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# Developing the Architecture for the Soldier of Tomorrow

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# Acknowledgements

I would like to thank the support that SEA has received from:

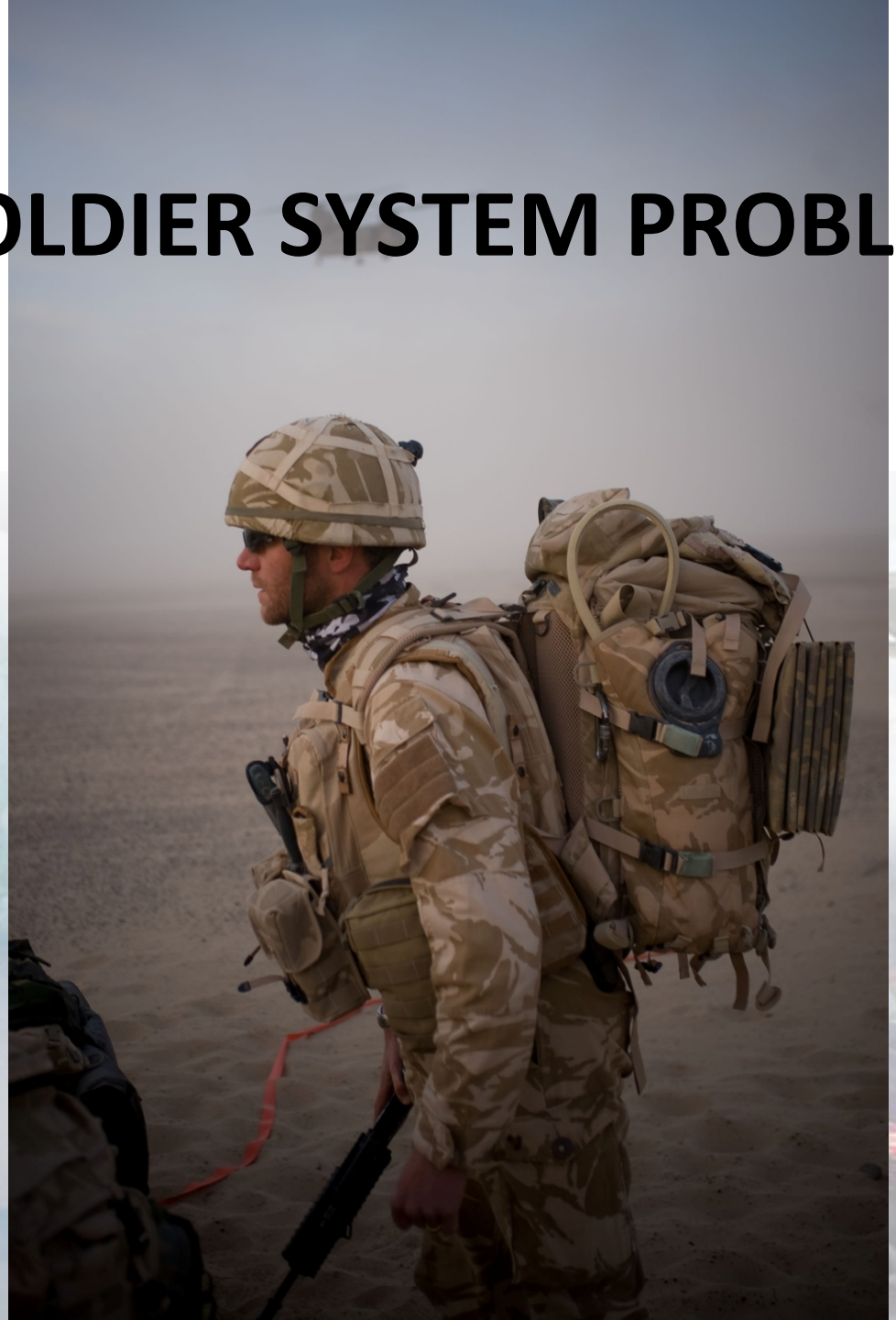
- Maj Gen Wilks (as previous Head of ICG)
- Maj Gen Riddell-Webster (as previous HoC GM)
- Brig Gaunt, Head of ICG
- Marcus Bruton, Team Lead, ISSE
- Lt Col Wills, Senior RM, ICG

# Introduction to SEA

- Systems Engineering & Assessment formed 1988
- Became part of Cohort plc 2007 (which includes SCS and MASS)
- Operates in 4 divisions
  - Sensor & Information Systems, Communication Systems, Aerospace, Sensor Processing Products
- Employs 240 people, based in Beckington and Bristol

- Company key skills:
  - Systems engineering, sensor systems, Human Factors Integration, hardware, software and firmware development, bespoke production, training systems, simulation, open systems, project management

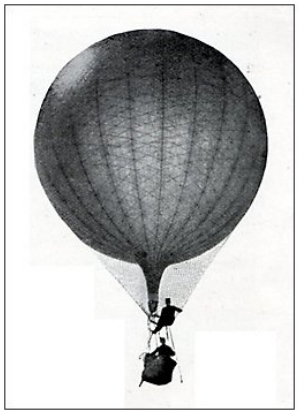
# SOLDIER SYSTEM PROBLEM



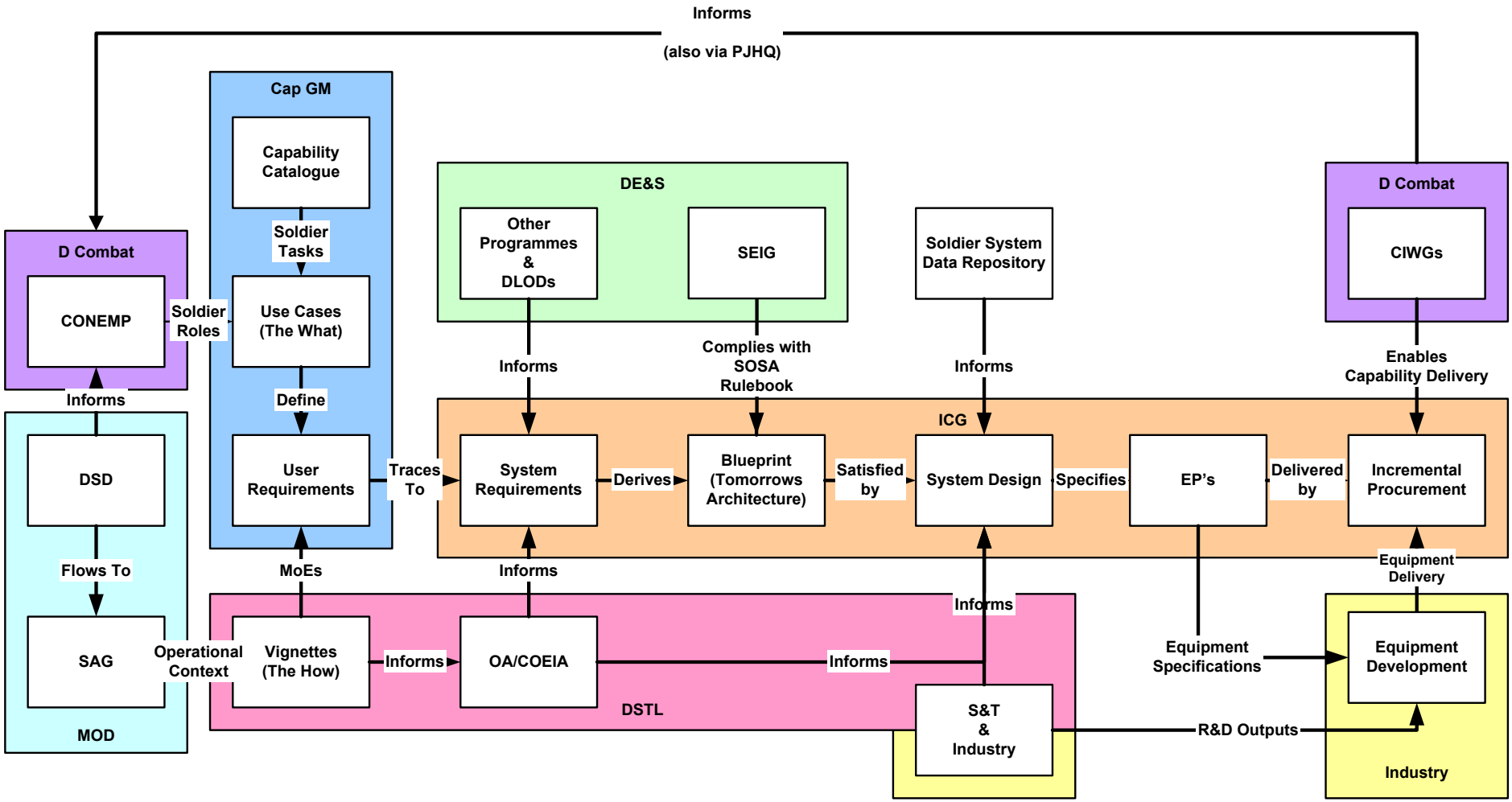
# Problem:

- Simply buying the best of everything does not result in the best system
- Need to understand the interaction between all soldier equipments
- Need to manage the soldier burden
  - Mass, power, cognitive
- Control the evolution of the soldier system
- Improve effectiveness through an coherent and integrated Soldier System

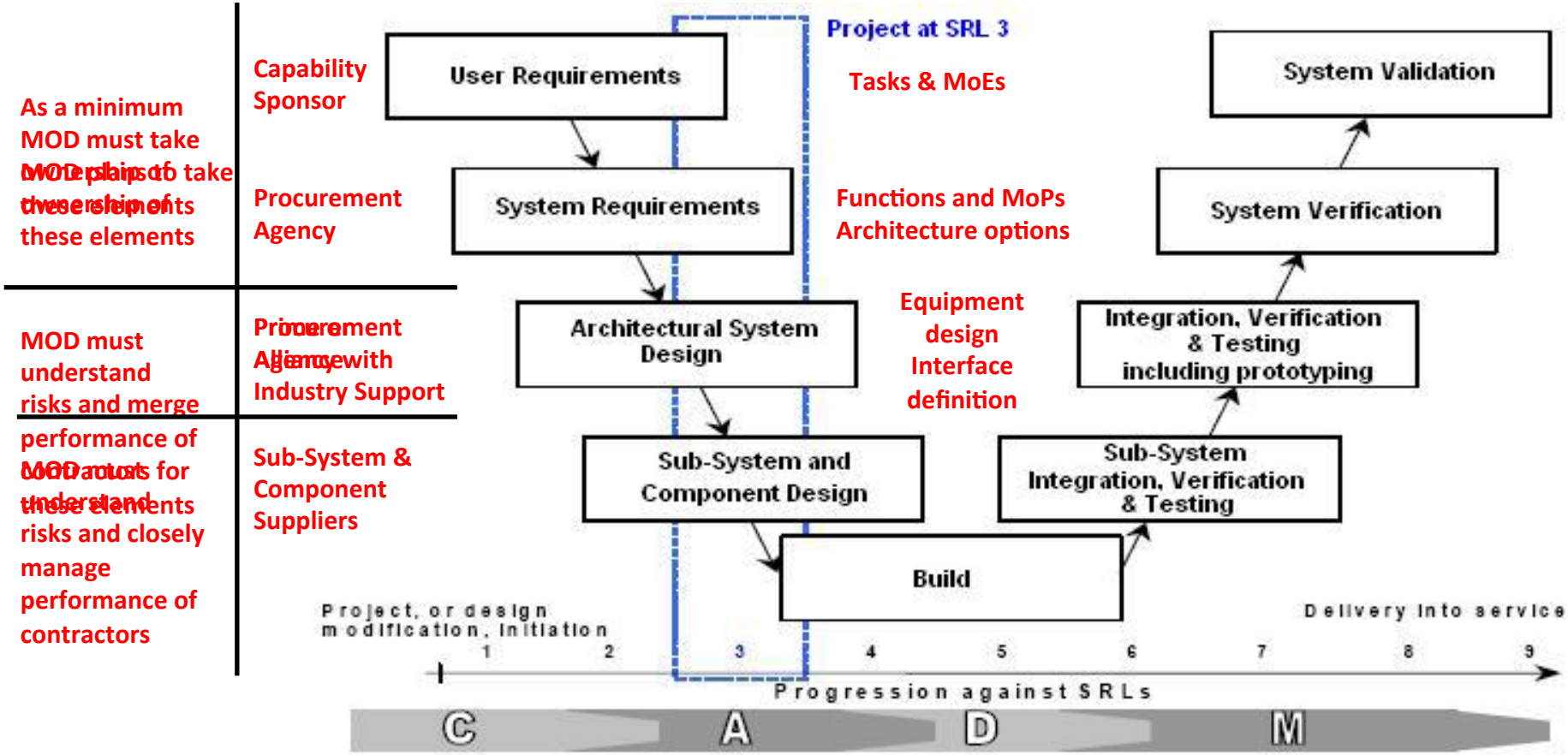
# Why is the soldier system different?



# Acquisition Model



# Systems Engineering V Diagram



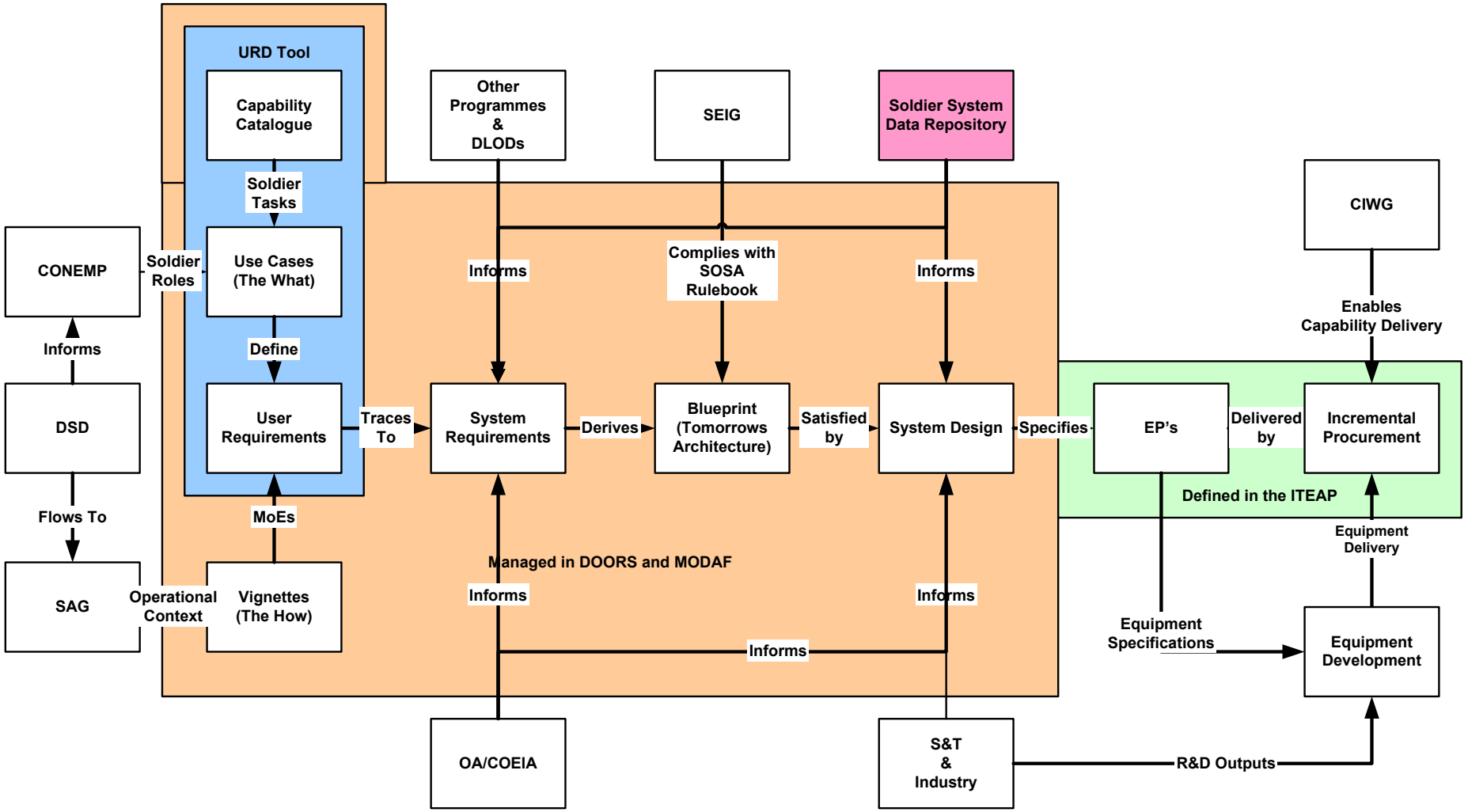
# SEA SUPPORT TO ISSE

# Solution:

**SEA has developed a strategy to solve this problem through the application of a Systems Engineering approach, supported by an equipment database, a system architecture, and sound processes, to:**

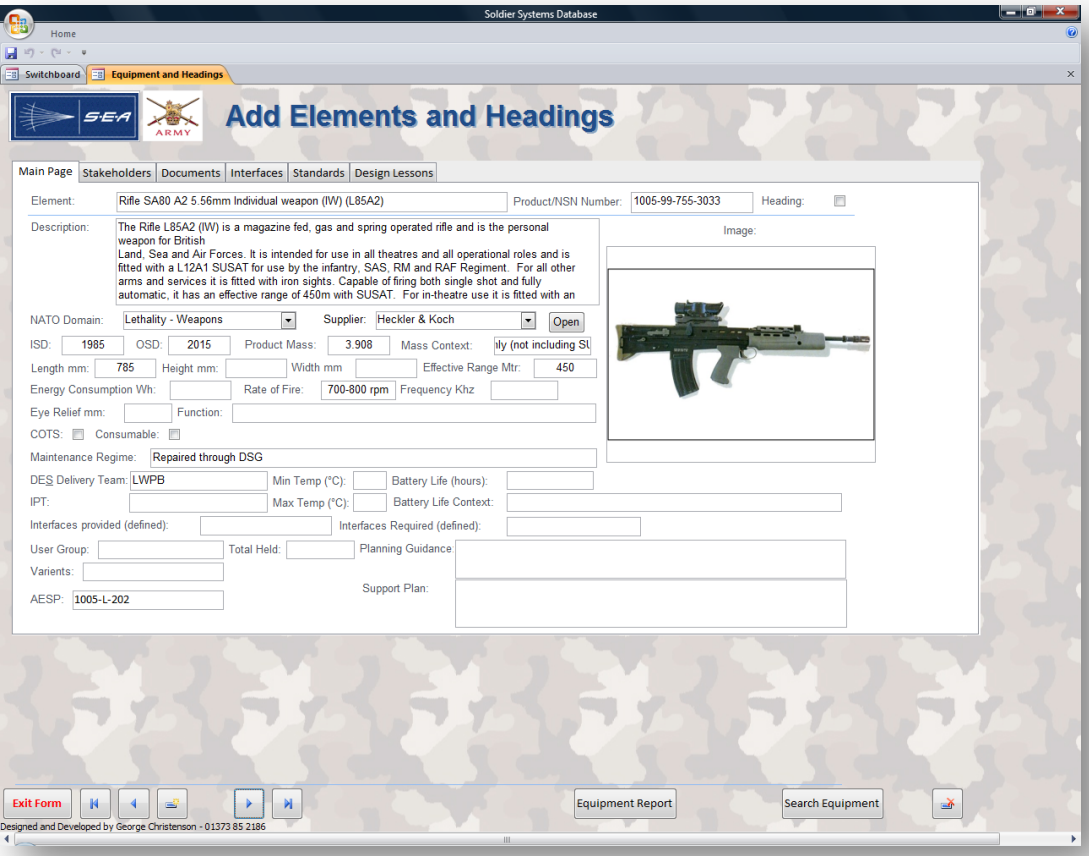
- Capture relationships
- Develop User Requirements
- Define interfaces
- Support System Design and Equipment Specifications

# Tool Mapping



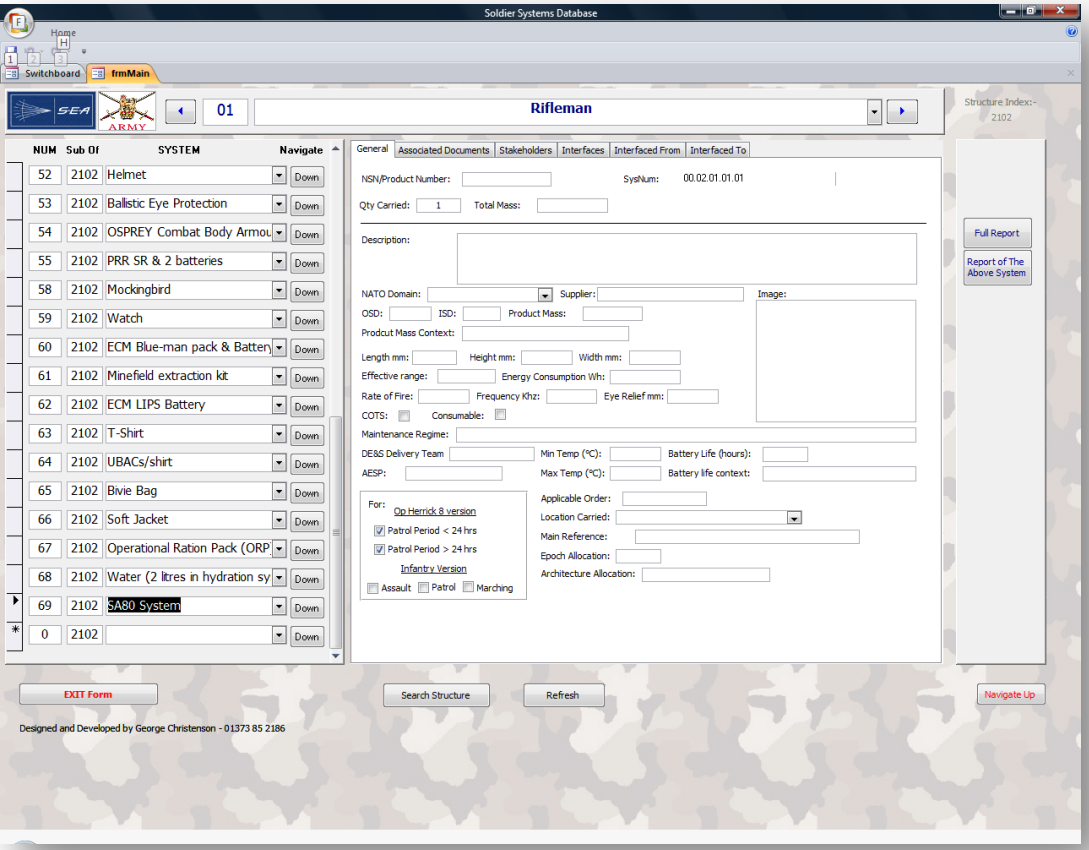
# EQUIPMENT DATABASE

# Equipment Database




- Provides a catalogue of all equipment available to the soldier
- Information available includes
  - Description
  - Mass
  - Power
  - Performance
  - NATO Stock Number
  - ISD and OSD
  - Supplier
  - NATO Domain
  - Responsible Authority
  - Interfaces
  - Lessons learned
  - Applicable standards

# Equipment Database




- Can define any soldier or squad configuration
- Has facilities to:
  - Report soldier mass and power burden
  - Categorise mass by domain, role, team
  - Categorise equipment by domain, supplier or country of origin
  - Produce a Product Breakdown Structure
  - Export to MS Project for equipment timelines
  - Hyperlinks to documentation and standards

# USER REQUIREMENTS

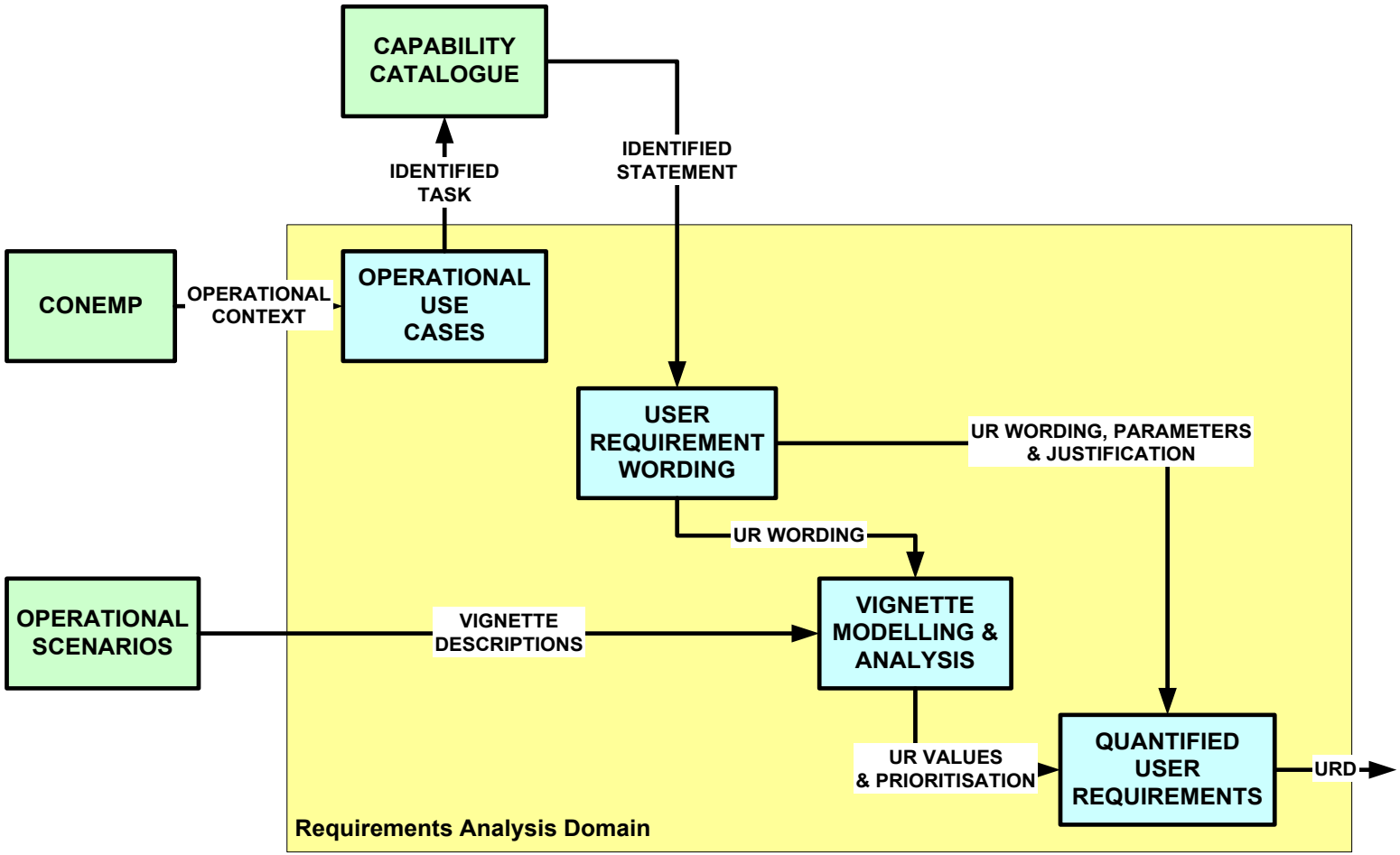
# User Requirements Document

- Defines the capability that users need in a defined environment.
- Focus on User needs, NOT equipment
- Support to Business Case and Scrutiny requirements

Systems Engineering Approach provides:

- A structured process to define and develop URDs
- A means to ensure URDs are developed within an overall understanding of the complete soldier system

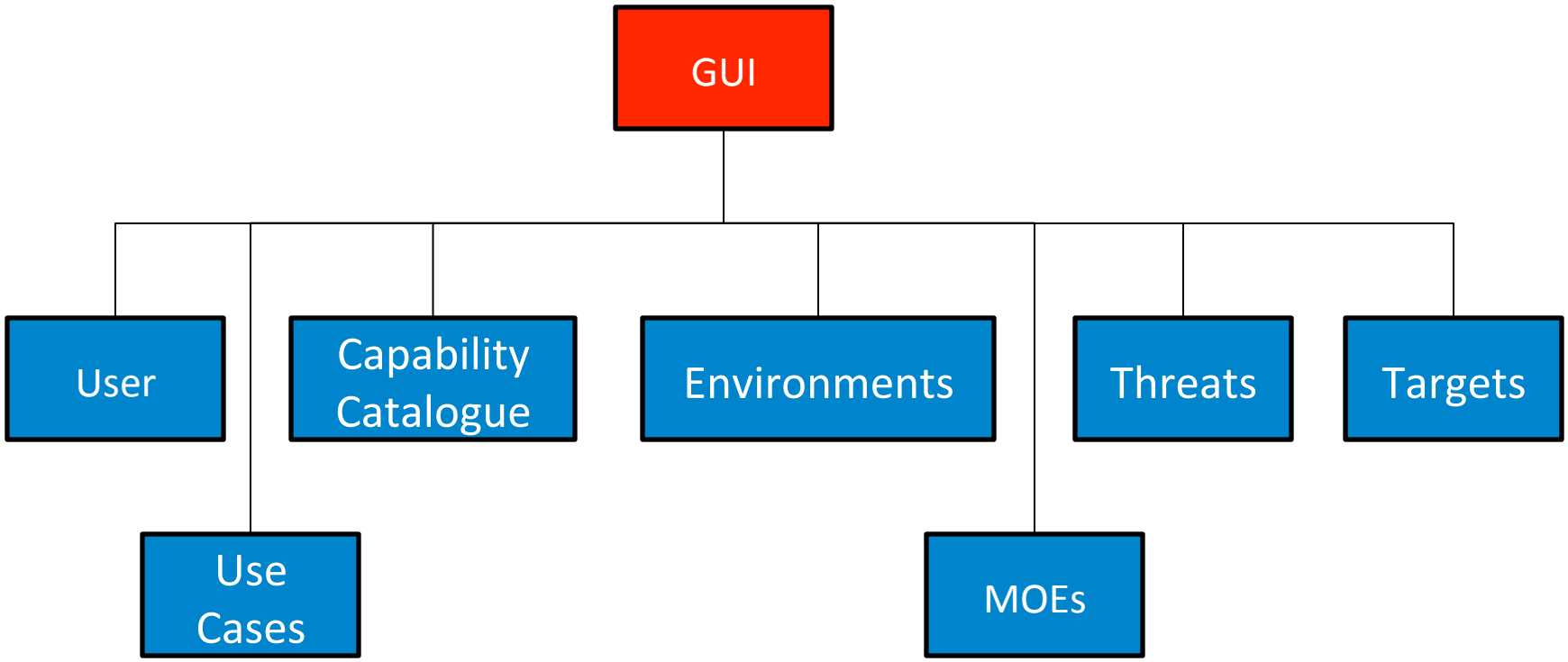
# User Requirement Derivation



# URD Software Tool

- Provides a ‘handrail’ to guide the Requirements Manager through the data
- Developed with input from Requirements Managers from Individual Capability Group
  - URDs currently in production by RMs
- Integrated into IBM DOORS requirements management toolset
- Ensures the “Golden Thread” from approved sources to the User Requirements

# DOORS Structure



# Definition of “User”

- **Through the requirements analysis, there are several Users that we need to consider**
  - The “Team”
  - The Commander
  - The Individual Soldier
  - The Maintainer
  - Plus other users of the “soldier system”
    - Logistics, Signals, Engineers

# Use Cases

- Use Cases are linked to each other in their activity sequence
  - Exploited in the MODAF model
  - This reflects the functional architecture of the Soldier
- Example Use Cases include:
  - Move Tactically
  - Defeat Enemy Personnel
  - Locate Enemy (In Contact)
- The Use Cases provide a basis for acceptance
  - Linked to the requirements in the formal URD

# MODAF & ARCHITECTURE

# Future Architecture Development

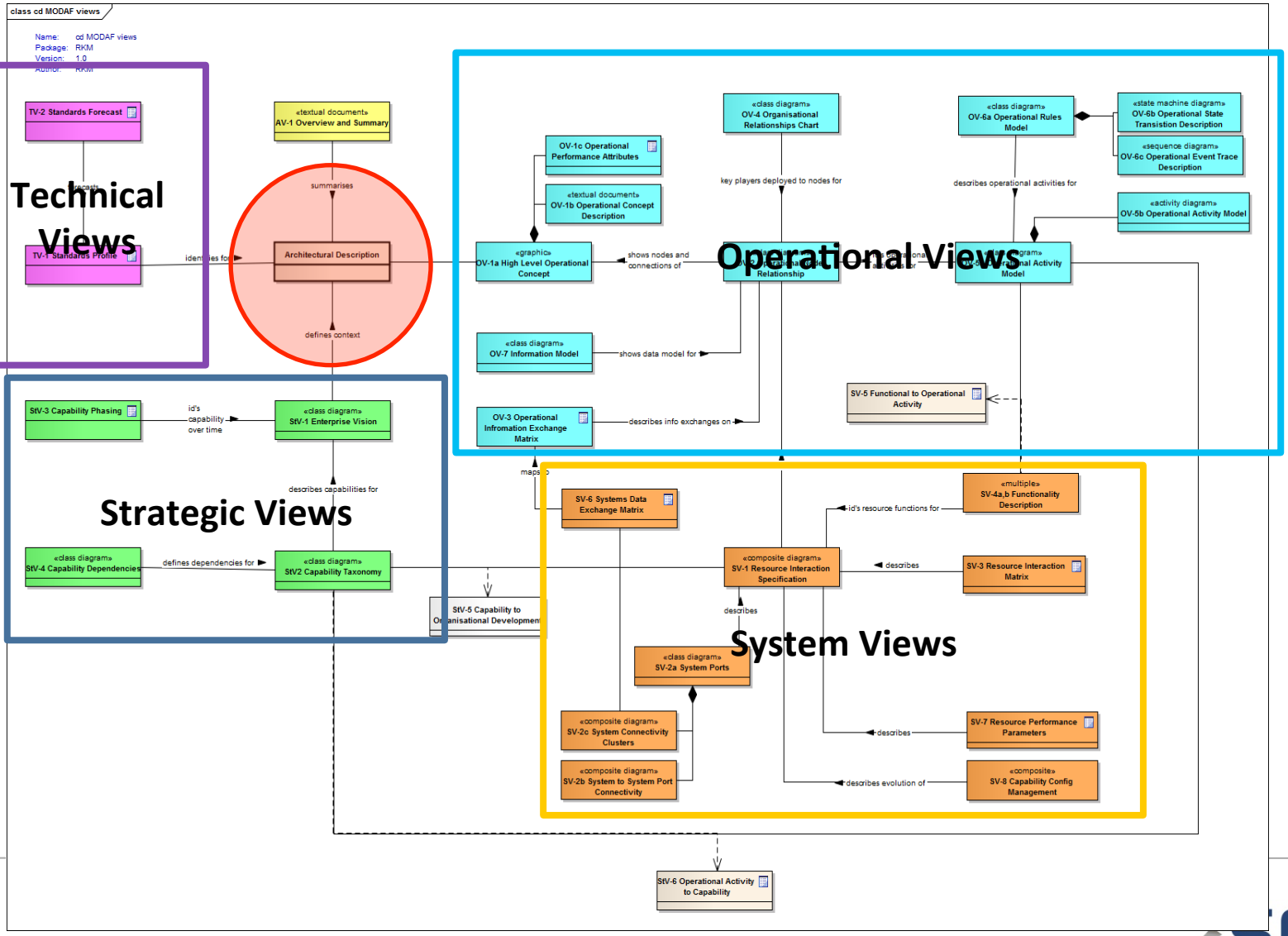
- Use of MODAF (specifically UPDM) to manage architecture design
  - Flow down from Strategic and Operational views
- Use of UML to define the architecture, including functions and interfaces

**This approach supports the specification of soldier equipment that will integrate into an overall system architecture**

UPDM : Unified Profile for DoDAF and MODAF

UML: Unified Modelling Language

# MODAF Views



# What is the “Soldier System”?

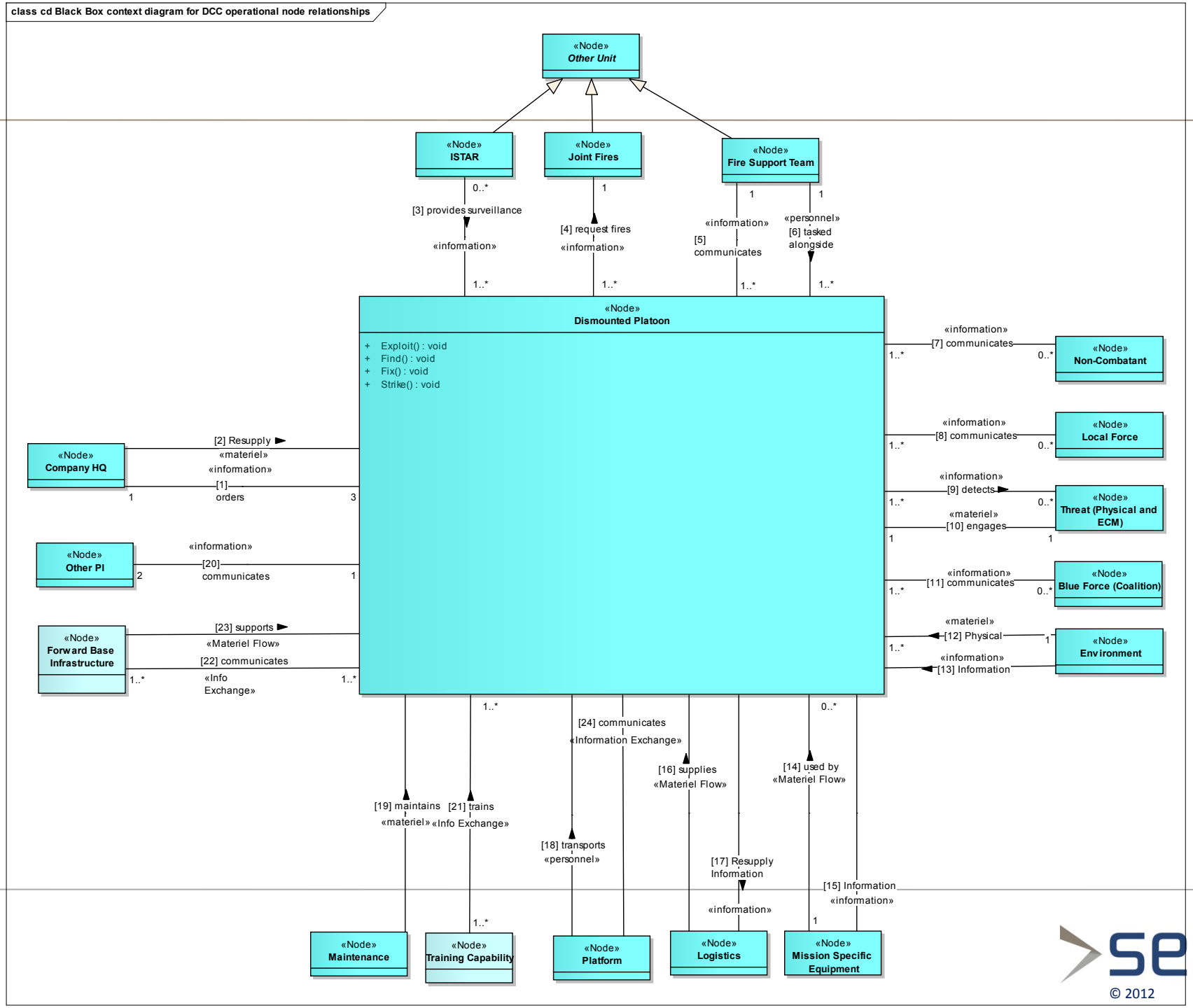
**What is the system of interest?**

- The individual soldier?
- The Fire Team?
- The Section?
- The Platoon?

- The answer to this defines the procurement approach.

# Wider System Aspects

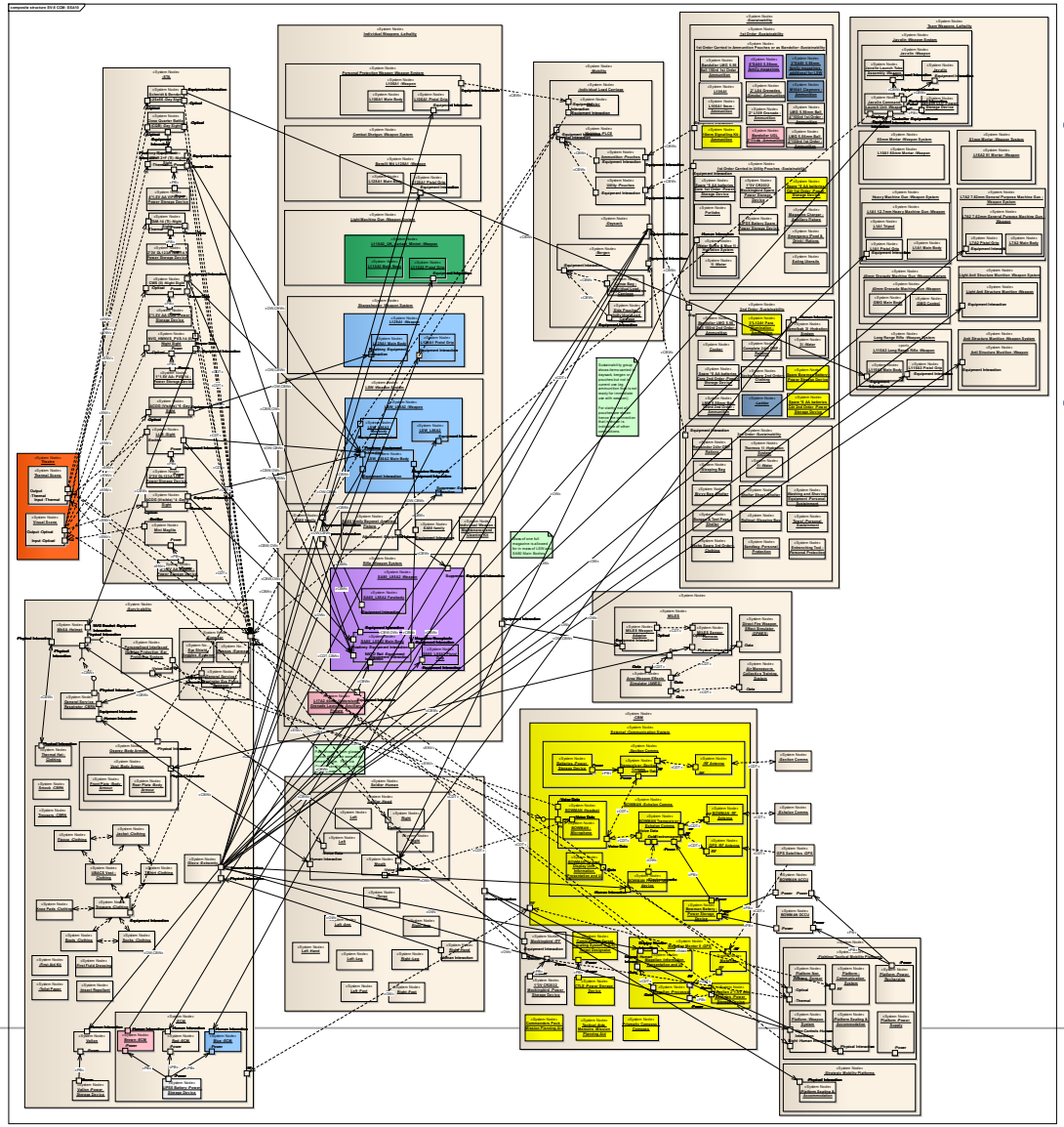
- Soldier system does not operate in isolation
- Need to apply SOSA rulebook
- Wider architecture
- “External” interfaces
  - CBM & communication systems
  - ISTAR systems
  - Platforms
  - Training systems


class cd Black Box context diagram for DCC operational node relationships
«Node»
Other Unit
«Node»
ISTAR
«Node»
Joint Fires
«Node»
Fire Support Team
0..*
[3] provides surveillance
«information»
1..*
1
[4] request fires
«information»
1..*
1
1
«information»
[5] communicates
1..*
1
«personnel»
[6] tasked alongside
1..*
«Node»
Dismounted Platoon
+ Exploit() : void
+ Find() : void
+ Fix() : void
+ Strike() : void
«information»
[7] communicates
1..*
0..*
«Node»
Non-Combatant
«information»
[8] communicates
1..*
0..*
«Node»
Local Force
«information»
[9] detects
1..*
0..*
«Node»
Threat (Physical and ECM)
«materiel»
[10] engages
1
1
«information»
[11] communicates
1..*
0..*
«Node»
Blue Force (Coalition)
«materiel»
[12] Physical
1
1..*
«Node»
Environment
«information»
[13] Information
«Node»
Company HQ
[2] Resupply
«materiel»
«information»
1
[1]
orders
3
«Node»
Other PI
«information»
2
[20]
communicates
1
«Node»
Forward Base Infrastructure
[23] supports
«Materiel Flow»
1..*
[22] communicates
«Info Exchange»
1..*
1..*
[24] communicates
«Information Exchange»
0..*
[19] maintains
«materiel»
[21] trains
«Info Exchange»
1..*
[18] transports
«personnel»
[16] supplies
«Materiel Flow»
[17] Resupply Information
«information»
[14] used by
«Materiel Flow»
[15] Information
«information»
1
«Node»
Maintenance
«Node»
Training Capability
«Node»
Platform
«Node»
Logistics
«Node»
Mission Specific Equipment

# Soldier Centric Approach

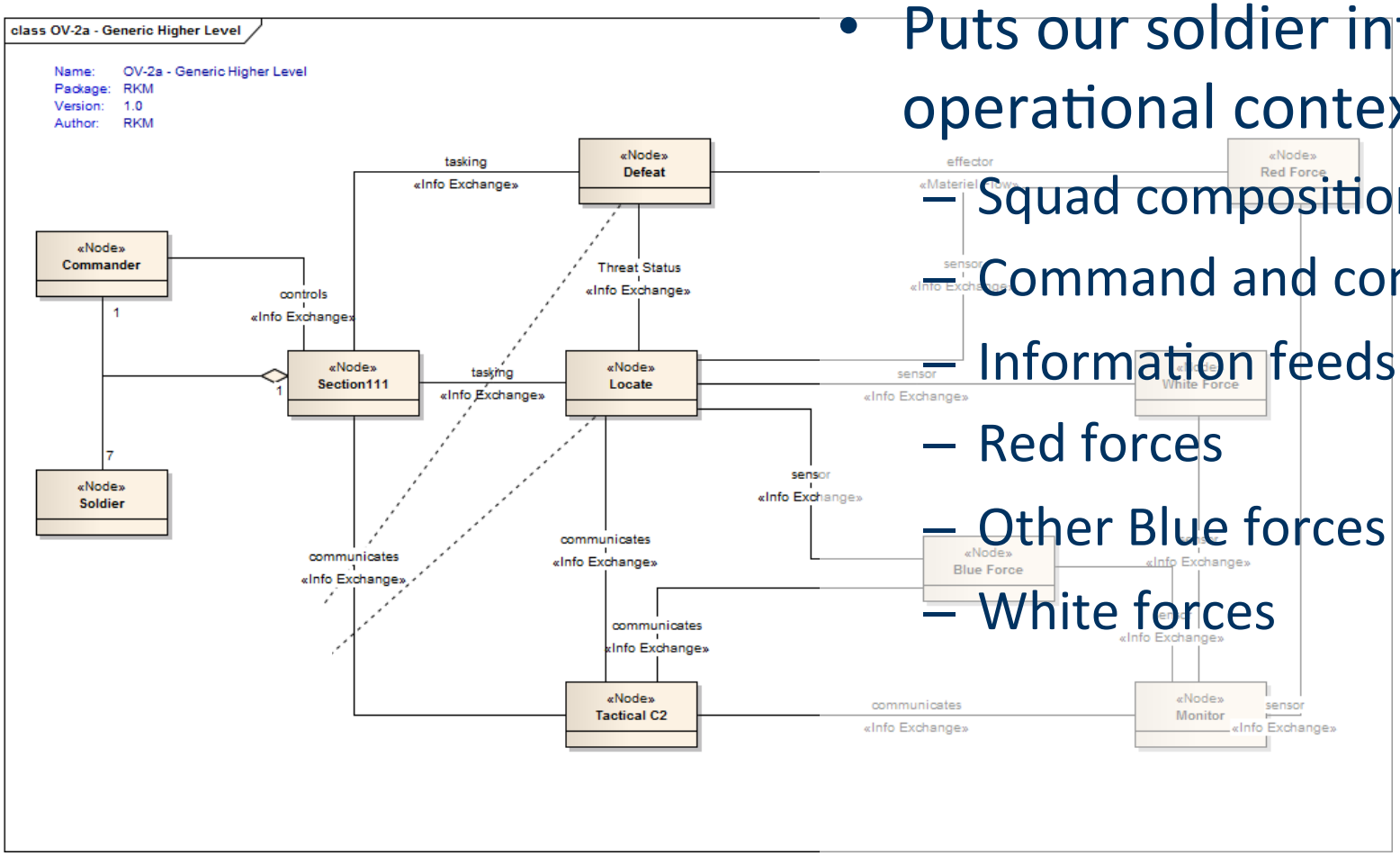
- **The Soldier is not simply a “User” of the system**
- **The Soldier is at the heart of the Soldier System**
  - He provides the integration platform
  - He provides the “motive power”
  - He provides the “data processing”
- **The definition of the architecture includes the functionality provided by the Soldier**

# Architecture 2010



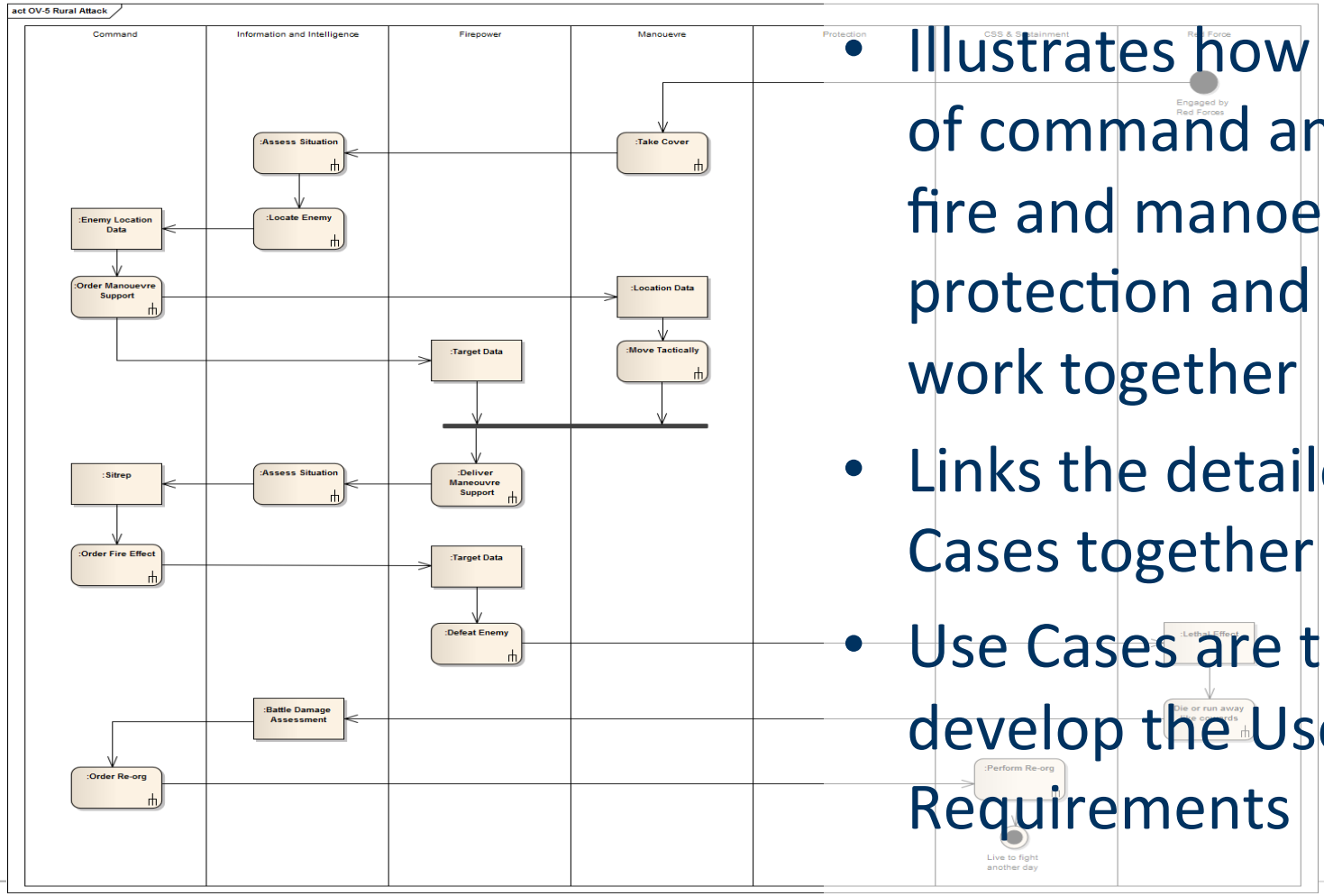
- Demonstrates the complexity of the soldier system
- Captures all variants and interactions in a single diagram

# Systems Architecture: OV-2 Logical Relationship



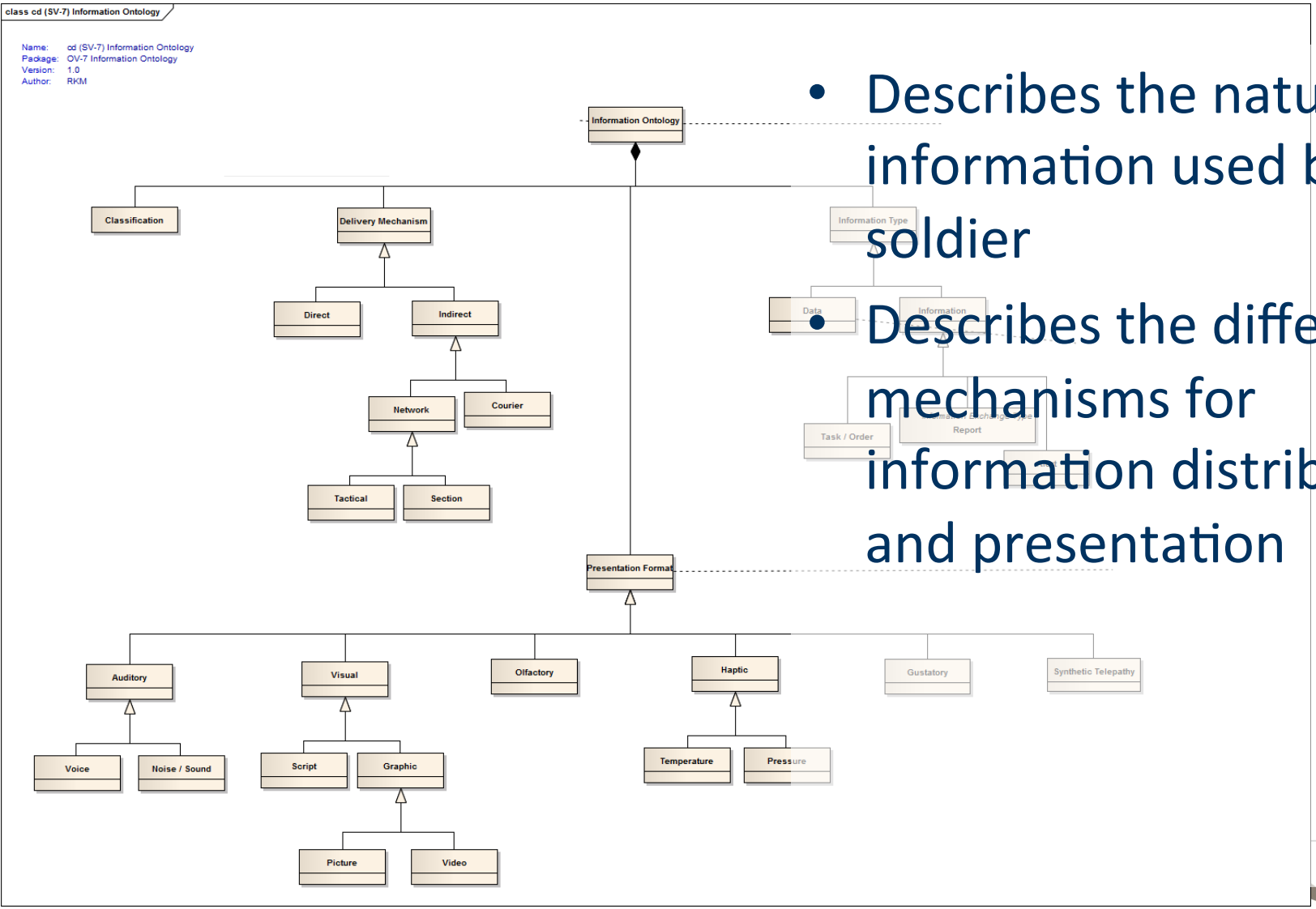

- Puts our soldier into operational context with:
  - Squad composition
  - Command and control
  - Information feeds
  - Red forces
  - Other Blue forces
  - White forces

# Systems Architecture: OV-5 Operational Activities



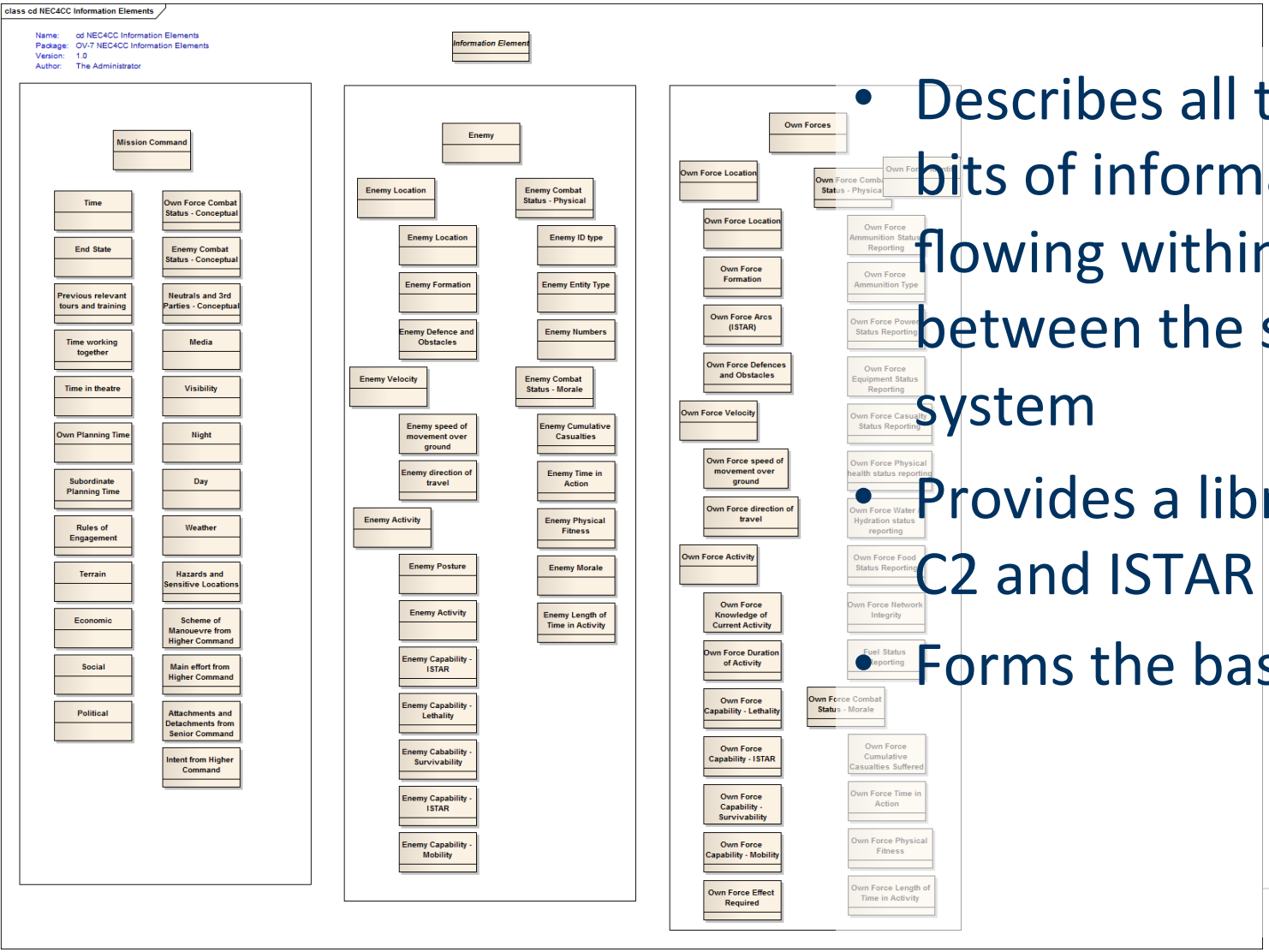

- Illustrates how the aspects of command and control, fire and manoeuvre, protection and information work together
- Links the detailed Use Cases together
- Use Cases are then used to develop the User Requirements

# OV-7 Information Ontology



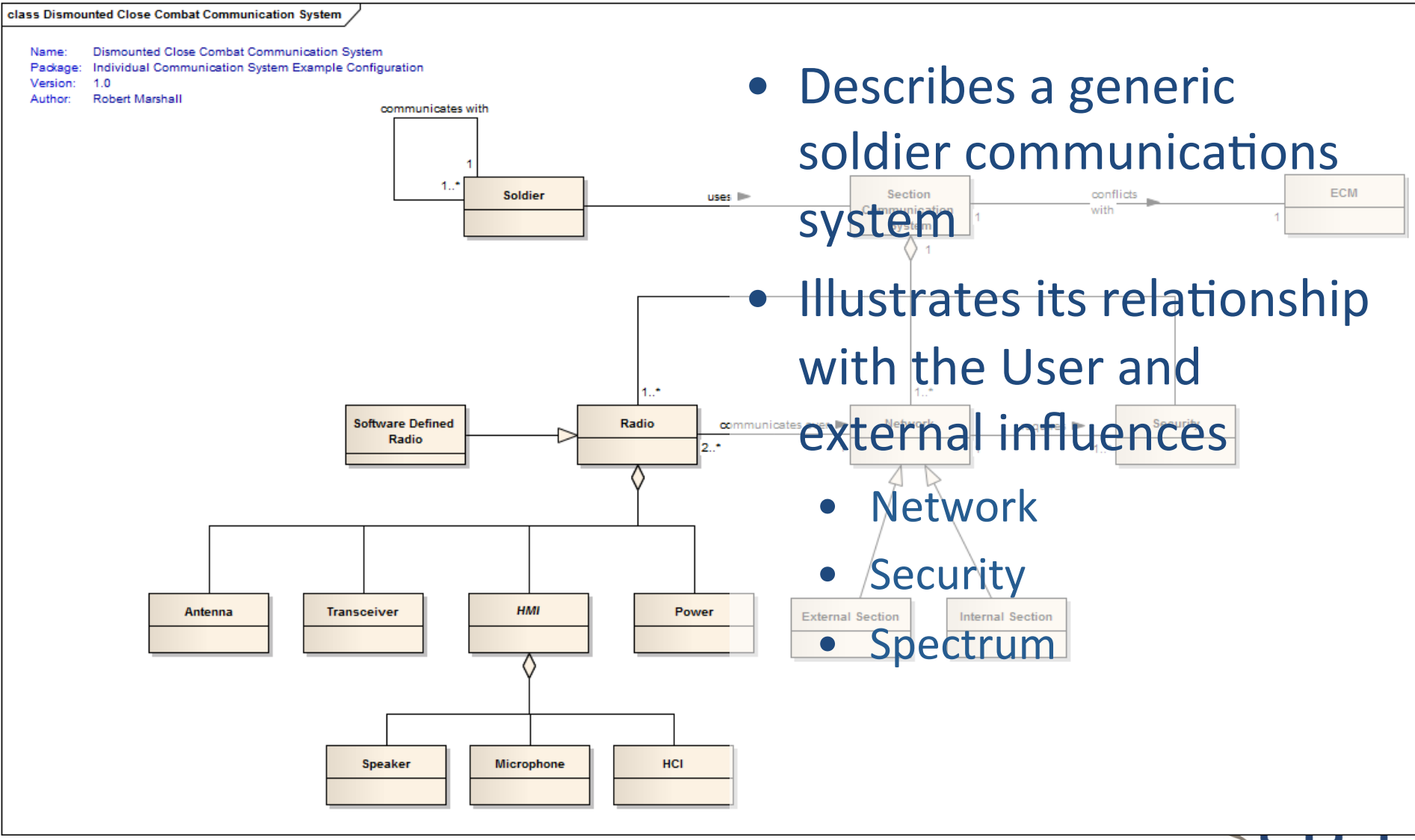

- Describes the nature of information used by the soldier
- Describes the different mechanisms for information distribution and presentation

# OV-7 Information Elements



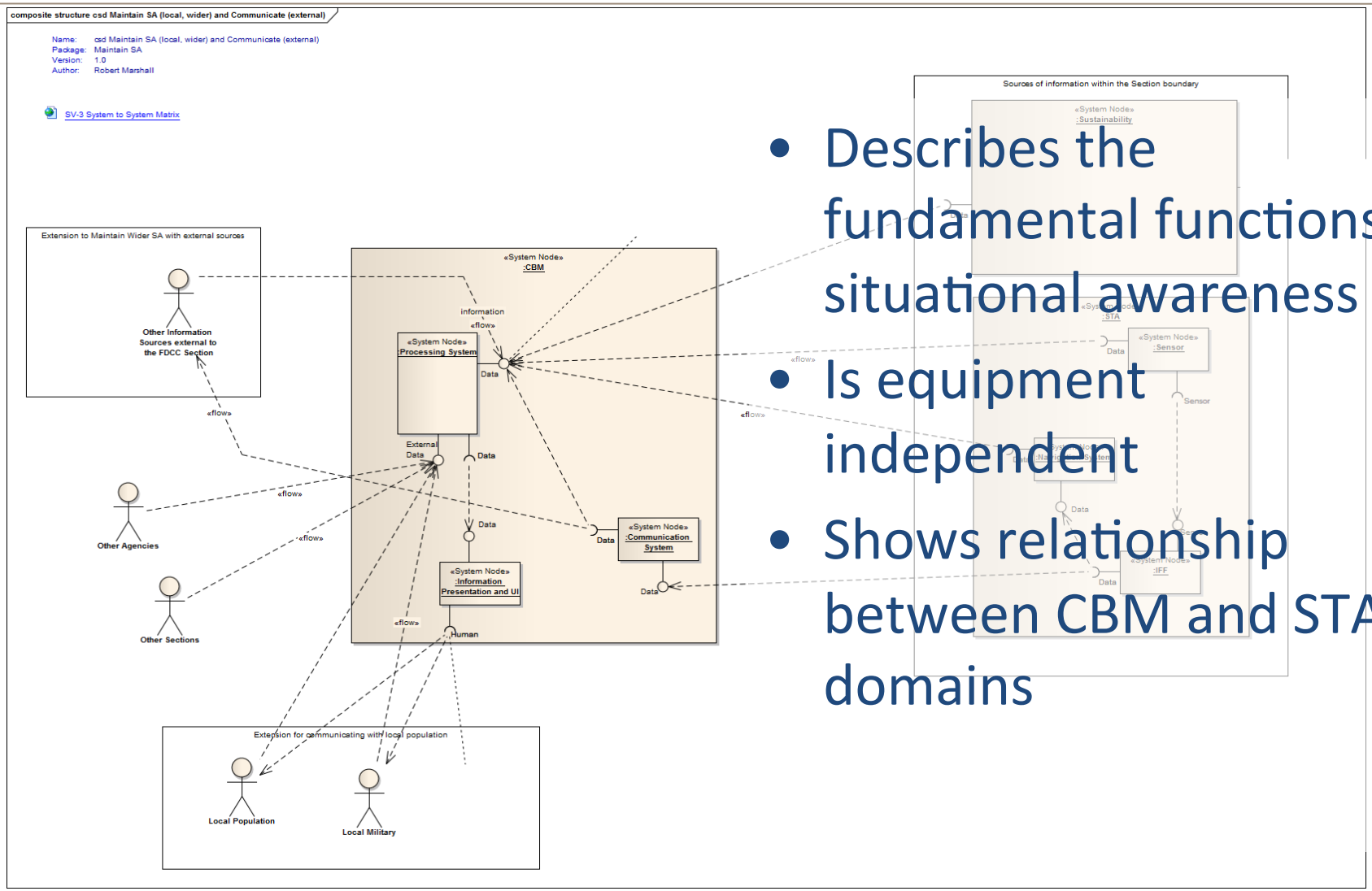

- Describes all the different bits of information flowing within and between the soldier system
- Provides a library for all C2 and ISTAR functions
- Forms the basis of IERs

# DCC Communications System Structure



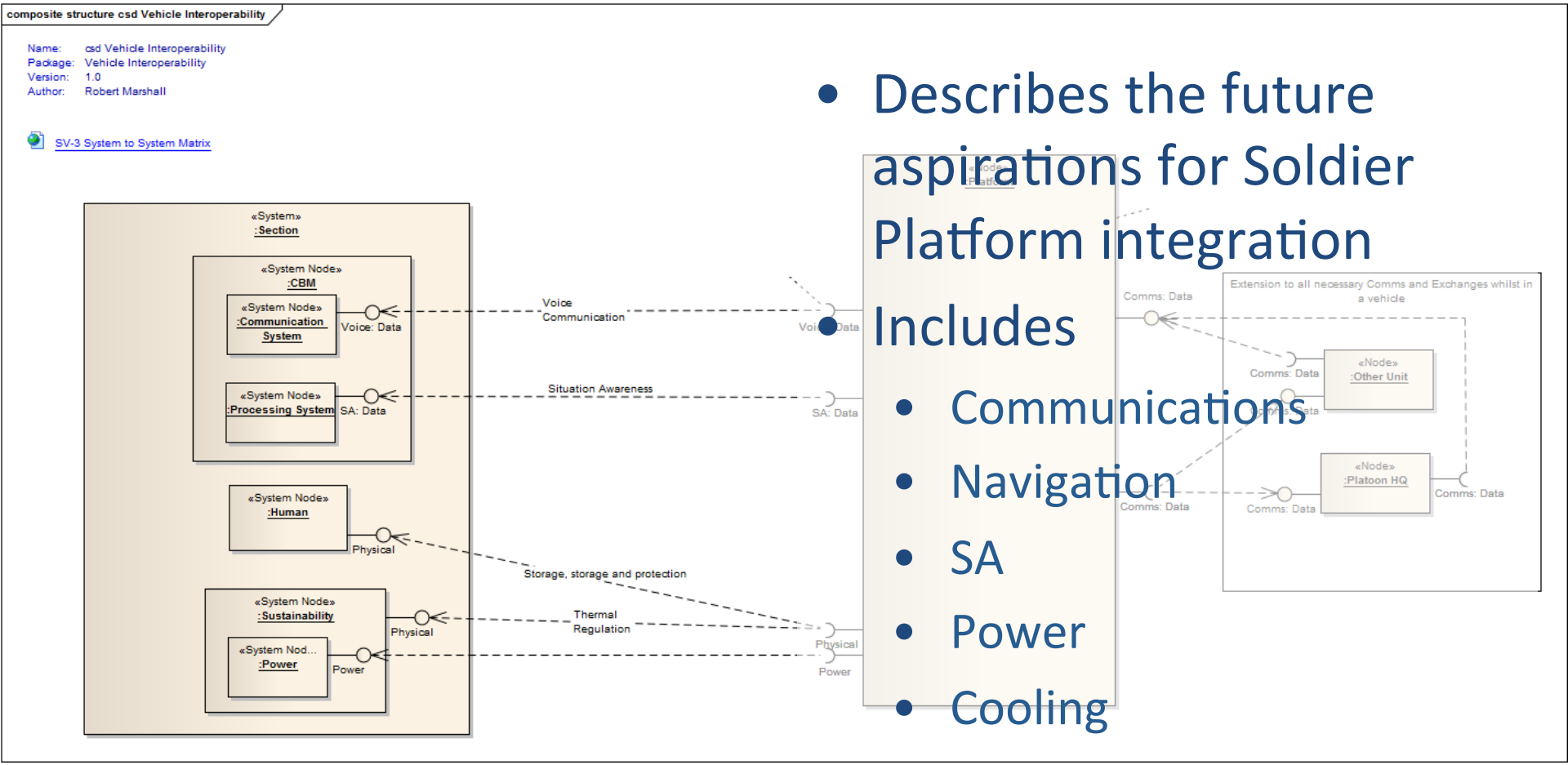

- Describes a generic soldier communications system
- Illustrates its relationship with the User and external influences
  - Network
  - Security
  - Spectrum

# Maintain Situational Awareness



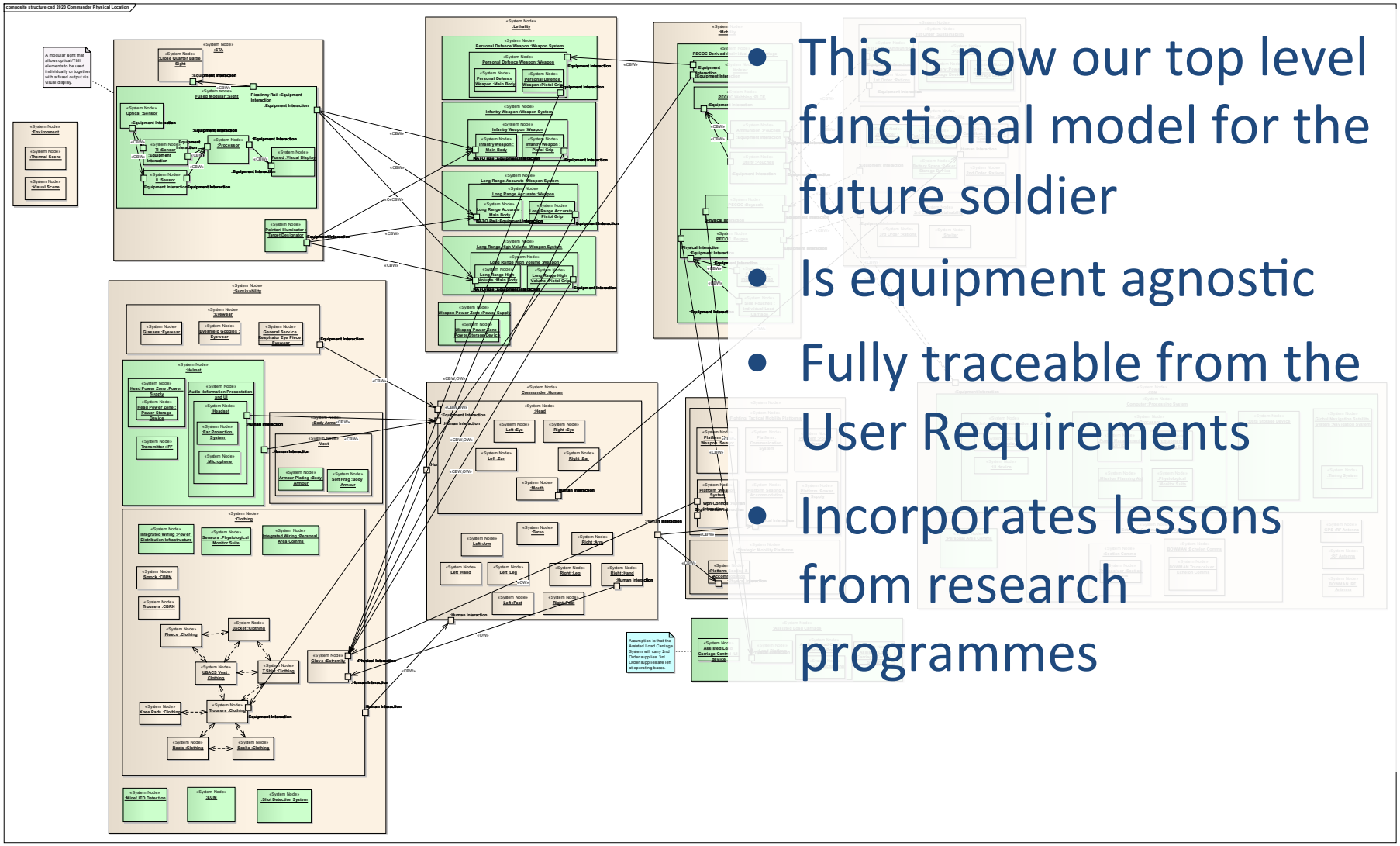

- Describes the fundamental functions of situational awareness
- Is equipment independent
- Shows relationship between CBM and STA domains

# Vehicle Interoperability




- Describes the future aspirations for Soldier Platform integration
- Includes
  - Communications
  - Navigation
  - SA
  - Power
  - Cooling

# Architecture 2020



- This is now our top level functional model for the future soldier
- Is equipment agnostic
- Fully traceable from the User Requirements
- Incorporates lessons from research programmes

# Conclusions

## Our Systems Engineering Approach enables:

- The derivation of quantified User Requirements
- Management of the interfaces between soldier equipment, between the soldier and platforms, and in a “system of systems” context
- The evolution of the Soldier System from “Today” into “Tomorrow”
- Management of the acquisition process and the selection of equipment based upon User need

# Thank You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