ATEQ Consulting

Practical & Pragmatic
TDL Interoperability Management

TDL Misconceptions

Why do we need Interoperability Management?

If you implement using the STANAG, what can go wrong?

TDL = Just another radio!

There is a Data Forwarder so we can be sure of seamless comms

He has MIDS, I have MIDS – we have Link 16

The Reality!

TDL solutions are often based on “high-level” operational requirements

- Integration of TDLs into platforms
  - is complex
  - is often led by industry
  - is often developed from a single platform perspective

TDL Standards

- Have been historically ambiguous
- Are living and (by committee action) evolving documents

Platforms are developed

- To different Standard baselines
- Using different
  - integration approaches
  - Interpretations of the standards

Illustrative Example

STANAG Draft Revision 3 **+DLCPs**
Early NRS
Circa 1995

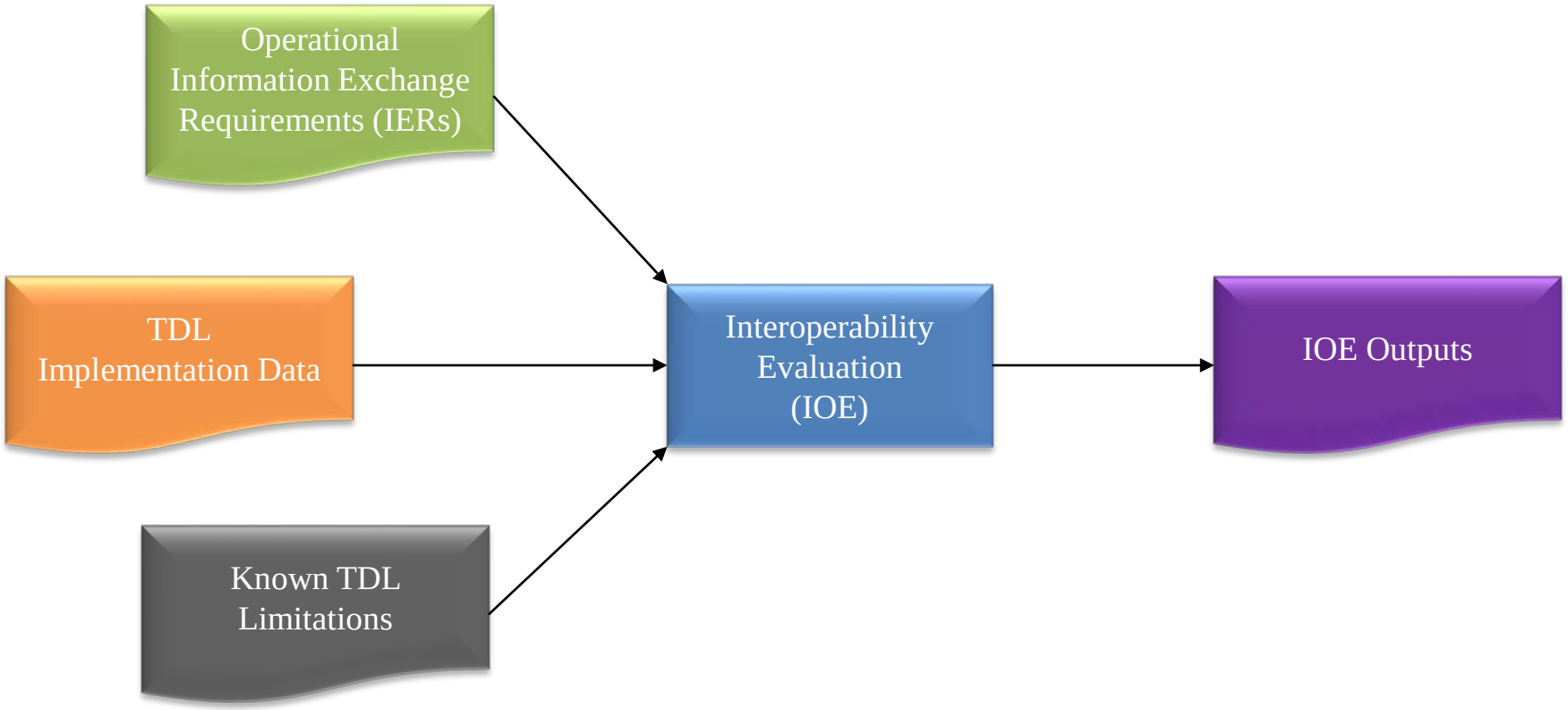
STANAG Ed 3 **+DLCPs**
Supplier Imp Plan
Circa 2001

STANAG Ed 6 **+DLCPs**
iSMART PRS
Circa 2011

STANAG Ed 1 **+DLCPs**
Supplier Spec
Circa 1998

MIL-STD 6016C **+DLCPs**
iSMART PRS
Circa 2005

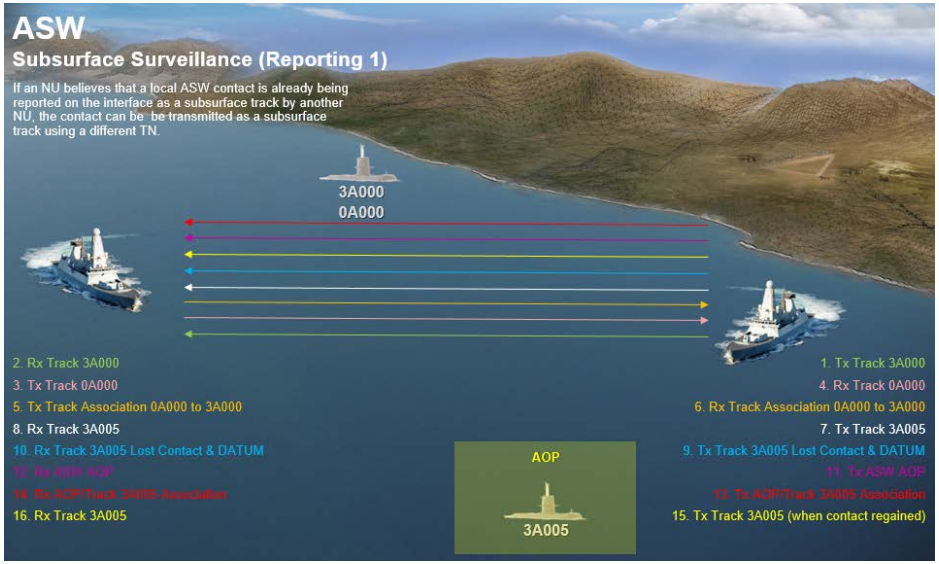
Key Components – IO Management



Define IERs – Operational Context

How do we define the Operational Context?

- Scenario/mission/role based Use Cases can assist in IER Capture



- IERs need to be:
  - Operationally focused
  - TDL agnostic
  - But mapped to TDL message structures to aid effective and efficient IO evaluation

IERs – Scope for IOE

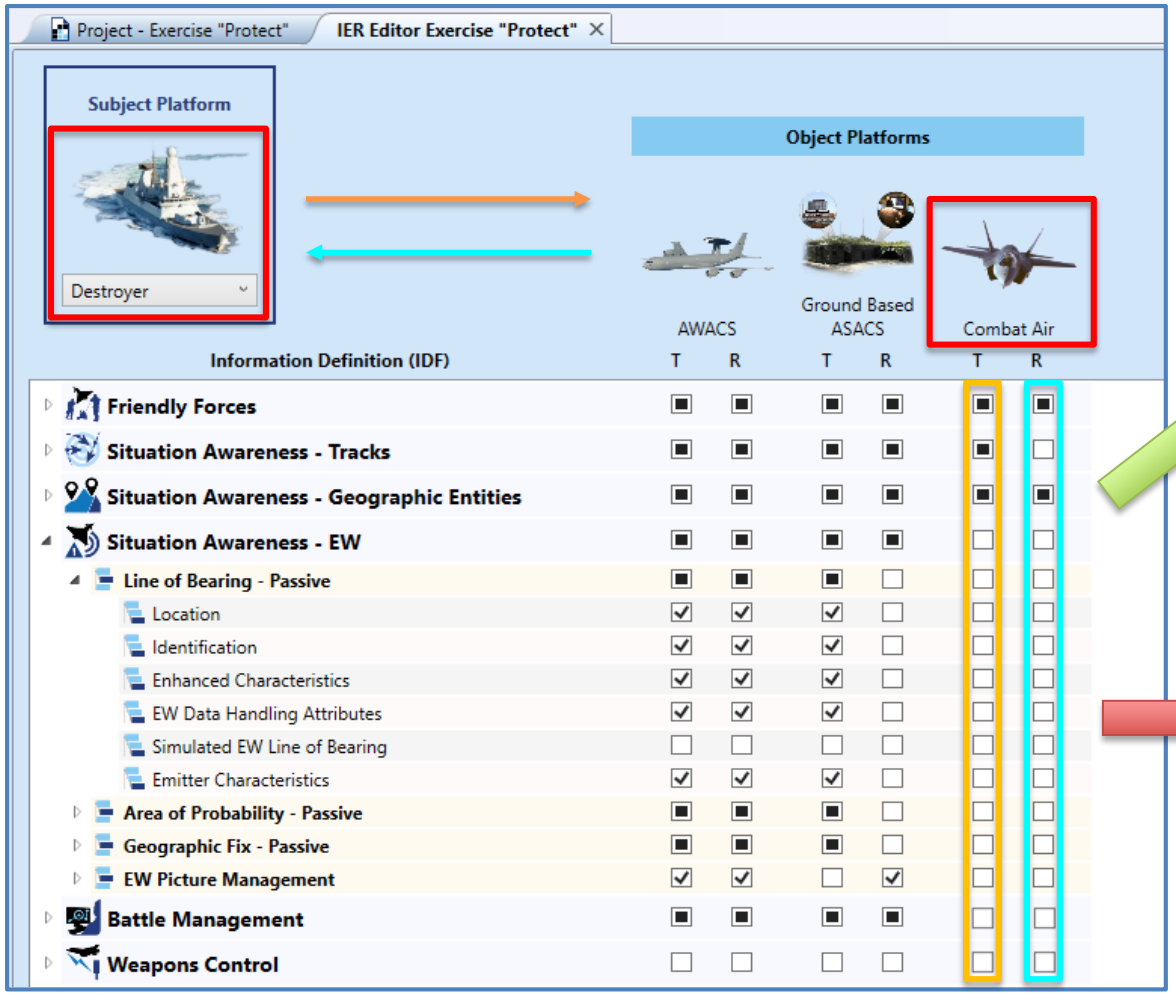


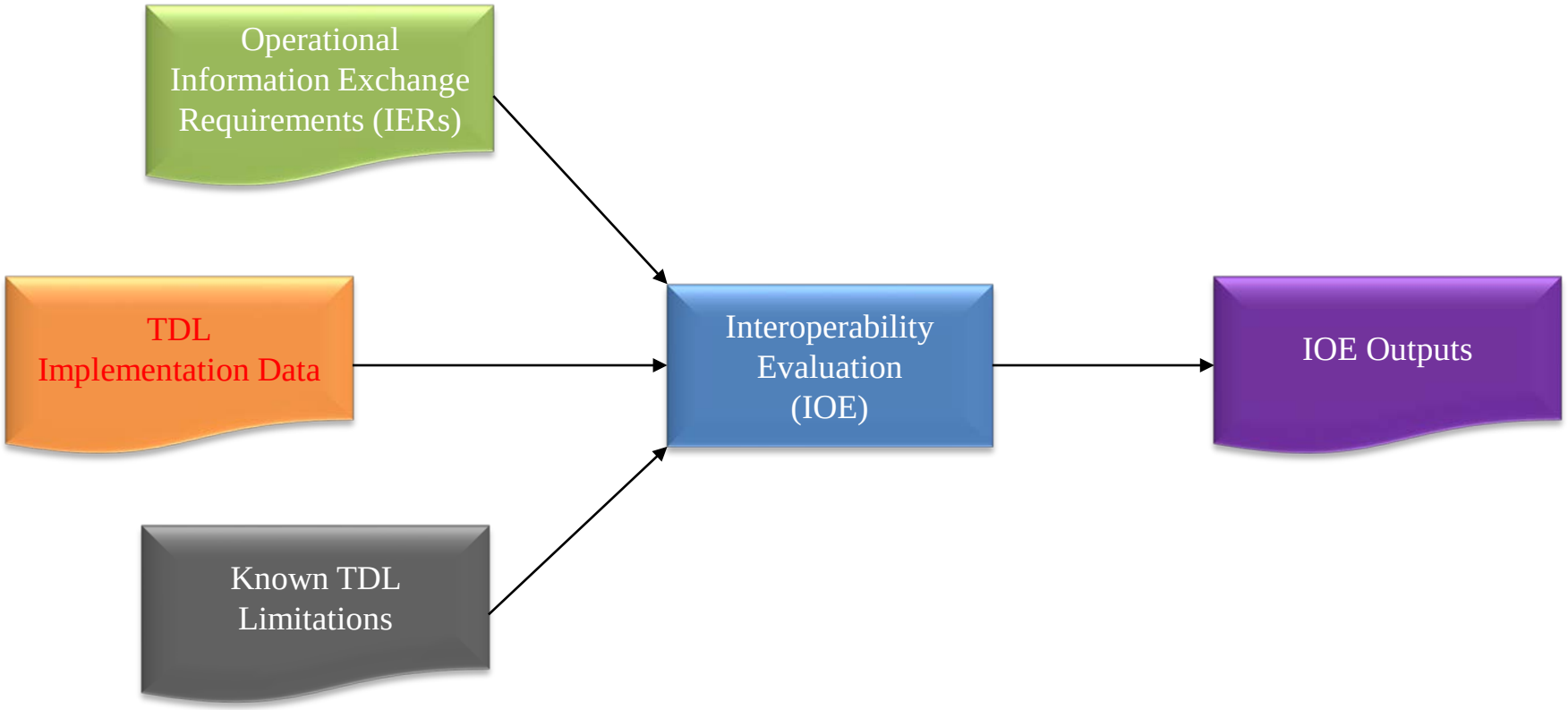
Table 2-1 - IERs - Destroyer and Combat Air

Functional Area	IERs
Friendly Forces	Location and Identification data Basic Status information Text Messages
Situation Awareness – Track Data	Air Tracks (Air Surveillance System to Combat Air) Land Tracks (Air Surveillance System to Combat Air) Threat Warnings (Air Surveillance System to Combat Air)
Situation Awareness – Geographic Entities	Geographic Reference Points, Lines and Areas (Air Surveillance System to Combat Air) Land Objects (Points) (Air Surveillance System to Combat Air) Emergency Points (Air Surveillance System to Combat Air) Data Update Request for Reference Point data (Combat Air to Air Surveillance System)

Table 2-2 - IERs Discounted from IOE - Destroyer and Combat Air

Functional Area	Discounted IERs
Situation Awareness – Track Data	Surface Tracks Space Tracks Subsurface Tracks Data Update Requests (Air Surveillance System to Combat Air) Force ID Change instructions (Air Surveillance System to Combat Air)
Situation Awareness – Geographic Entities	Data Update Request for Reference Point data (Air Surveillance System to Combat Air) Emergency Points Pointers
Battle Management	No requirement to exchange
Weapons Control	No requirement to exchange
Local Target Data	No requirement to exchange
Situation Awareness - EW	No requirement to exchange
EW – Parametric Data	No requirement to exchange
Ballistic Missile Defence	No requirement to exchange
Anti-Submarine Warfare	No requirement to exchange
Imagery	No requirement to exchange

Key Components – IO Management



TDL Implementation Data

Often “Project Owned”

- Key issue for central TDL “authority”

Available in several forms

- Full iSMART Products
- Supplier specific documents
- Implementation Plan
  - Excel
  - Tool set “specific”
  - PDF
- IOM Data

Implementation Data

D.1.2 C² TRACK TRANSMISSION

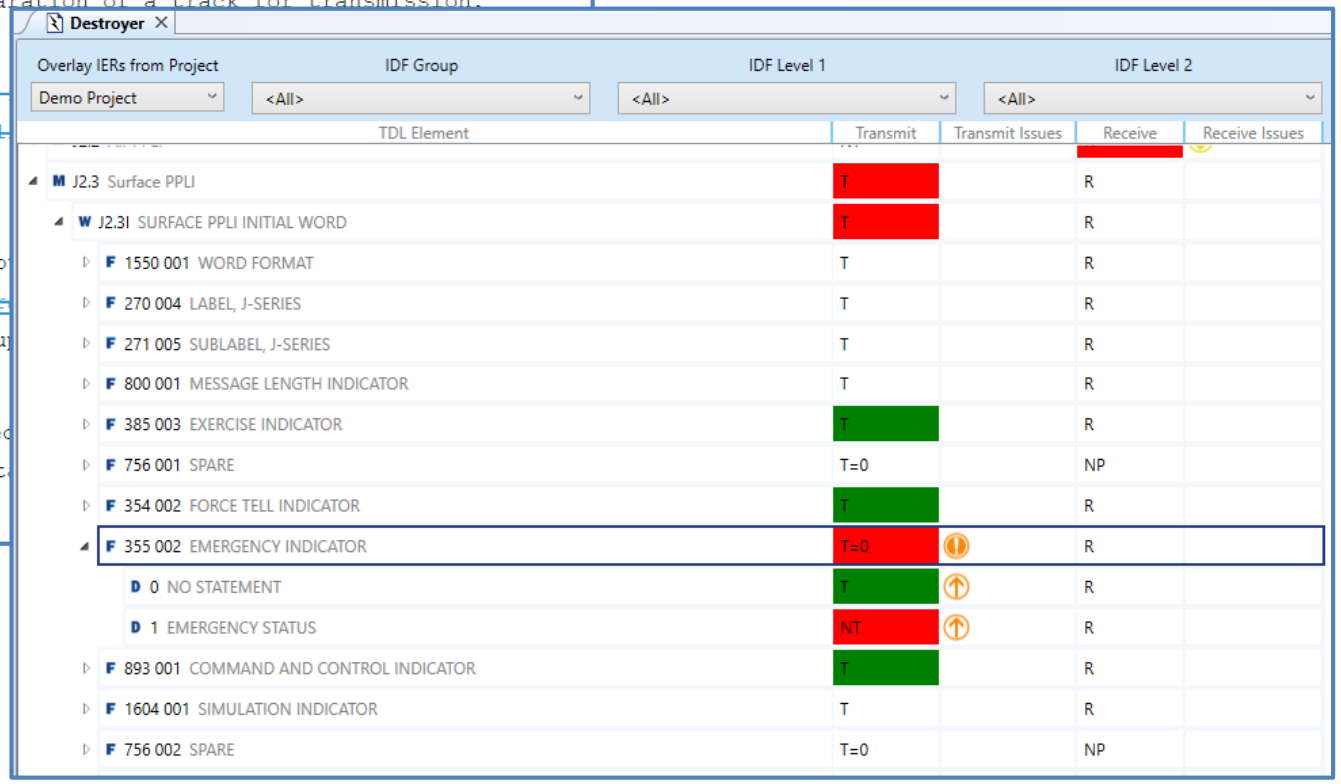
D.1.2.1 C² Track Transmission Stimulus

D.1.2.1.1 Transaction D.1.1, C² Preparation for Track Transmission (Paragraph D.1.1.3.6.1), upon preparation of a track for transmission.

D.1.2.1.2 ~~Periodically as defined Paragraph D.1.2.3.3.12.e, for a Bal repeated transmission.~~ Not Used

D.1.2.1.3 Transaction E.1.3, Recep Number (Paragraph E.1.3.3.1, ~~Paragr E.1.3.3.14~~), on receipt of a data u

D.1.2.1.4 Transaction P.3.3, C² Rec P.3.3.3.5.a), upon automatic accept for which R² is held.



IOM Data

Platform Details

Add Platform | Export Platform | Clone Platform | Remove Platform | Main Menu | Record Editing: Enabled / Disabled

TDL: Link 16 Platform: Navy Frigate

Classification NATO UNCLASSIFIED
Releasable to APN(AUS, AUT, CHE, FIN, SWE)
Platform Navy Frigate
Country Partner
Service Navy
SoftwareVersion Combat System 5.1.5
Operational SW? ☐
Terminal MIDS LVT 5- BU1
Terminal SW BC7
Base Spec' Doc' 5516 Edition7/ATDLP-5.16(A)(1)
Entry Type 5 - Full Responses (Planned Implementation)
Point of Contact Lt Cdr Kirk

Operational Role

ARTIFICIAL DATA

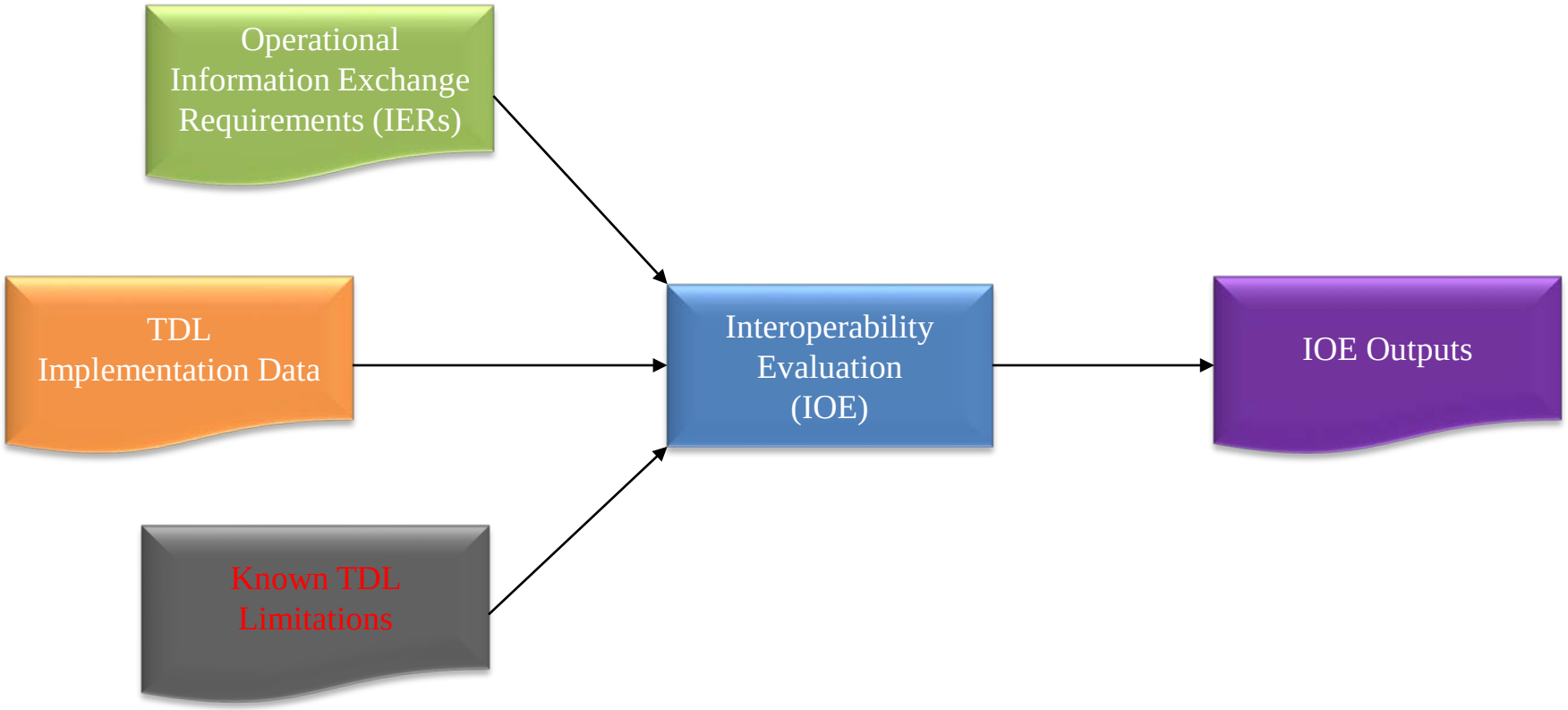
The Navy Frigate operates as a warship and is part of a Carrier Strike Group. It is able to provide Air Surveillance and will interact with all Naval and Air Force assets using Link 16 and Link 22 as needed.

Technical Comments

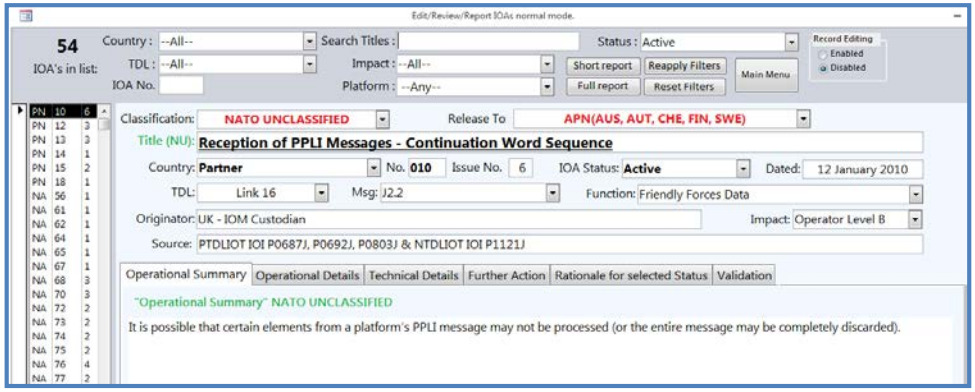
Defines the Link 16 message processing for LOS (MIDS Exchange). For Link 16 over JREAP, a reduced subset of messages will be implemented (largely excluding J12.x series messages).

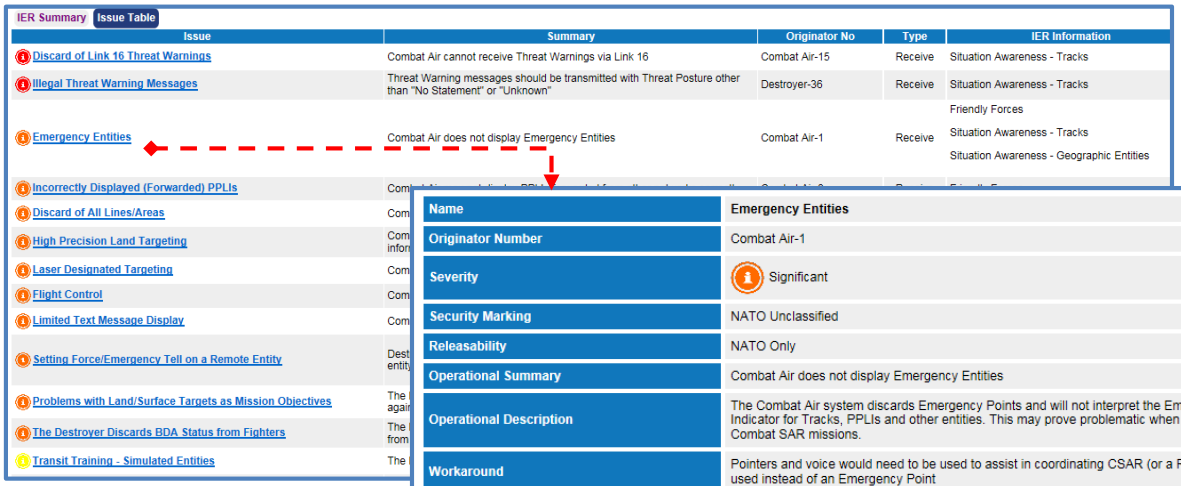
Mess	Implementation Question	Description	Plat A	Plat A	Plat A Responses	Plat A Response	Plat B	Plat B	Plat A Response	Plat A Responses	Plat A Comme	Plat B Comme
J0.0	Initial Entry Message	Primarily used for network synchronisation. It is also possible to include a basic set of timeslots that a joining platform can then use to join a network without a previously allocated timeslot load.	T	R	-	-	T	R	-	-	No Comment	No Comment
J0.1	Test Message	Automatically generated by the Terminal in response to a J0.6 Terminal Interrogation. Used to establish the presence of connectivity between two platforms.	T	R	-	-	T	R	-	-	No Comment	No Comment
J0.2	Network Time Update Message	Facilitates a change to network time. Supports the promulgation of the change required to network time and the time of execution for the change.	T	R	-	-	T	R	-	-	No Comment	No Comment
J0.3	Time Slot Assignment Message	Provides the Network Manager with the ability to dynamically assign or deassign Time Slot Assignments being used within the Network.	NT	R	NT	NP	NT	R	NT	NP	No Comment	No Comment
J0.4	Radio Relay Control Message	Provides the Network Manager with the ability to dynamically assign or deassign Relay Functions being used within the Network in order to ensure effective data propagation within the network.	NT	R	NT	NP	NT	R	NT	NP	No Comment	No Comment
J0.5	Repromulgation Relay Message	Used to identify particular messages within a specific timeslot that are to be relayed as part of the repromulgation relay function. A unit can either originate repromulgation relay or simply repromulgate messages that were originated by others.	NT	R	-	-	T	R	-	-	No Comment	No Comment
J0.6	Communications Control Message	See Below	NT	R	NT	NP	T	R	NT	NP	No Comment	No Comment
J0.6	Action, Communication Control = 0 (Terminal Interrogation)	Request that a remote unit responds with either a J0.1 (Test Message) or J2.x (PPLI Message). Used to establish connectivity.	tbd	tbd	tbd	tbd	tbd	tbd	tbd	tbd	No Comment	No Comment
J0.6	Action, Communication Control = 3 (Control Request)	Request from a unit to the Network Manager to request more/less Timeslots be assigned on a specified NPG. Used by systems that can automatically detect over or under utilisation of timeslots.	tbd	tbd	tbd	tbd	tbd	tbd	tbd	tbd	No Comment	No Comment
J0.6	Action, Communication Control = 3 (Control Request)	Allows the appropriate authorised unit to effect a change of CVLL within a remote unit.	tbd	tbd	tbd	tbd	tbd	tbd	tbd	tbd	No Comment	No Comment
J0.7	Time Slot Reallocation Message	Provides the capability for a JU to request a percentage of time slots from a shared Time Slot Reallocation (TSR) pool and disseminate the requests of other JUs.	T	R	-	-	NT	NP	-	-	No Comment	No Comment

Key Components – IO Management



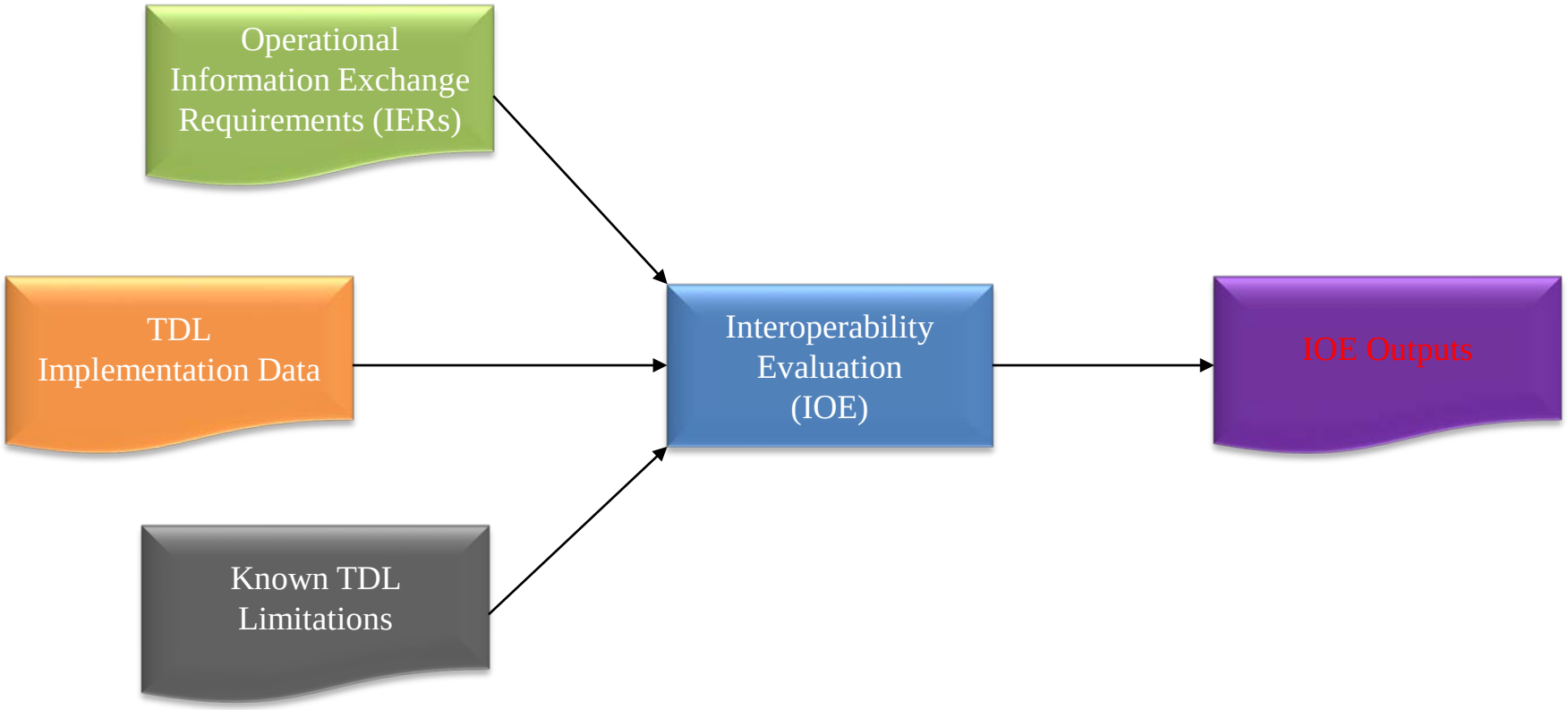
Known TDL Limitations





Name	**Emergency Entities**
Originator Number	Combat Air-1
Severity	Significant
Security Marking	NATO Unclassified
Releasability	NATO Only
Operational Summary	Combat Air does not display Emergency Entities
Operational Description	The Combat Air system discards Emergency Points and will not interpret the Emergency Indicator for Tracks, PPLIs and other entities. This may prove problematic when undertaking Combat SAR missions.
Workaround	Pointers and voice would need to be used to assist in coordinating CSAR (or a Reference Point used instead of an Emergency Point
Technical Description	J3.1 Emergency Point message is discarded on reception. The Emergency Indicator in all other J-Series messages is not interpreted.
Further Action	Future upgrade
IOA Number	
IOI Numbers	
National Issue Numbers	
Issue Status	InvestigationComplete
Issue Applies To	[Op Flt Prog 12.0] J2.3 Surface PPLI J2.3I SURFACE PPLI INITIAL WORD 355 002 EMERGENCY INDICATOR

Key Components – IO Management



IOE Outputs - Key Issues

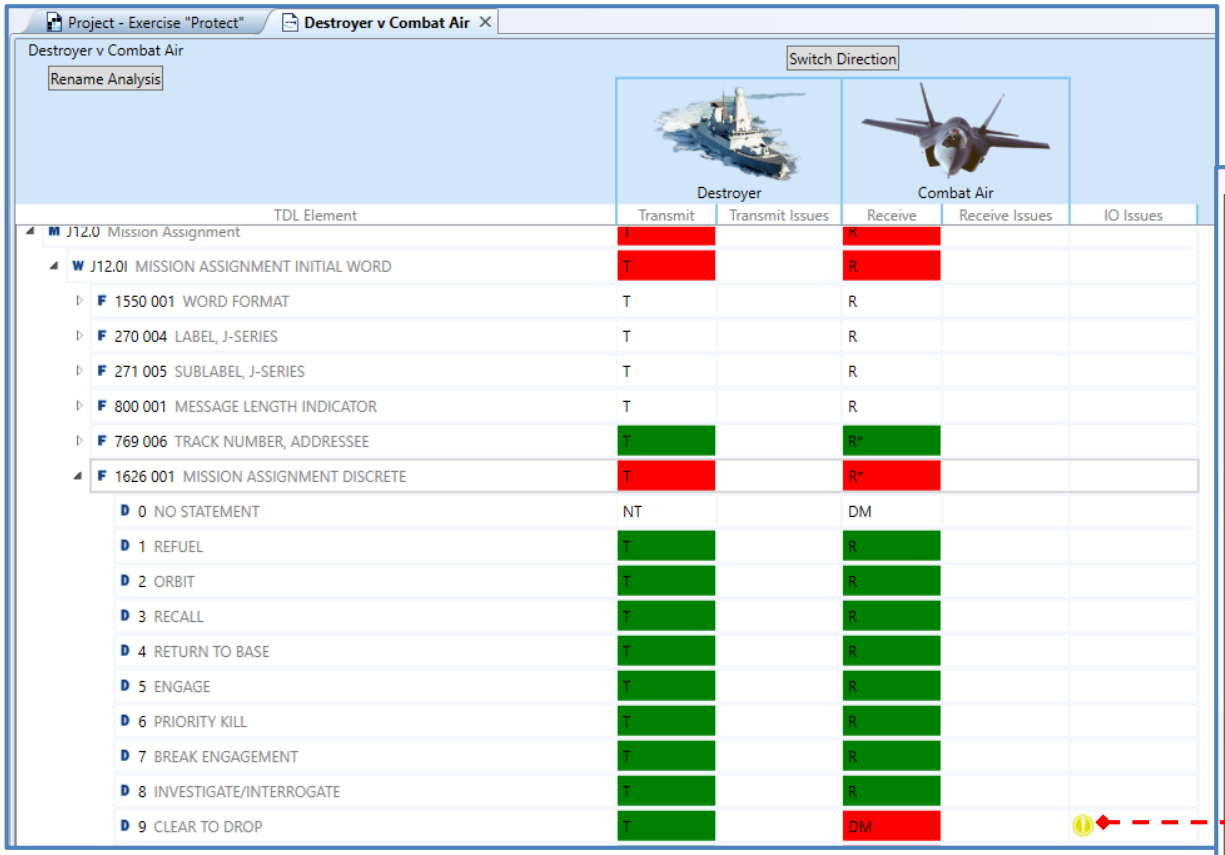
IOEs reports historically developed from a technical standpoint

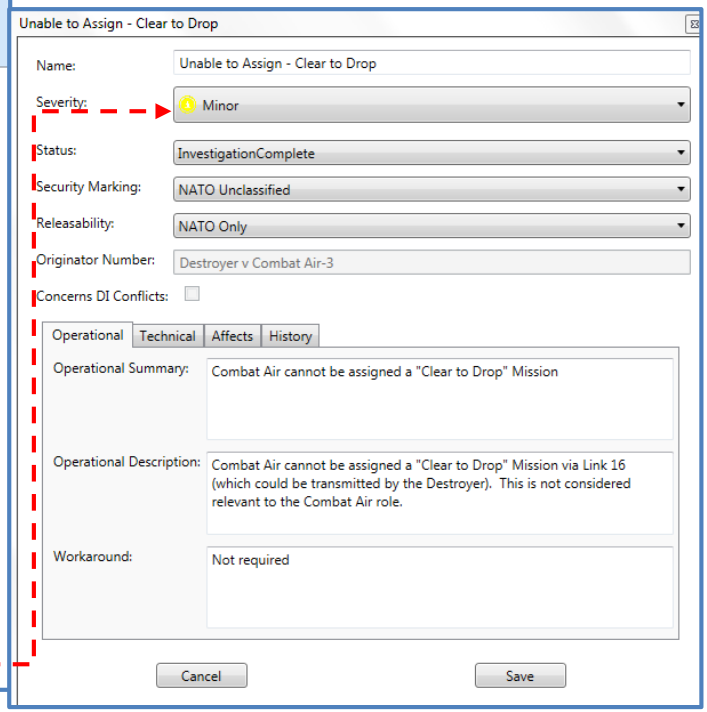
- Overly focussed on technically derived issues
  - Little or no operational significance
    - Impacts not well identified
- As a consequence, front line were not benefiting
- IOE Reports:
  - "Bulky"
  - Static
  - Required SME knowledge to interpret
- A more operationally focussed output was needed
  - And more dynamic

Key Components of IOE Output

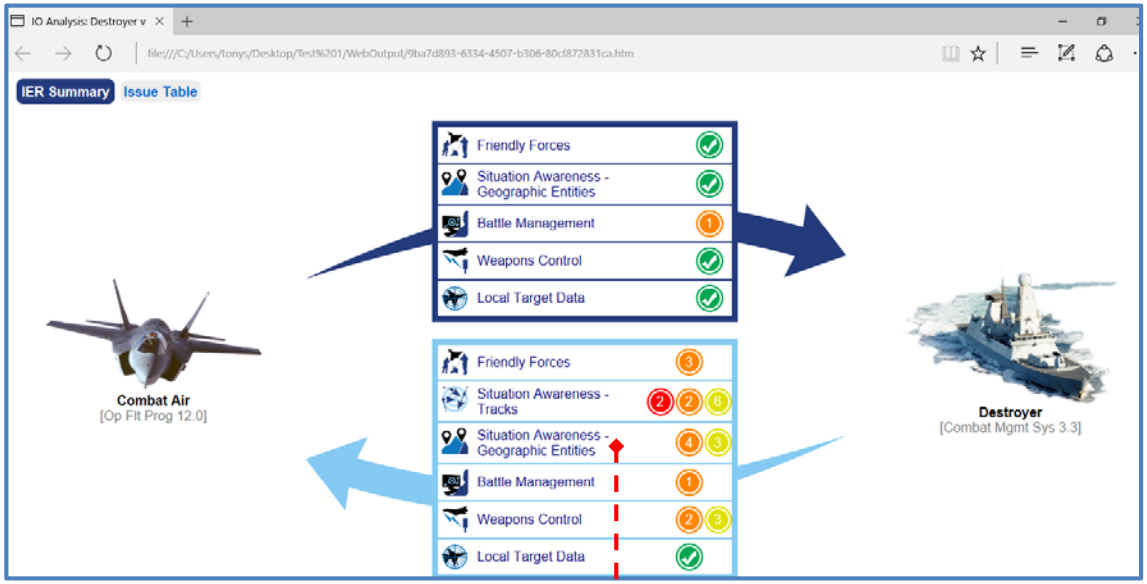
- Detailed Analysis
- Operational View
  - Representation of IERs
  - Capabilities & Limitations

Detailed Analysis





Operational View



Situation Awareness - Geographic Entities

Geographic entities that are exchanged to provide additional SA or to report entities for which direct sensor support is not available.

Reference Point - Hazard

A geographic reference point that reports an entity that is a potential Hazard to friendly forces

Information Type	Issue	Operational Summary
Hazard Description	No Known Issues	
Location	Combat Air Discards All Slaved Reference Points	The Combat Air system discards any Reference Point which is slaved to another track or PPLI

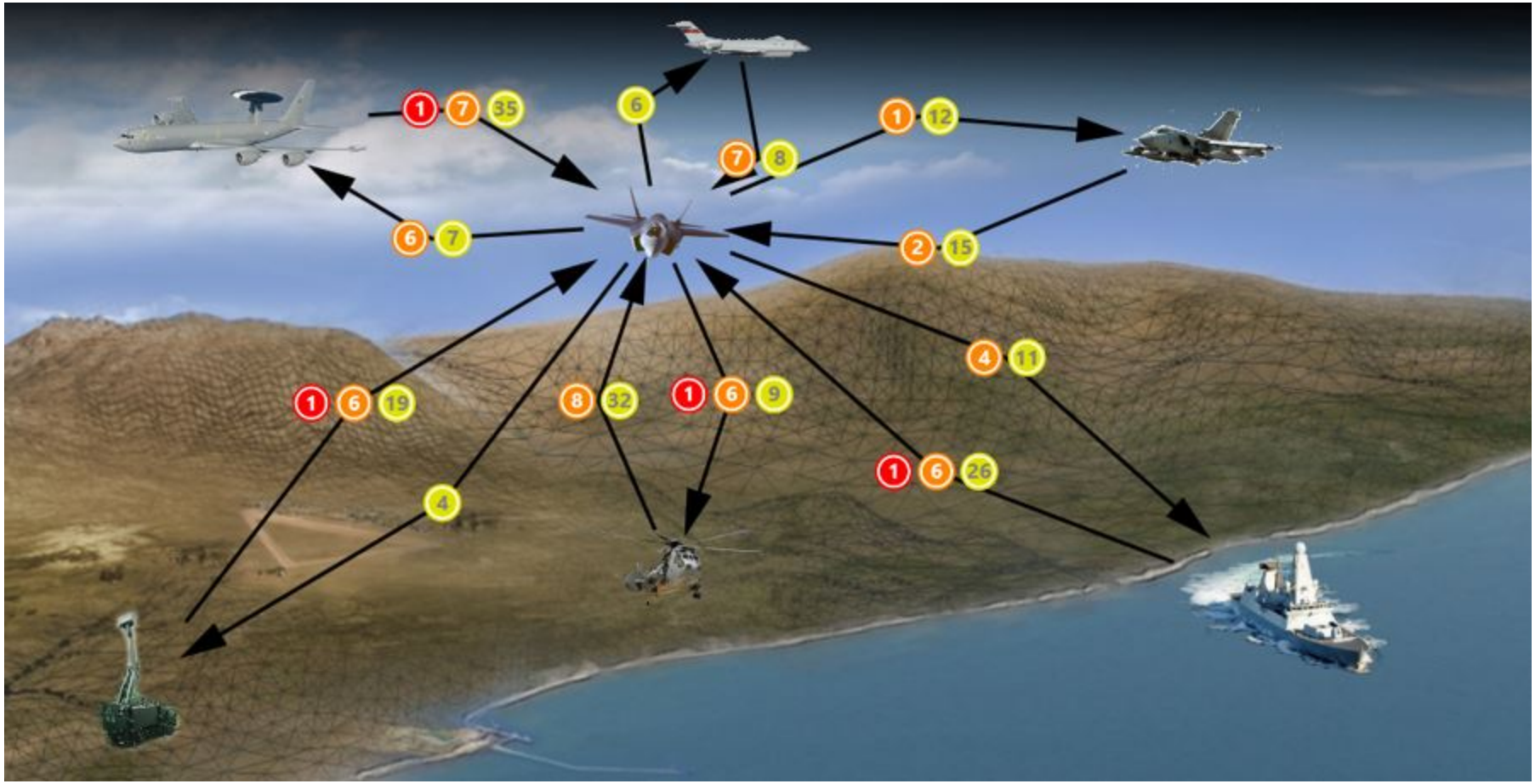
Land Object

A geographic object in the Land domain that has been derived from other than sensors

Information Type	Issue	Operational Summary
Location	High Precision Land Targeting	Combat Air does not interpret Land Objects with High Precision positional information correctly
Identification	Exercise Objects - Displayed as Real	Combat Air displays all exercise tracks/points as if real
Enhanced Point Characteristics	Setting Force/Emergency Tell on a Remote Entity	Destroyer may not be able to set Force Tell or Emergency Status on a remote entity.
	Limited Supporting Information - Land Points	Destroyer reports limited information for Land Points.

Geographic Pointer

Operational View



Future Challenges

RF Interoperability

- Introduction of new technologies/waveforms etc

Multi-Link Interoperability

- Source TDL Issues;
- Destination TDL Issues; and
- Data Forwarder Issues, exacerbating the problems

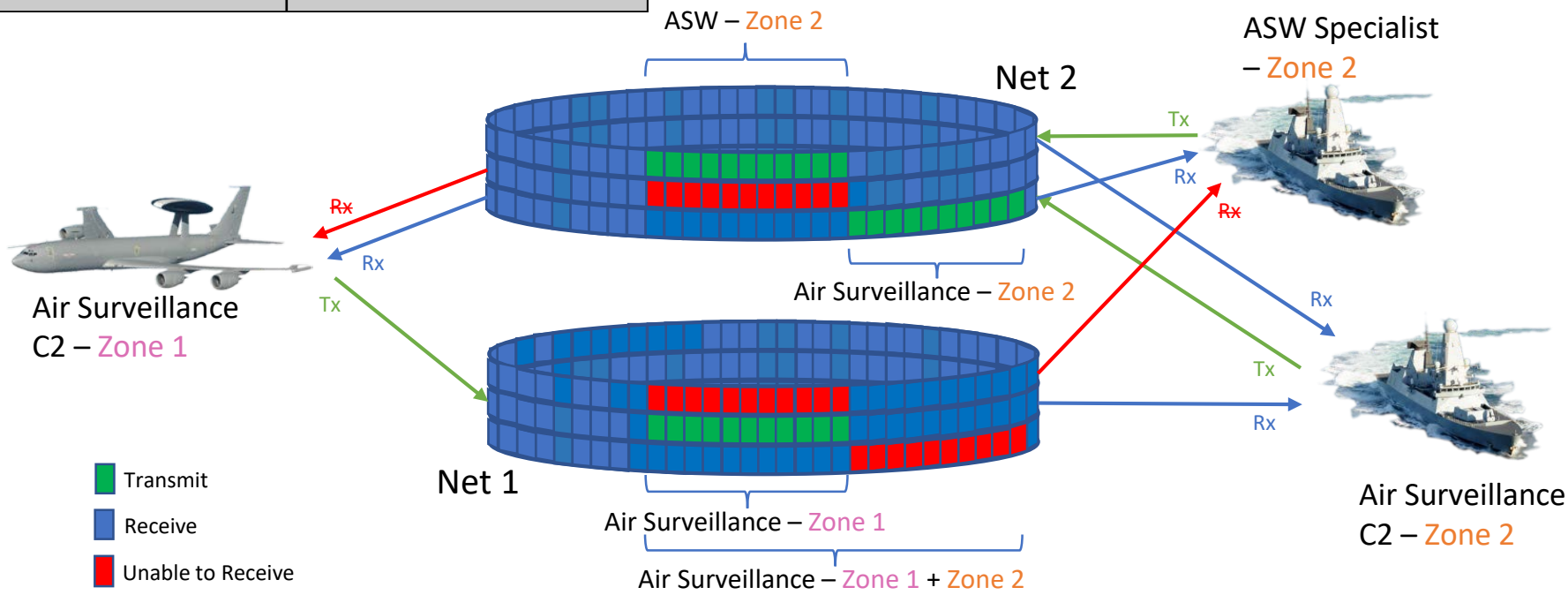
Expanded functional use of TDLs

- Network Enabled Weapons, Ballistic Missile Defence, Imagery

Example – RF Interoperability Planning

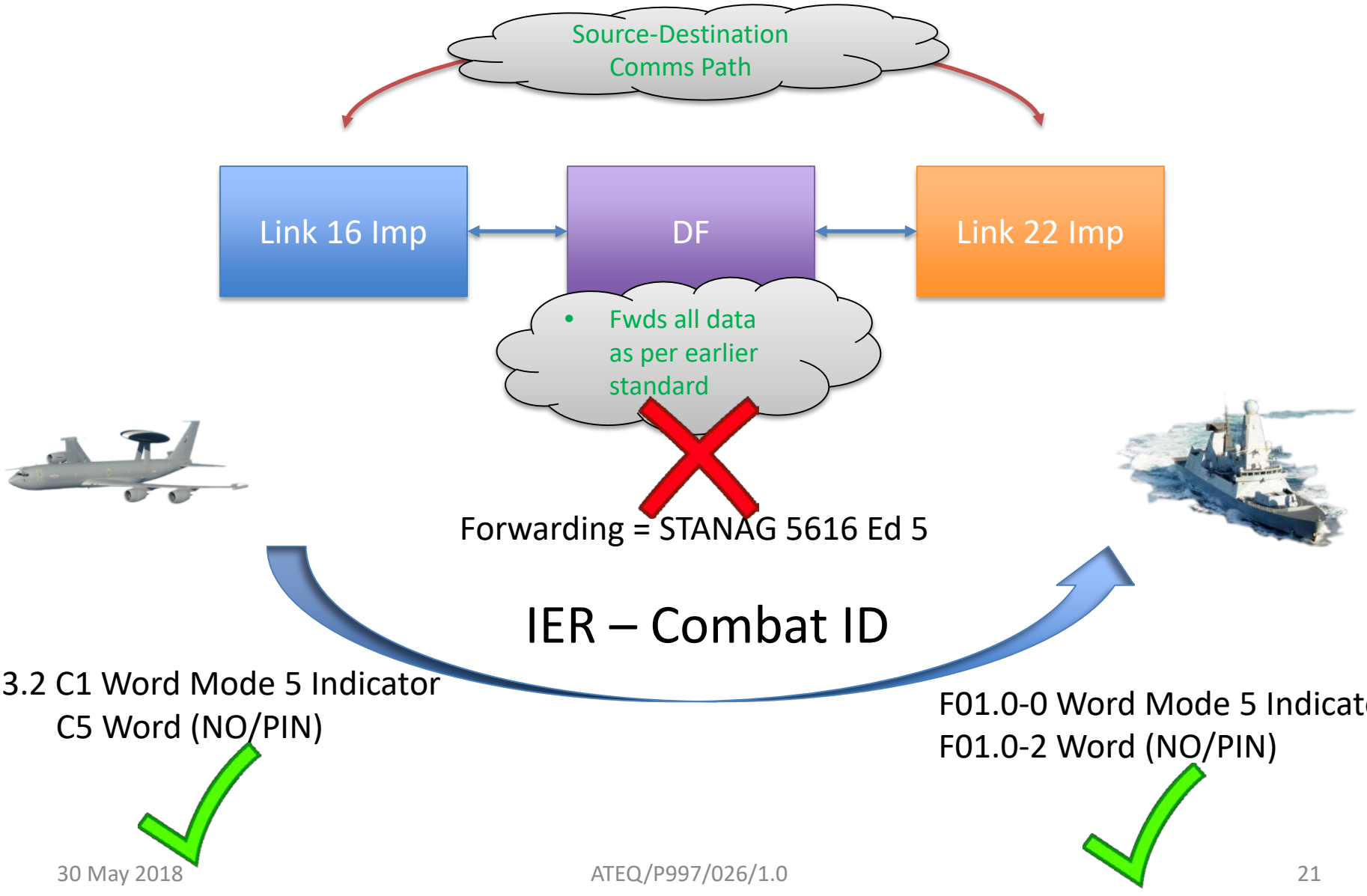
Tx	Rx
Air Surveillance – Zone 1 on Net 1	Air Surveillance – Zone 2 on Net 2

Tx	Rx
ASW – Zone 2 on Net 2	Air Surveillance – Zone 2 on Net 2

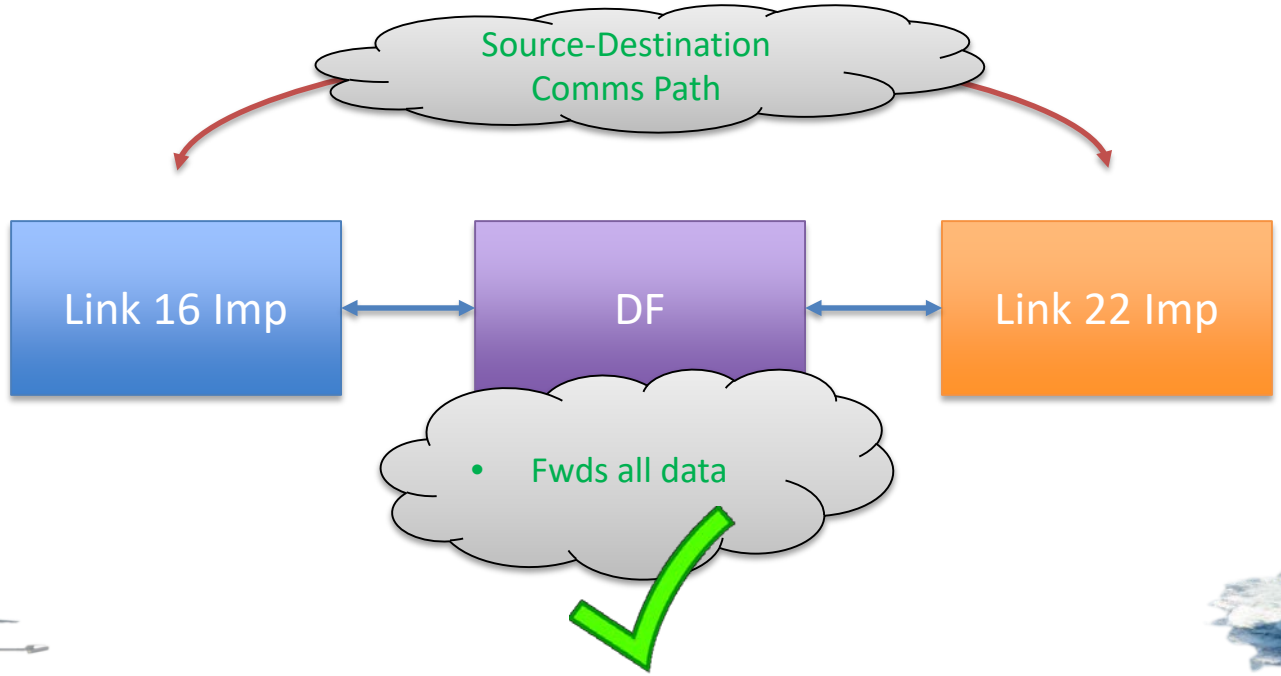


Tx	Rx
Air Surveillance – Zone 2 on Net 2	Air Surveillance – Zone 1 on Net 1
-	ASW – Zone 2 on Net 2

Example – Multi Link Interoperability



Example – Multi Link Interoperability



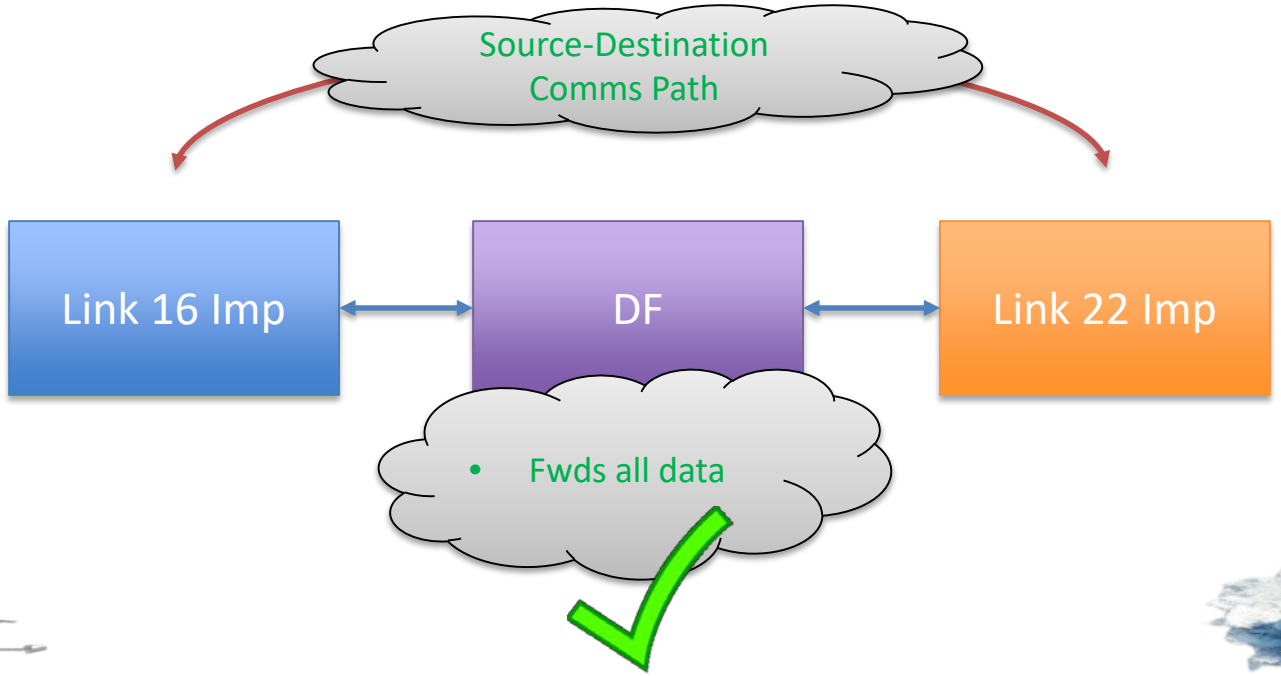
Forwarding = ATDLP-6.16(A)(1)

IER – Combat ID

J3.2 C1 Word Mode 5 Indicator
C5 Word (NO/PIN)

STANAG 5522 Ed 4

Example – Multi Link Interoperability



Forwarding = ATDLP-6.16(A)(1)

IER – Combat ID

J3.2 C1 Word Mode 5 Indicator
C5 Word (NO/PIN)

F01.0-0 Word Mode 5 Indicator
F01.0-2 Word (NO/PIN)

Questions?