Operational Based Enterprise Architecture for Tactical Communications Requirements

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Purpose of presentation is to discuss:

- A model based approach to structure operational requirements

- Your thoughts and experience related to this.

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Operational Based Enterprice Architecture for Requirements for Tactical Communications

Content:

- Definitions of Interoperability

- IO CONOPS Model

- Multi TDL Model

- Conclusions

- Challenges

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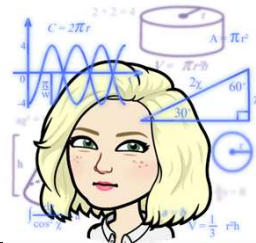
Definitions Interoperability
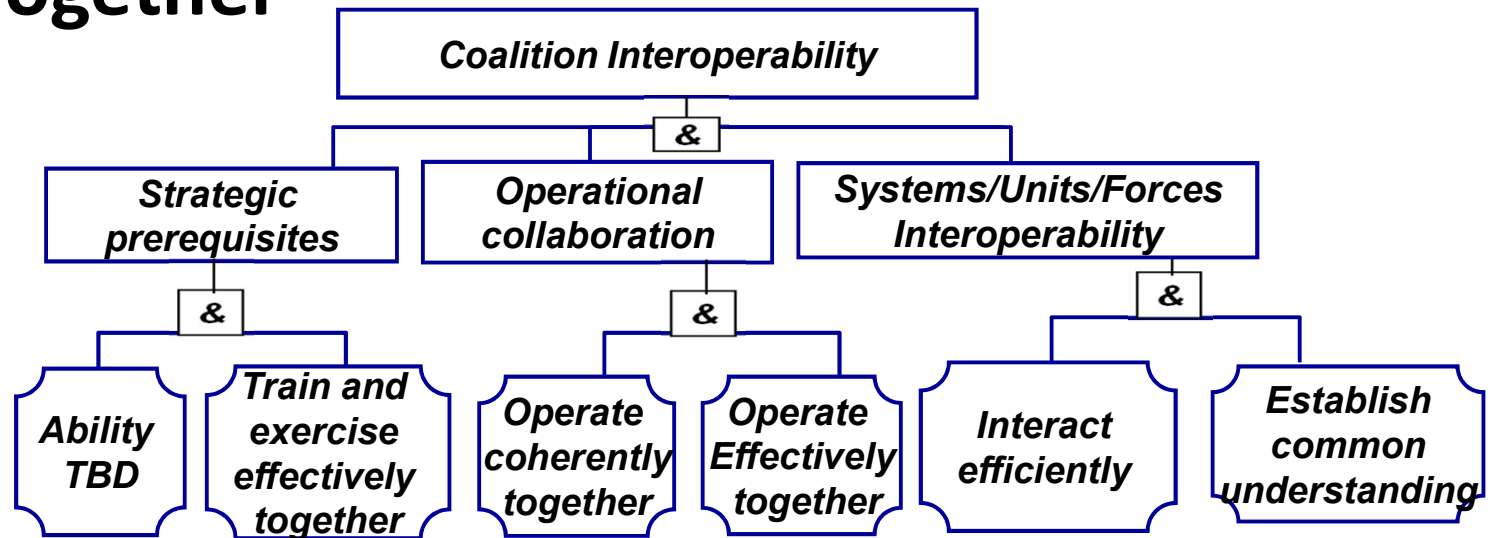
- **Interoperability (NATO 2010):**

The ability to act together coherently, effectively and efficiently to achieve Allied tactical, operational and strategic objectives.

- **Military Interoperability (NATO 2010)**

The ability of military forces to train, exercise and operate effectively together in the execution of assigned missions and tasks.

Working Together

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                    ┌──────────────────────────────┐
                    │   Coalition Interoperability   │
                    └───────────────┬────────────────┘
                                  [ & ]
        ┌───────────────────────────┼───────────────────────────┐
┌───────────────┐         ┌───────────────┐         ┌───────────────────────┐
│  Strategic    │         │ Operational   │         │ Systems/Units/Forces  │
│ prerequisites │         │ collaboration │         │   Interoperability    │
└───────┬───────┘         └───────┬───────┘         └───────────┬───────────┘
      [ & ]                     [ & ]                         [ & ]
   ┌─────┴─────┐           ┌──────┴──────┐             ┌────────┴────────┐
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│Ability│ │Train and│  │Operate │  │Operate │      │ Interact │  │Establish │
│ TBD  │  │exercise │  │coherently│ │Effectively│   │efficiently│ │ common   │
│      │  │effectively│ │together│  │together│      │          │  │understanding│
│      │  │together │  │        │  │        │      │          │  │          │
└──────┘  └────────┘   └────────┘  └────────┘      └──────────┘  └──────────┘
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Requires:

- Our systems support this

- Understanding of Operational Context

- Derivation of Requirements within this context

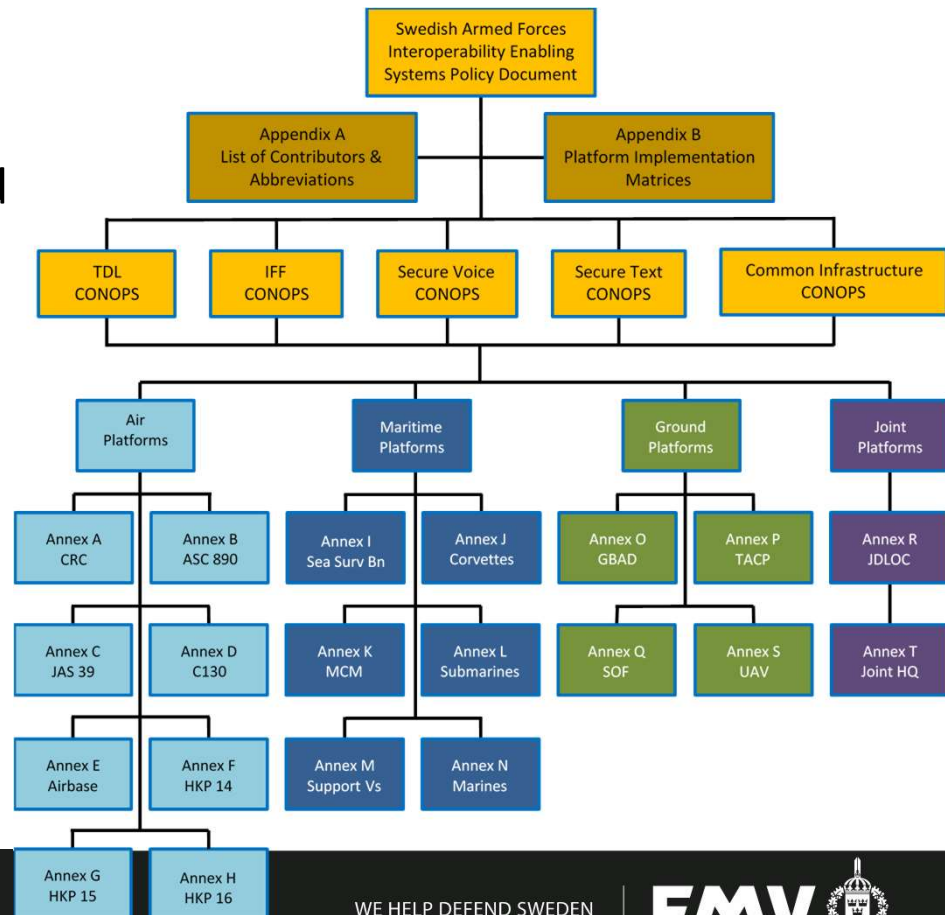- Ability to handle Requirements and steering information in a structured manner

2 Projects

- Model based Version of Swedish Armed Forces Joint Policy Document for Interoperability Enabling Systems 2016-2025 document suite. ('IO CONOPS")

- Swedish Joint Multi Tactical Data Link Architecture (MTDLA)

SweAF Joint Policy Document for Interoperability Enabling Systems 2016-2025

Strategic description of the operational usage of interoperability enabling C2 and information systems.

- Inter-related set of 30 documents
  - complex
- Different Authors
  - Structure & coherence?
- Difficult to maintain
  - time consuming updates

Swedish Armed Forces Interoperability Enabling Systems Policy Document

Appendix A — List of Contributors & Abbreviations

Appendix B — Platform Implementation Matrices

TDL CONOPS · IFF CONOPS · Secure Voice CONOPS · Secure Text CONOPS · Common Infrastructure CONOPS

Air Platforms · Maritime Platforms · Ground Platforms · Joint Platforms

Annex A CRC · Annex B ASC 890 · Annex I Sea Surv Bn · Annex J Corvettes · Annex O GBAD · Annex P TACP · Annex R JDLOC

Annex C JAS 39 · Annex D C130 · Annex K MCM · Annex L Submarines · Annex Q SOF · Annex S UAV · Annex T Joint HQ

Annex E Airbase · Annex F HKP 14 · Annex M Support Vs · Annex N Marines

Annex G HKP 15 · Annex H HKP 16

'IO CONOPS' Architecture – Top Level Navigation

'mirrors' the structure of the document suite

- To support a revision of the Swedish Armed Forces Joint Policy for Interoperability Enabling Systems document set ensuring coherence and consistency across the document set

- To support the production of coherent updates to the Sw IO documentation using a model based output

- To communicate the information in a coherent, searchable and intuitive format

'CONOPS' Architecture

Platform Interactions

Data Exchange Matrix

Platform Enabler Fit

P–P connectivity

Platform Annex
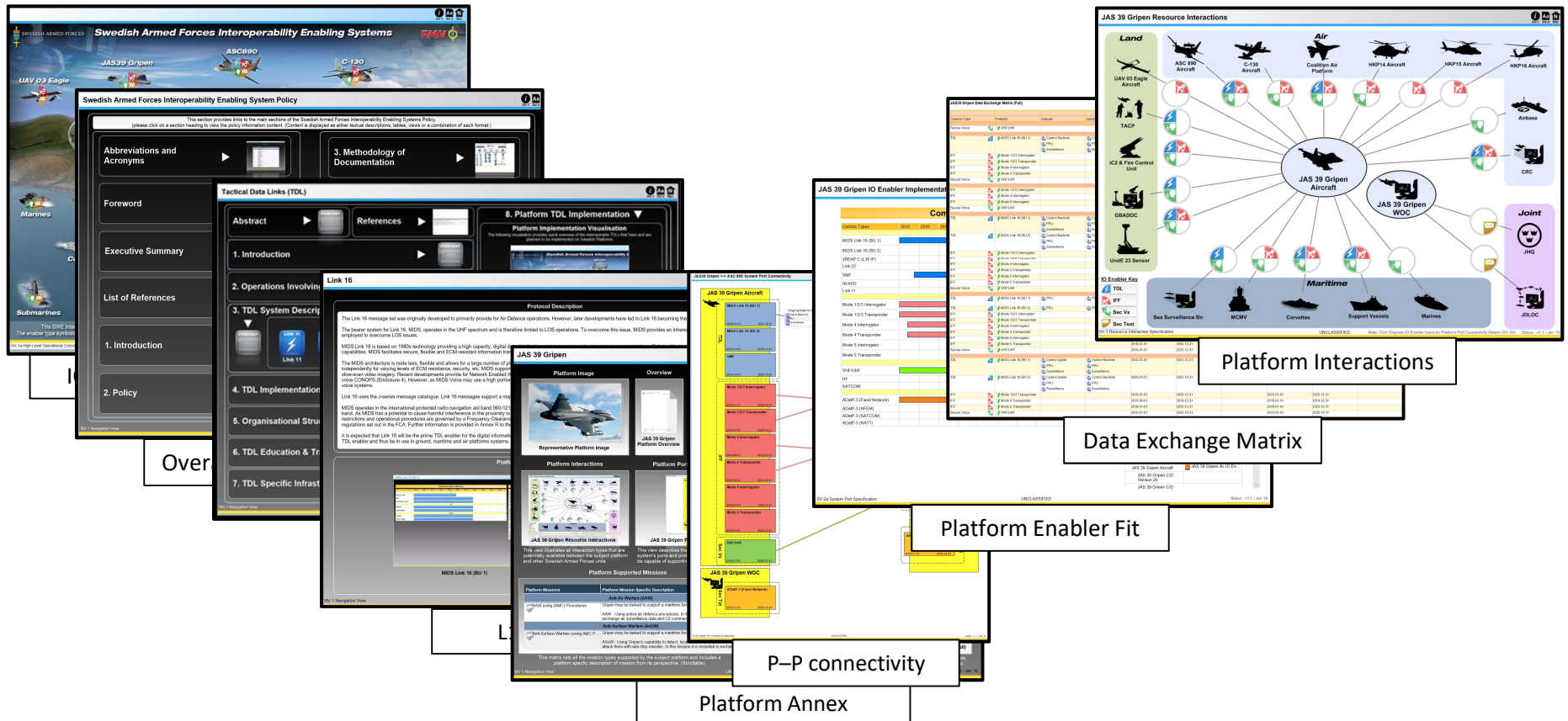
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Conclusion 'IO CONOPS' Architecture

- Web Published Model

  - relational database, searchable

  - coherence 'built in' - 'single source of truth'

- Can be used within FMV System Management as a coherent requirements database from the Swedish Armed Forces regarding interoperability.

- Updating the model and extract the documentation

  - Everyone updating the same thing - One 'source of truth'

  - Shorter review cycle

    "Taming Complexity"

The perspectives of interoperability
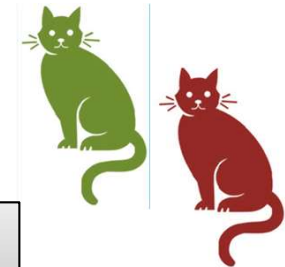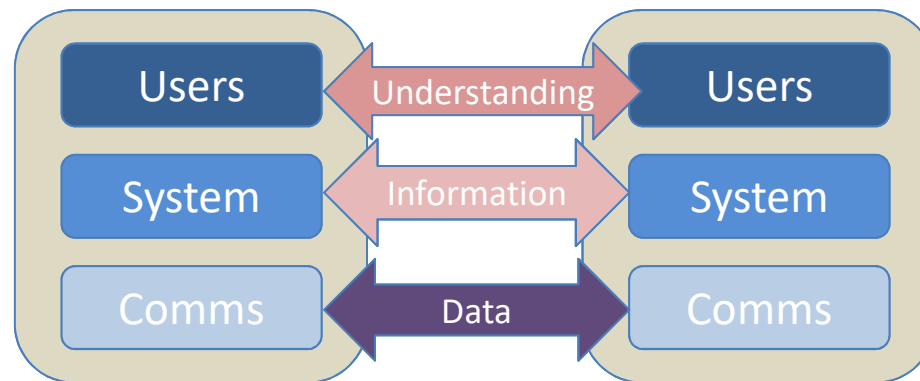
"The ability to act together coherently, effectively and efficiently to achieve allied tactical, operational and strategic objectives."

TDL Employment

- The employment of multiple TDLs within an operational scenario provides a complex range of overlapping and mutually dependent communication paths to ensure data exchange requirements are met.

- The full operational impact of any changes to the availability of a particular TDL capability are often hard to determine due to this complexity.

- This needs to be investigated
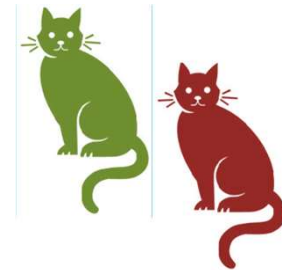
Questions to Address

In particular, we have the following questions:

- What are the IERs in some plausible scenarios?
- How well does the current IO enabler deployment meet the operational scenario IERs?
- How do Platform/System outages impact the ability to exchange information?
- What possible solutions are available to overcome given Platform/System outages?

Multi Tactical Data Link Architecture (MTDLA)

Purpose:

- To support the development of Air-Maritime Cooperative Multi-TDL deployment to meet the operational mission
- To feed back to the SweAF 'IO CONOPS' doc set

FMV developed a model to complement the first model

- more operational descriptions and capture of the information exchange requirements in an multi TDL environment
- Combined scenario of ASW, ASuW and AD.
- The approach has been both Top-Down and Bottom-Up.

Operational Context

Scenario Description
- Define Mission Threads, Vignettes and Events
- Detailed, focussed
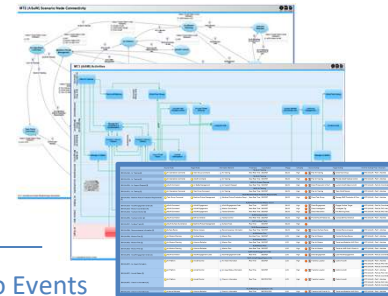
Logical Mission Models
- Define IERs
- Include criticality, security classification and timeliness attributes
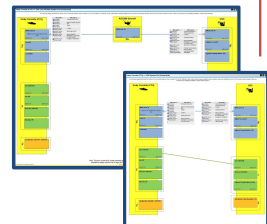- Solution Independent
- Broader perspective
- Reusable

IERs map to Events

DERs map to Events and IERs

Physical / System
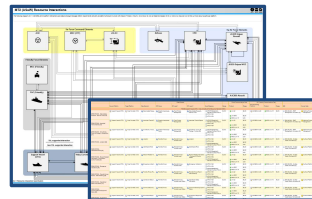
Top-Down: DER Development
- Platform to Platform DERs
- Mapped to logical IERs
- Include Range attribute

Port connectors map to DERs

Bottom-Up: Platform TDL Fits
- Ports and Protocols
- Forwarding / Retransmitting platforms

Model Analysis

Analysis queries entire model

Each DER now has:
- Operational justification
  - with criticality, security classification and timeliness attributes from logical IER
  - Mapping to MT Events
- Range attribute (dependent on solution chosen)
- Possible TDL realisations based on Platform Fits
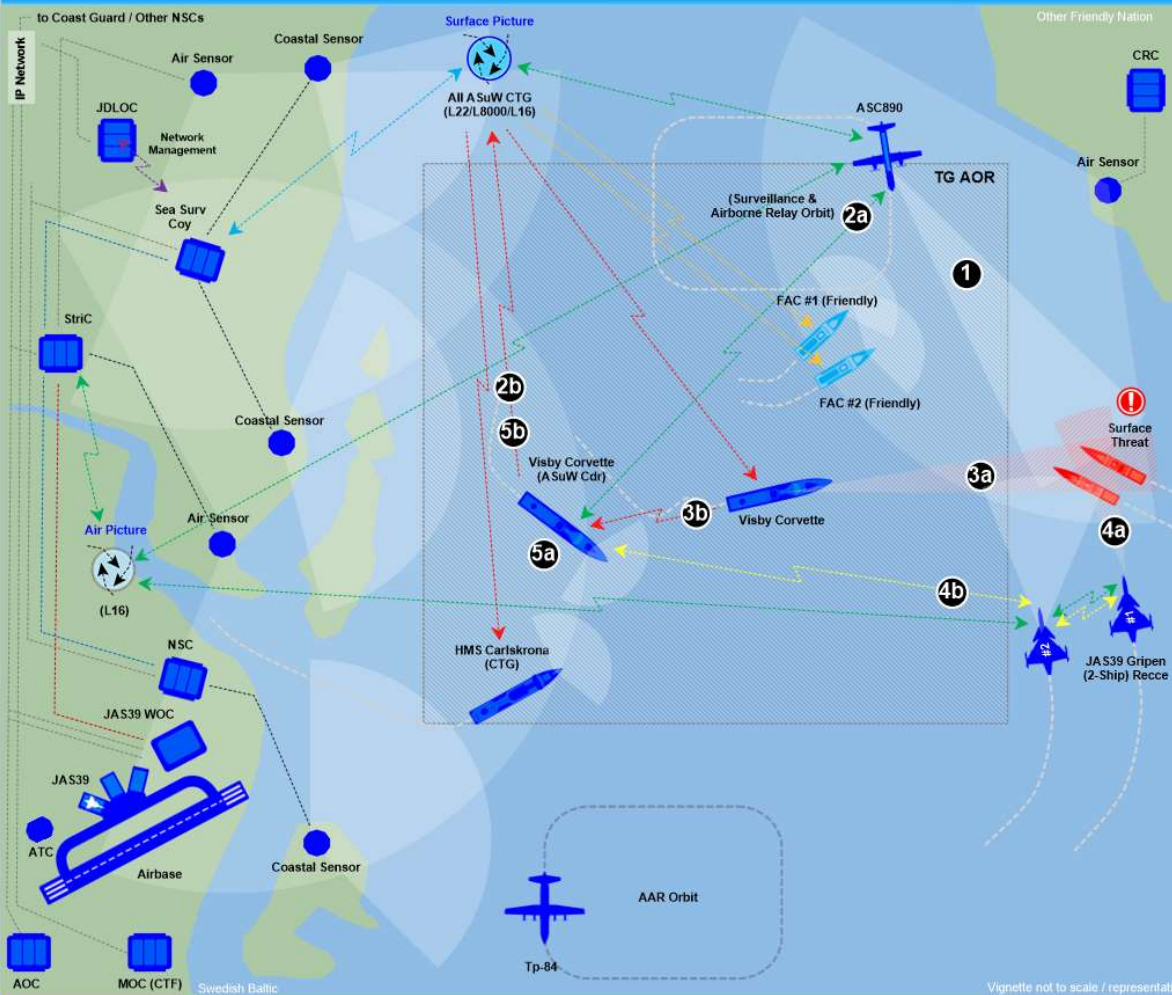 - Including retransmitting platforms
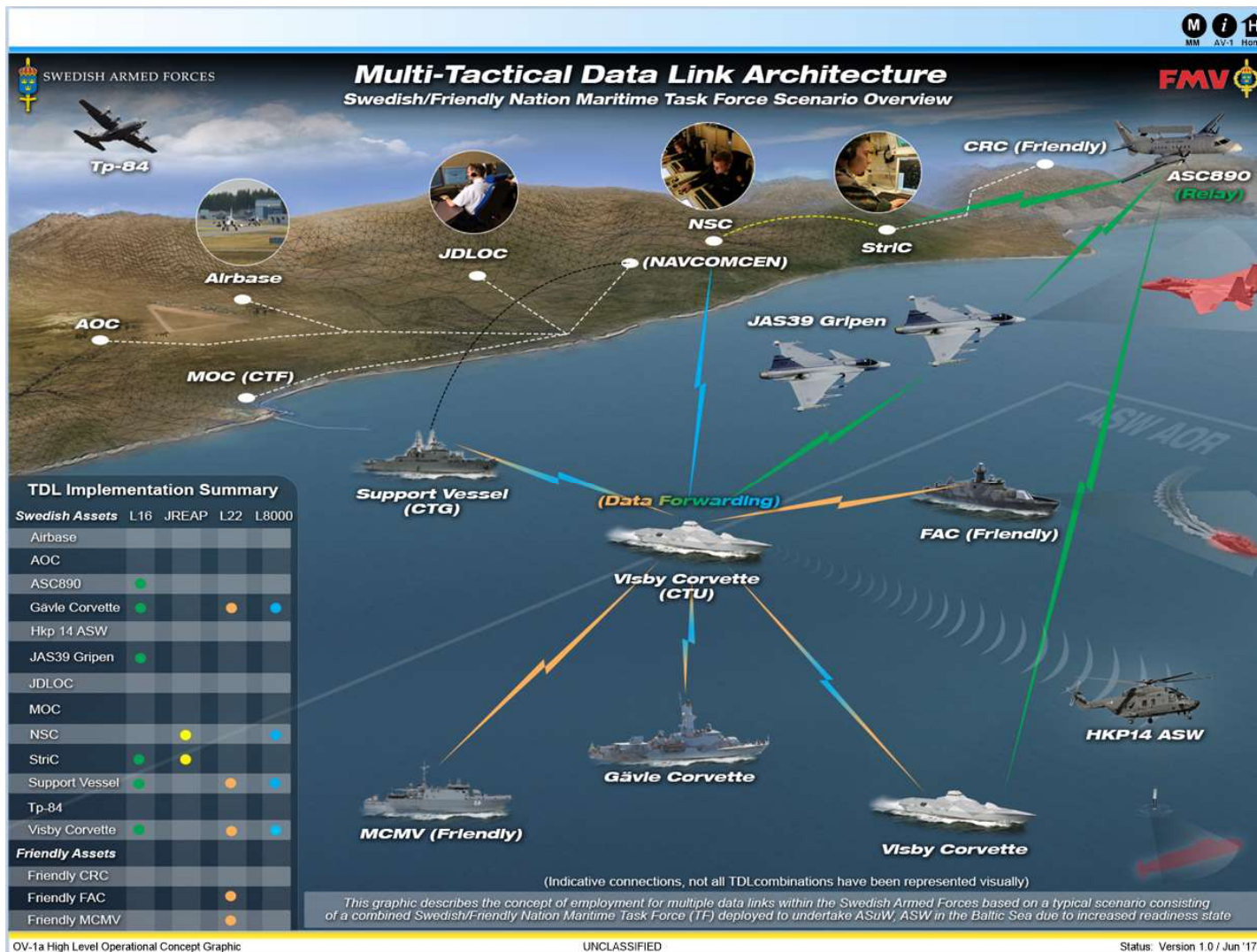
Combined Swedish/friendly nation maritime Task Force
Deployed to undertake surface and sub-surface maritime surveillance in the Baltic Sea.

- ASW TG
- ASuW TG
- AD TG

ASuW Mission Thread 2, Vignette 3 'Surface tracks detected'

to Coast Guard / Other NSCs

Other Friendly Nation

IP Network

Surface Picture

Air Sensor

Coastal Sensor

CRC

JDLOC

Network Management

All ASuW CTG
(L22/L8000/L16)

ASC890

Air Sensor

Sea Surv Coy

(Surveillance & Airborne Relay Orbit)

TG AOR

2a

1

StriC

FAC #1 (Friendly)

Coastal Sensor

2b

5b

FAC #2 (Friendly)

Surface Threat

3a

Visby Corvette
(ASuW Cdr)

3b

Visby Corvette

Air Picture

Air Sensor

5a

4a

(L16)

4b

NSC

HMS Carlskrona
(CTG)

JAS39 Gripen
(2-Ship) Recce

#2

#1

JAS39 WOC

JAS39

ATC

AAR Orbit

Airbase

Coastal Sensor

Tp-84

AOC

MOC (CTF)

Swedish Baltic

Vignette not to scale / representative

OV-1a High Level Operational Concept Graphic — UNCLASSIFIED — Status: Version 1.0 / Jun '17

Vignette TDL Connectivity
Link 16
Link 22
Link 8000

Vignette Pre-Conditions
A: ASuW TG performing surface surveillance in AOR
B: JAS 39 Gripen 2-ship AAR prior to recce mission
C: ASC890 on-station conducting surface surveillance
D: StriC disseminate air picture

Vignette Events
1: ASC890 detects unknown surface tracks

2a: ASC890 reports surface tracks to ASuW Cdr via L16 and 2b: ASuW Cdr forwards updated surface picture for all units

3a: Visby Corvette detects ESM LOB and 3b reports to ASuW Cdr

4a: JAS39 Gripen #1 detects ESM LOB and 4b: reports via Voice to ASuW Cdr

5a: Visby Corvette (ASuW Cdr) associates unknown tracks with ESM LOBs and 5b: updates surface picture for all units
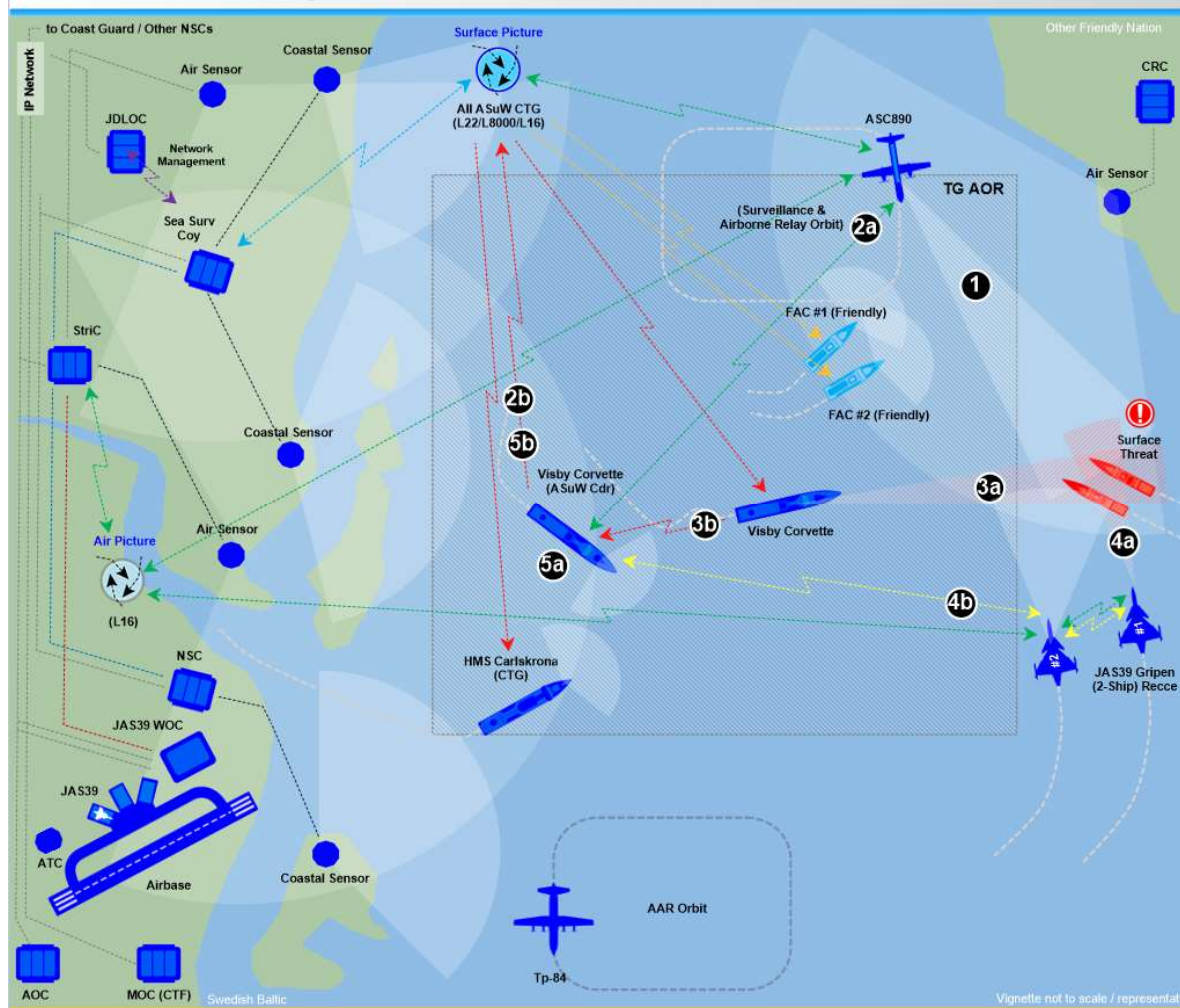
Vignette Key
- Link 22 / L8000
- Link 8000
- Link 16
- Link 22
- Sec Vx (V/UHF)
- Insec Vx (V/UHF)
- Sec Vx (HF)
- Sw Leg Nat Txt (ACP127 Format) (HF)
- Agreed Comms Link
- Fibre (IP)
- L16 (JREAP)
- Sec Vx (LL)
- Data (LL)

Vignette Navigation
Previous ◀ ▶ Next

ASuW Mission Thread 2, Vignette 3 'Surface tracks detected'

A: ASuW TG are performing surface surveillance in AOR
B: Gripen 2-ship AAR prior to recce mission.
C: ASC890 conducting surface surveillence
D: StriC disseminate air picture.

Vignett events:
1: ASC890 detects unknown surf. tracks.
2a: ASC890 reports surface tracks to a ASuW Cmd via L16
2b: ASuW Cmd forwards updated surface picture for all units.
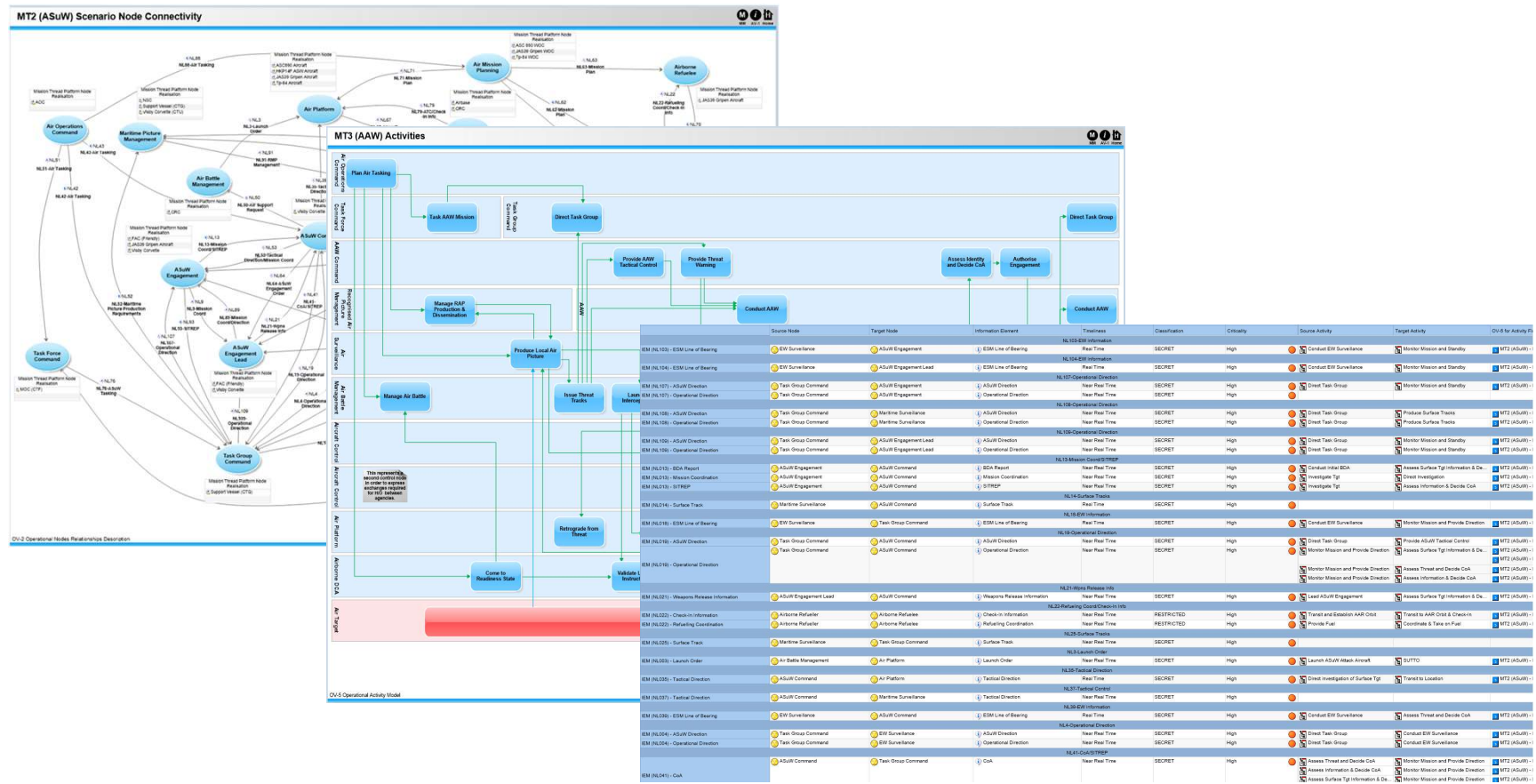3a: Visby Corvette detects ESM LOB and
3b: reports to a AsuW Cmd.
4a: Gripen #1 detects the ESM LOB and
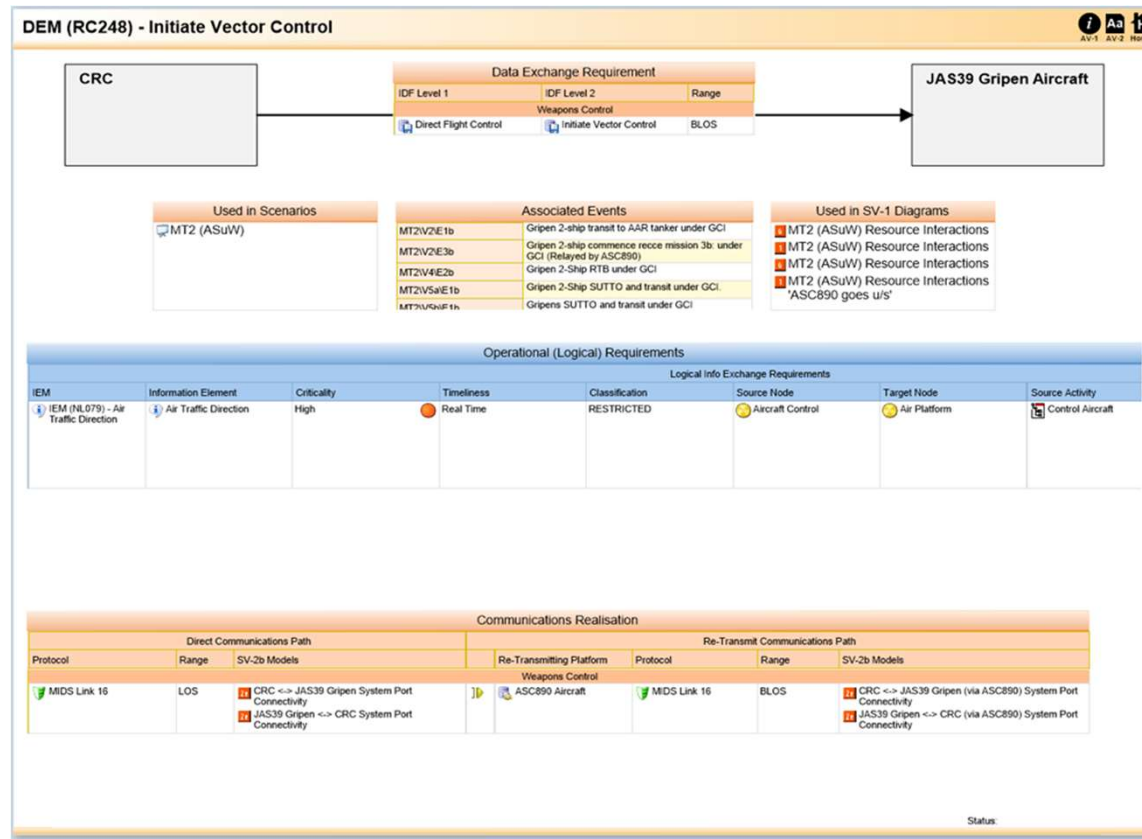4b: reports via Voice to a ASuW Cmd
5a: Visby corvette Cmd associates unknown tracks with the ESM LOBs and
5b: updates surface picture for all units.

OV-1a High Level Operational Concept Graphic   UNCLASSIFIED   Status: Version 1.0 / Jun '17
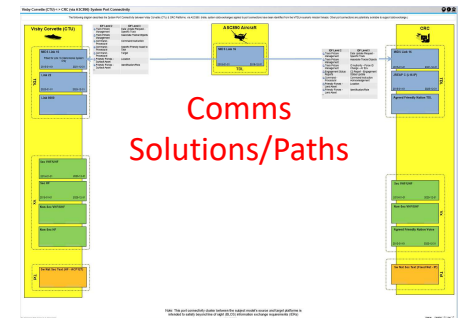
Logical Requirements

Top-Down: Developing DERs

Bottom-Up: Platform TDL fits

- The 'bottom-up' modelling involved describing the communications systems actually fitted to each platform

- A set of Port Connectivity Models (SV-2b) were developed, each showing the methods available for a pair of platforms to communicate

  - Based on the 'IO CONOPS' model

- Where applicable, re-transmitting platforms were also modelled, showing the 'hops' that are required to fulfil a DER
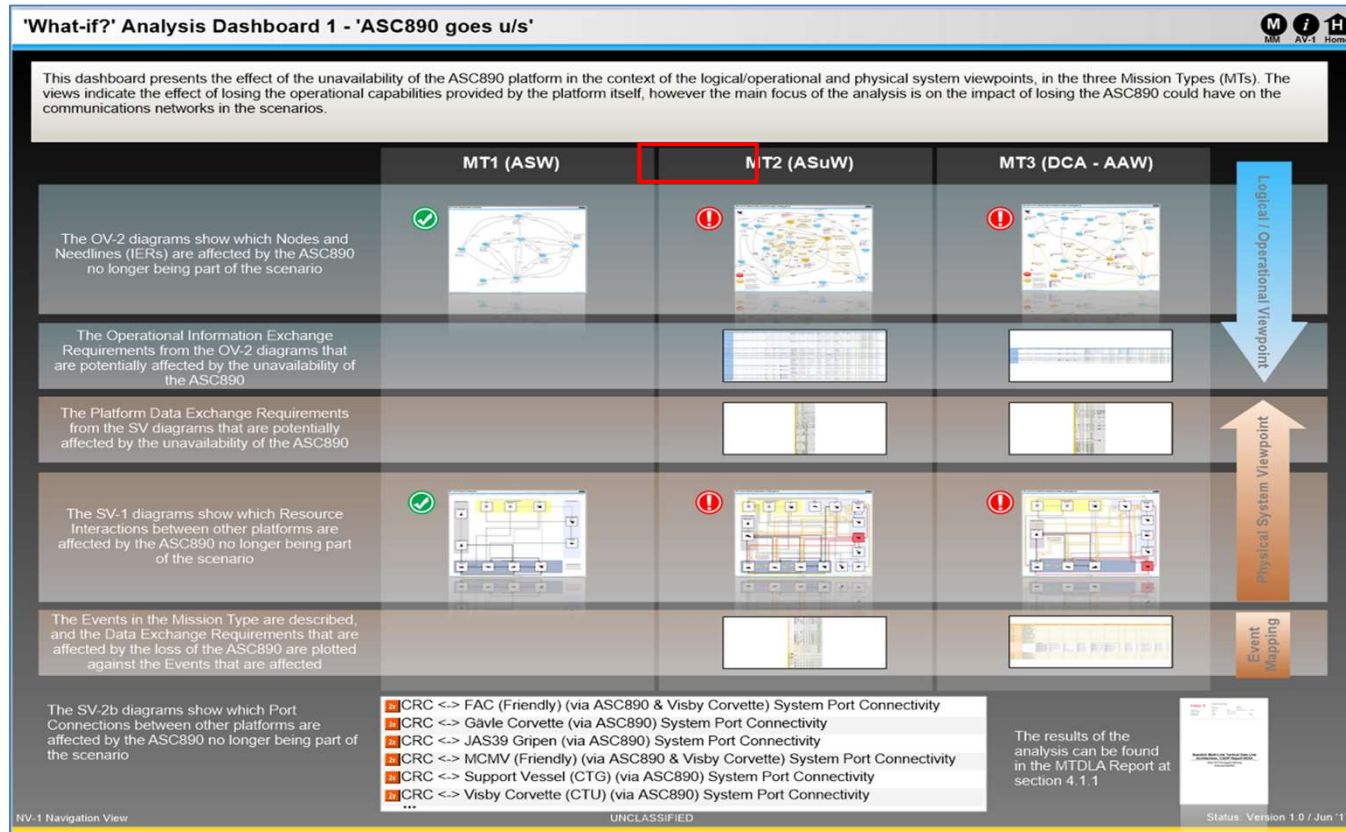
Analysis

- The model:

  - Describes the operational requirement for information exchange based on the scenario and MT

  - Extends this into the physical/system domain to provide a set of DERs between platforms

  - Considers how these requirements are met in terms of the possible physical data paths that exist given the stated TDL configurations

- It is therefore possible to identify the relationship from the solution level back up through DERs to Logical IERs, all in context of the MT and scenario

Logical/Operational IERs

Physical DERs

Comms Solutions/Paths

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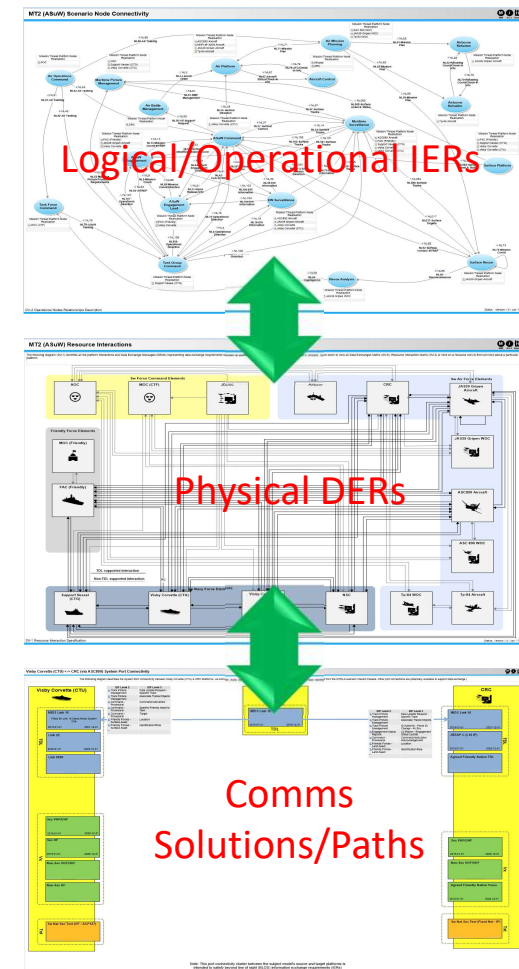
What If #1: Unavailability of ASC890 Link 16 Relay

Conclusion MTDLA

- The MTDLA support analysis of the operational impact of any changes to the availability of a particular TDL capability.

- The MTDLA describes the Multi TDL deployment for a given set of MTs within a Joint Air/Maritime Operation within the Baltic Region.
  - It can be used to conduct analysis of changes to a typical Multi TDL deployment and provides a methodology to conduct analysis on a variety of 'What-Ifs'.

- This approach can support a 'golden thread' from operational requirements right down to issues identified at the bit level of TDL communications.

Conclusions Model Based Approach to Operational Analysis (1/2)

- Can be used to validate documents on its content in order to ensure that it really holds together.

- Document updates will be more effective if updating the model and from that create already coherent documents.

- Gives an opportunity to theoretically test different solutions and see which will satisfy the operational needs in the best way.

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Conclusions Model Based Approach to Operational Analysis (2/2)

- Can be used to identify communication gaps, informing platform communication requirement specifications, and supporting 'What-if' analyses.

- Understanding the operational impact of system / platform issues provides the opportunity to develop operational 'work-around' or inform future procurement decisions.

- Can be used as a coherent requirements database from the Swedish Armed Forces regarding interoperability.

"The Golden Thread"

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Challenges and discussion

- How do we get the right people in the modelling workshops?

- How can we make better use of the models we have?

- What is the right level of detail?

- What should we not model?

- Share requirements not only solutions?

Questions & Comments?

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