

Understanding Data Link Gateway Challenges

TDL Summit

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Introduction

- Technology improvements allow new technology radios to be deployed in shorter periods of time than past history
- Gateway Software and hardware allows disparate Data Links to share information
 - Impacts to Message formats and standards
 - Security
 - Real Time SA

Data Links across the battlefield (Example)



Edge Users impact on Mission Capability

- > Significantly increased and accurate situational awareness
- > Improved Air to Ground Coordination
- > Improved fratricide and collateral damage prevention
- > Integrated message translation capability that increases access to net enabled warfare
- > Increased ISR visibility of fighter aircraft and operators
- > Ability of ground radio users to effectively join networks (with only a laptop, radio, and hand held device)
- > Significant increased mission effectiveness and lower observability
- > Improved airspace de-confliction

The Challenge: Disadvantaged Users are Participating on Multiple Networks

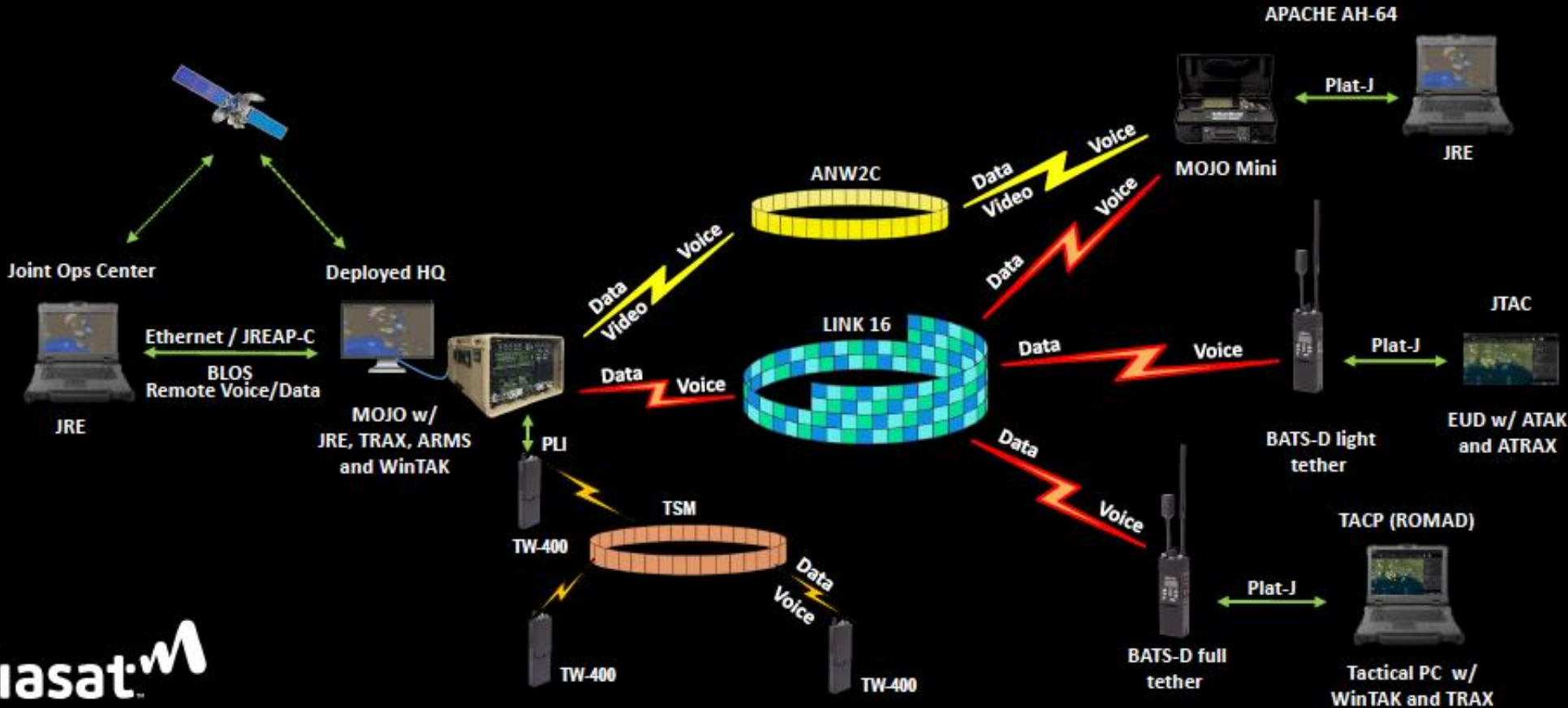
- > Legacy radio systems are deployed over the battlefield
- > Gateway software and hardware systems are critical to moving information around the battlefield
 - Link 16
 - UHF Narrowband Data
 - VMF
 - SATCOM
- > Data transfer Limitations exist when forwarding information between disparate networks
 - Wideband to narrowband networks
 - Critical time delays and data security issues

Demonstration Architecture



Land Forces 2018 Working Group Architecture

-  LINK 16 – Data / Voice / Imagery
-  ANW2C – Data / Voice / Imagery / Video
-  TSM - Data / Voice
-  ETHERNET / Platform-J



Move-Out and Jump-Off (MOJO) Multi-Link Gateway

- > **Three-Channel Communications Host**
- > **Tactical Voice**
 - UHF/VHF SINGARS, HAVE QUICK or UHF SATCOM
- > **Line-of-Sight (LOS) Tactical Data Links (TDL)**
 - Link 16, SADL, EPLRS and VMF
- > **LOS Networking**
 - ANW2-C1, Soldier Radio Waveform (SRW)
- > **Beyond LOS (BLOS) SA/C2**
 - UHF SATCOM JREAP/IW, L-Band
 - 25 Watt Power Amp
- > **Bridge and gateway among channels**
 - Compatible with multiple host gateways

STT Integrated Into MOJO Kit



Expeditionary Tactical Gateway

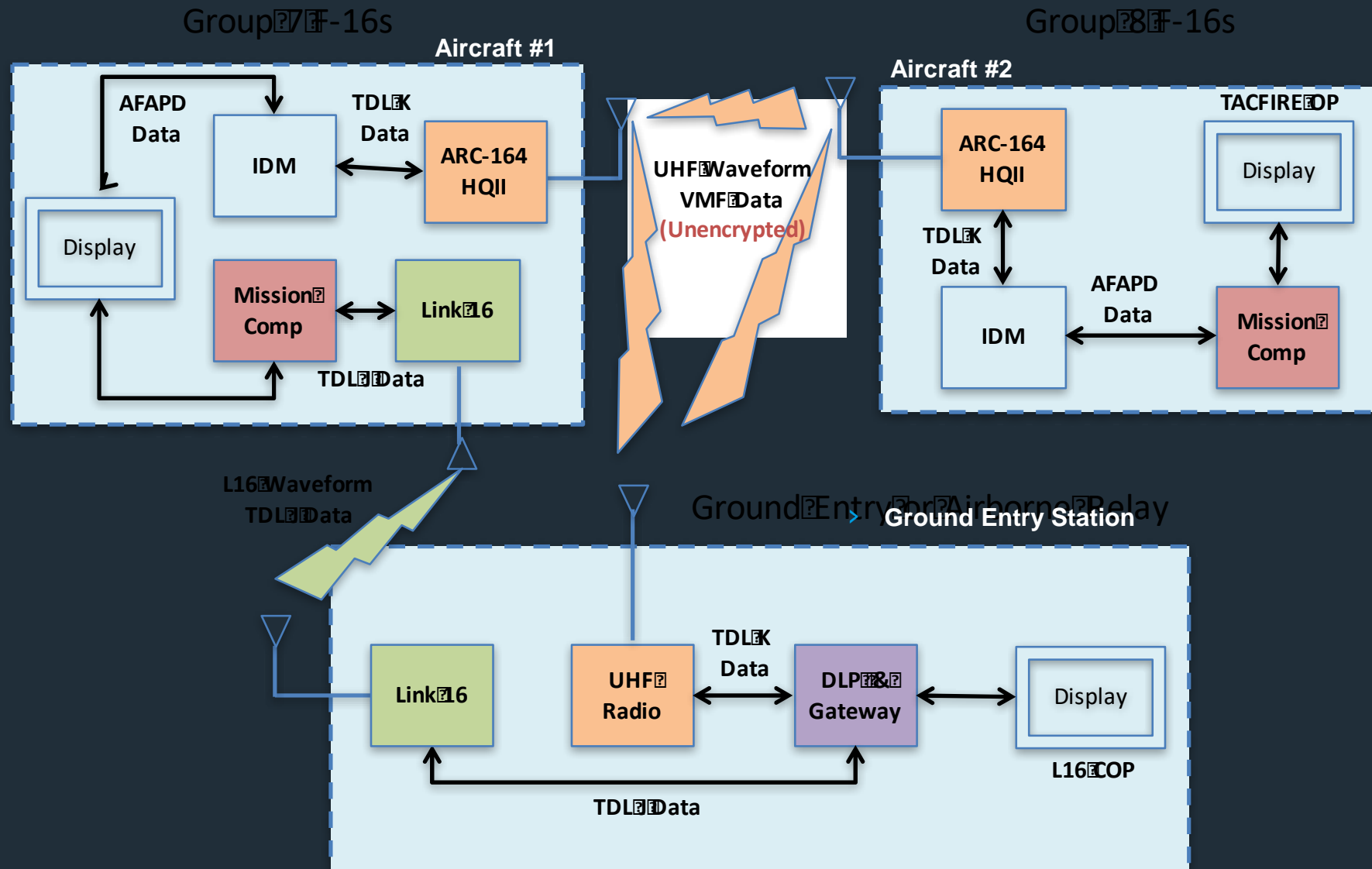
Concept of Data Forwarding and Fusion

- n Link 16 is a Joint/Allied Line-of-Sight (LOS) Anti-Jam Secure Digital Data Link between Military Platform Computers
 - u Uses a unique protocol message set (TADIL-J-MIL-STD-6016)
 - u Used by US and about 40 other countries for assured interoperability and assured Friendly ID
 - Inventory nearing 10,000 and rising
 - 300 nautical mile Information Exchange
- n Three major Joint and Allied Information Exchange Requirements (IERs) Satisfied
 - u Total Air, Ground and Sea Situation Awareness (SA)
 - Self Reported Blue Force and Tactical ISR Sensor reporting
 - u Primary Air Assured Command and Control (C2)
 - u Sensor Sharing/Target Refinement/Handover
- n Forwarding Rules & Systems to Extend IER Exchange Beyond LOS (MIL-STD-3011 & MIL-STD-6020)
- n All Information Handled as Coalition SECRET

Data Link Forwarding Challenges

- Timing between the two networks results in significant loss of key data being transferred to VMF
- Data Rate differentials between VMF and Link 16 will result in slow down of “real time data”
 - Positional and Target data may not be current and accurate
 - Target quality from VMF to Link 16 considered to be low because of very slow update rate
- Limited Message catalog forwarding between K and J Series messages

Aircraft/Ground Station Interaction Example



Data Link Interoperability Challenges

Category	Link 16	VMF	Problem	Mitigation Approach
Periodicity	Mandated Clock Cycles	No mandatory periods for data transfer	Cannot send Link 16 Data onto VMF networks at 12 sec intervals- low bandwidth	Limit number of reports from L16 to VMF (i.e. 1 in 10 reports)
Periodicity	Discard tracks if not updated regularly	VMF tracks are transmitted at different intervals: 10 sec, 30 min, 46 min etc.	Link 16 declare data stale if not updated on period	Modify Link 16 DLP to not drop VMF data too soon. VMF data must be identified to Link 16 operators
Track Quality	Track quality Assessment	No Track quality	VMF tracks appear as track quality =0 on Link 16	SW automatically makes VMF tracks quality =1 so they will not be discarded in Link 16
Track Management	Track Continuity and Management	Automatic Track management	No Track management	Track management must be done by voice or Free Text Messages
Message Receipt Comply	Link 16 expects receipt compliance response in period of time	VMF Net Access slows the Receipt Compliance Process	Failure to receive Receipt Compliance leads to multiple repeat transmissions	Slow the timer process for VMF data to avoid multiple re-transmissions

Message Forwarding Series J and Series K

K message to J Message Forwarding

- > J2.2/J13.3 to K05.1 Position Report
- > J2.3/J13.3 to K05.1 Position Report
- > J2.3/J13.4 to K05.1 Position Report
- > J2.5 to K05.1 Position Report
- > J3.1 to K03.6 MAYDAY Message
- > J3.2 to K04.1 Observation Report
- > J3.3 to K04.1 Observation Report
- > J3.4 to K04.1 Observation Report
- > J3.5 to K04.1 Observation Report
- > J28.2(0) to K01.1 Free Text

J Message to K Message Forwarding

- **K01.1 Free Test to J28.2(0)**
- **K03.6 MAYDAY to J3.1**
- **K04.1 Observation Report to J3.2/J3.3/J3.4/J3.5**
- **K05.1 Position Report to J2.0**

Technology Improvements to Aid in Data Forwarding

- Digital Technology moving rapidly allowing high speed transfer of critical data
 - Behavior Modelling for SW code Generation
 - Advanced DSP capability
 - High Density Field Programmable Gate Arrays
- Partitioned Computer systems allowing isolation between processing elements
- Software architectures with embedded security protocols and routing capability

Security Concerns and Options

- > Determination of critical data to be forwarded and security level of data
- > Cross Domain or Multi-level security creates a restricted data flow
- > Interface between VMF and Link 16 systems in current architecture:
 - One way gateway moving VMF data to Link 16 with no return path
 - Specially designed Gateway software to filter messages between data links
 - SW must be certified by US NSA

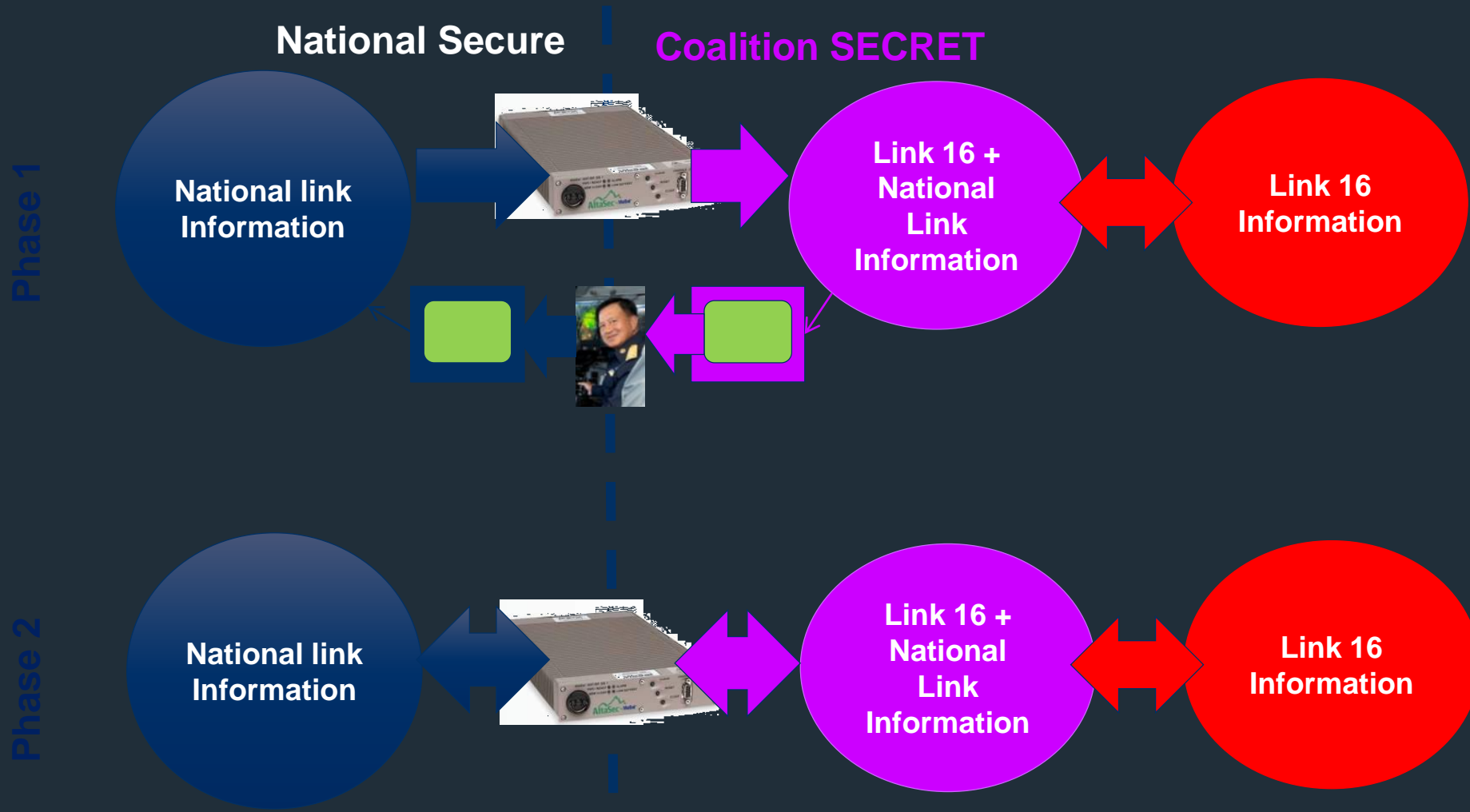
Multi-Network Information Description

- Link 16 Information must be maintained at Coalition SECRET Level
 - Protected by Approved Cryptographic Communications Security
 - Keys provided by Coalition Manager (usually US)
 - Information Security Managed for Thailand by US Pacific Command (PACOM)
- National Link Information is maintained as an individual nations National Secure
 - Protected by National Sovereign Cryptographic Communications Security
 - Keys/Passwords provided by National Security
 - Information Security Managed by National Security Services
 - Treated by PACOM as “Sensitive but Unclassified” Sovereign Information

Information Mixing Rules

- > Information can move “up” from National Secure to Coalition SECRET (Link 16)
 - Data all becomes Classified at this higher level (SECRET)
- Transfer is Managed by a “Data Diode” Cross Domain Solution (CDS)
 - Several such Accredited devices exist today
- > Information can be moved from SECRET (Link 16) to National Secure one of only two ways
 - Manually, by a Cleared Person
 - Assures that the information on the SECRET system is legitimate for transfer and manually transfers the information (types on the computer) into the Tnational Secure System
 - Electronically, when a PACOM Accredited CDS is developed and Accredited which filters the data that is allowed to pass
 - Rules (and software/firmware) must be developed jointly between national Security and PACOM plus the CDS Accredited by PACOM (2-3 year process)

Two Phase Approach (Example)



Some Final thoughts

- Technology has improved capability to share data from disparate systems with Link 16 and Link 22
- Information exchange requirements are utilized to determine what data is shared across various links
- Security Policy may dictate architecture and capability more than software capability
- Flexibility in software design allows multiple mission roles for gateways