr>
<tr>
<td>Gen 2</td>
<td>LOS/BLOS, Digital Voice</td>
</tr>
<tr>
<td>Gen 3</td>
<td>LOS/BLOS, Digital Data</td>
</tr>
<tr>
<td>Gen 4</td>
<td>LOS/BLOS, Advanced Links</td>
</tr>
<tr>
<td>Gen 5</td>
<td>LOS/BLOS, Advanced Networks</td>
</tr>
</tbody>
</table>