



# Advancing MBSE via Unified Profile for DoDAF/MODAF (UPDM)





# UPDM



- UPDM is the Unified Profile for DoDAF/MODAF that provides industry standard UML/SysML representation of DoDAF/MODAF architecture artifacts
- UPDM Submitters: Adaptive, ARTiSAN Software Tools, Ltd., EmbeddedPlus Engineering, IBM (includes Rhapsody and RSx), Mega, No Magic, Inc., Sparx Systems Pty Ltd., Visumpoint
- Supporters: Advanced System Management Group, Ltd., BAE Systems, Generic AB, Lockheed Martin Corporation, MITRE, DOD, MOD, Raytheon Company, Rolls Royce



# Motivation for UPDM



- Enhance the quality, productivity, and effectiveness associated with enterprise and system of systems architecture modeling
- Improve the integration between system of systems modeling and system modeling to support post acquisition life cycle design modeling

**Develop UML Profile for DoDAF/MODAF that provides industry standard UML/SysML representation of DoDAF/MODAF architecture views**



# Industry Based Standard-UPDM



- UPDM emerged as a common profile from about a dozen separate tool implementations
- Spurred by DoD and OMB requirements to utilize architectures on any project of a significant size
- Provides support for the latest standards in modeling, including SOA component modeling and SysML systems modeling
- Recognizes the inevitable need to work with other modeling languages, systems, & standards, such as BPMN, IDEF, Excel, Personnel Systems, and Federal Information Exchange Standards

**The diversity of approaches will make DoDAF stronger with a common method for comparison, reuse and evolution. UPDM provides that common structure that will help the DoD deal with emerging modeling issues**



# Benefits of Industry Based Standards-UPDM



- Promote architecture model reuse and maintainability
- Improve tool interoperability and communications between stakeholders
- Reduce training impacts due to different tool implementations and semantics
  
- UPDM is an emerging standard in DISR-online
- UPDM is endorsed by SAF/XC, Navy, OSD, MoD, and NATO/NAF as the UML/SysML Architecture modelling standard



# OMG UPDM Scope



- Uses DoDAF v 1.5 as a baseline—working towards DoDAF v 2.0
- Incorporates MODAF's additional views (Acquisition and Strategic views)
- Supports modeling system-of-systems architectures
  - Systems that include hardware, software, data, personnel, procedures, and facilities (DOTMLPF & MOD Lines of Development )
  - Service oriented architectures and net-centricity

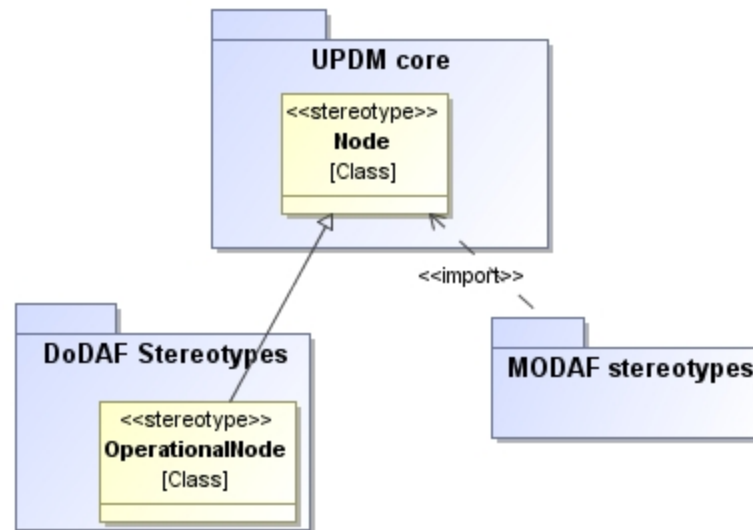
RFC page: <http://www.omg.org/spec/UPDM/1.0/Beta2/>



# Architecture Principles



- Single layer
  - UML / SysML Extension
  - Compliance against UPDM will be assessed via XMI interchange
- Core profile for all AFs and sub profiles for differences:
  - Additional elements that belong just to this AF
  - Different naming (Alias)





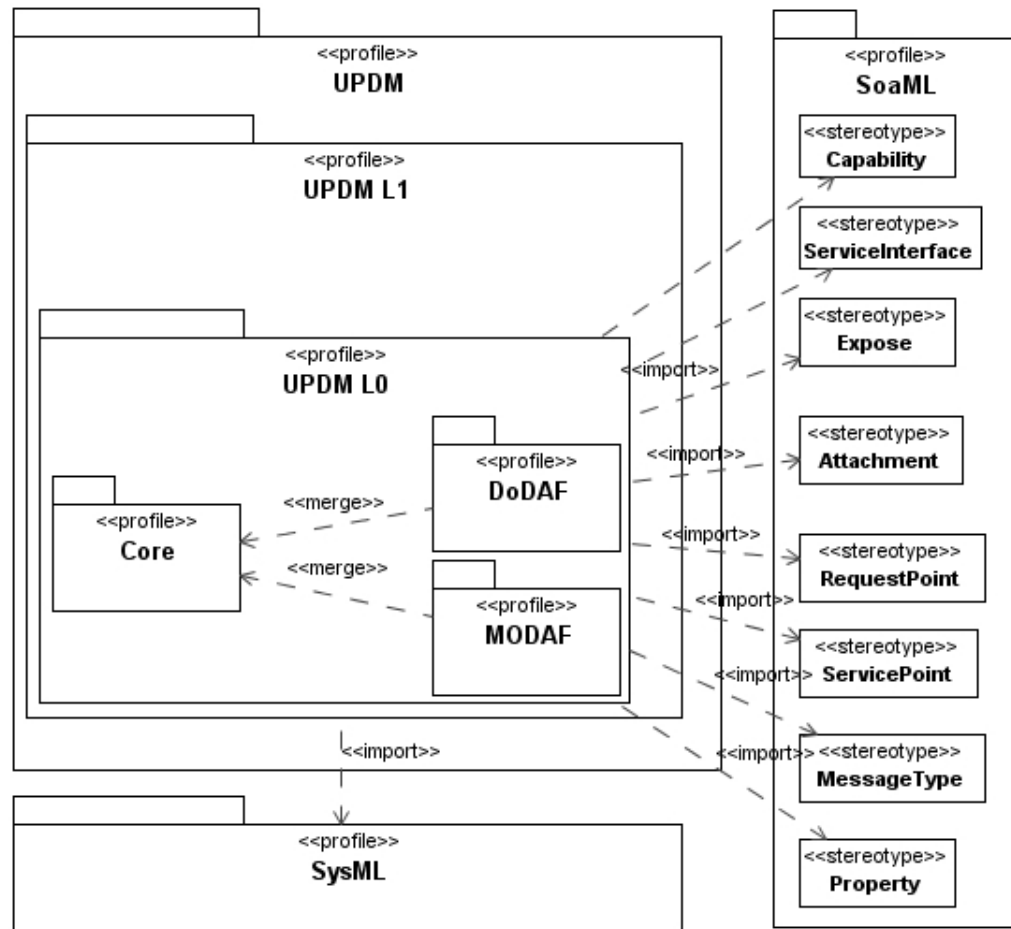
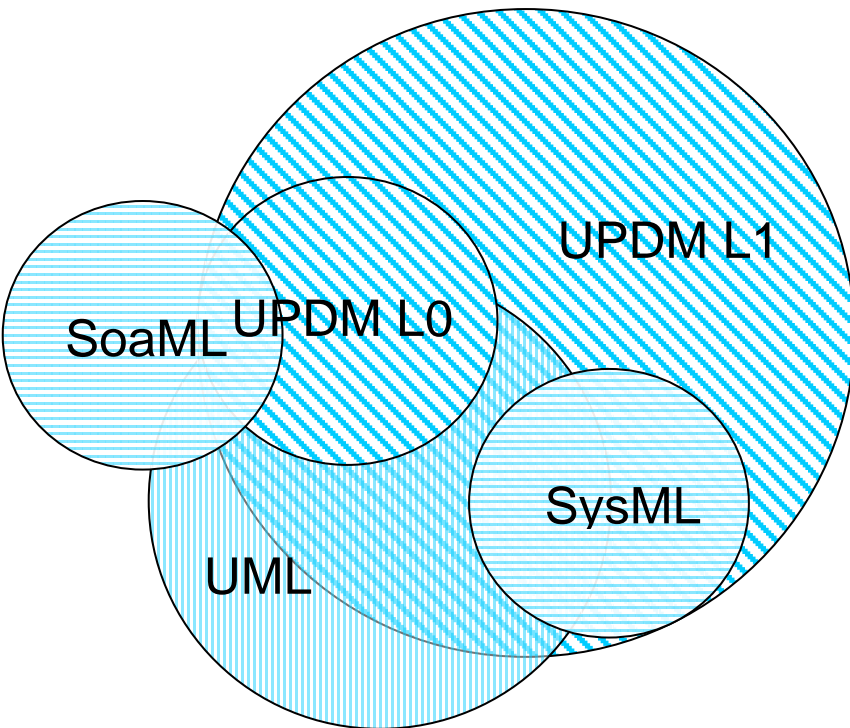
# UPDM Principles



- Model-Based Development of the Specification
  - Specification and XMI generated from the model
- Open, Collaborative Process
  - Include all stakeholders in decision making
  - Open membership
- All Member Inputs Considered
  - Discuss, Debate, Decide, Prioritize, Defer
- 80-20 Rule
- “Keep it Simple”
- Re-Use Rather than Re-Define
  - MODAF 1.2/M3, DoDAF 1.5/2.0, NAF
  - UML 2, SysML 1, BMM, UPMS, BPMN, ...
  - Domain Meta-Model based on the above



# UPDM Compliance





# UPDM Level 1 Compliance SysML Extensions



- Extends UPDM Level 0 with SysML stereotype definitions
- Facilitates integration of DoDAF and MODAF models for system of systems modeling with SysML models for system modeling
- Enables UPDM to fully leverage SysML features



# UPDM Level 1 Compliance SysML Extensions (cont'd)



- Enables UPDM to leverage SysML features
  - SysML blocks to represent structural elements such as operational nodes, artifacts (systems), capability configurations, which enable the use of flow ports, item flows, and value properties with units and distributions
  - SysML activities to support continuous flow modeling, activity hierarchies, and support for enhanced functional flow block diagrams
  - SysML parametrics to enable the integration of engineering analysis with the architecture models (e.g., performance parameters in an SV-7 can be captured in parametric equations)
  - SysML allocations to support various types of mappings such as an SV-5 that maps system functions to operational activities



# Remaining Challenges to Model Interchange



- Tool vendors may:
  - implement different versions of the XMI\*
  - support a different subset of the versions
  - use proprietary extensions of the UML‡ meta-model
  - provide XMI exporter that generates non-compliant XML code

\*XMI: eXtensible Markup Language (XML) Metadata Interchange

‡UML: Unified Modeling Language™



# Solution: Model Interchange Working Group (MIWG)



- To improve the interoperability of MOF/XMI-based tools
- Initial focus is on model interchange among UML, SysML, and UPDM -capable tools
- <http://www.omgwiki.org/model-interchange/doku.php>



# Search and Rescue

Example



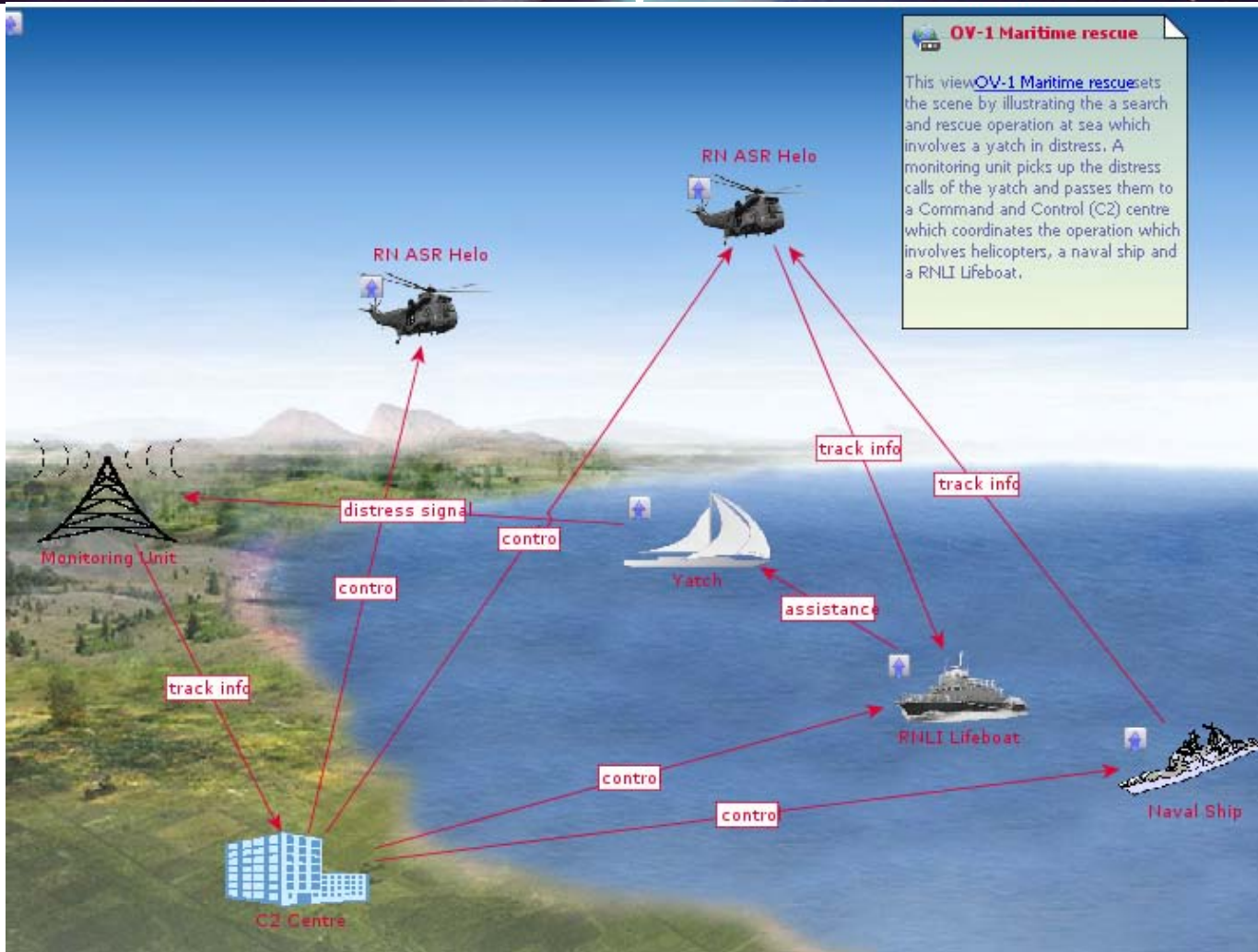
# UK Search and Rescue Framework



- Describes the use of UPDM as it applies to a Maritime Search and Rescue (SAR) operation of a yacht in distress. A monitoring unit picks up the distress signal from the yacht and passes it on to the Command and Control (C2) Center. The C2 Center coordinates the search and rescue operation among helicopters, a naval ship and a Royal National Lifeboat Institution (RNLI) Lifeboat.

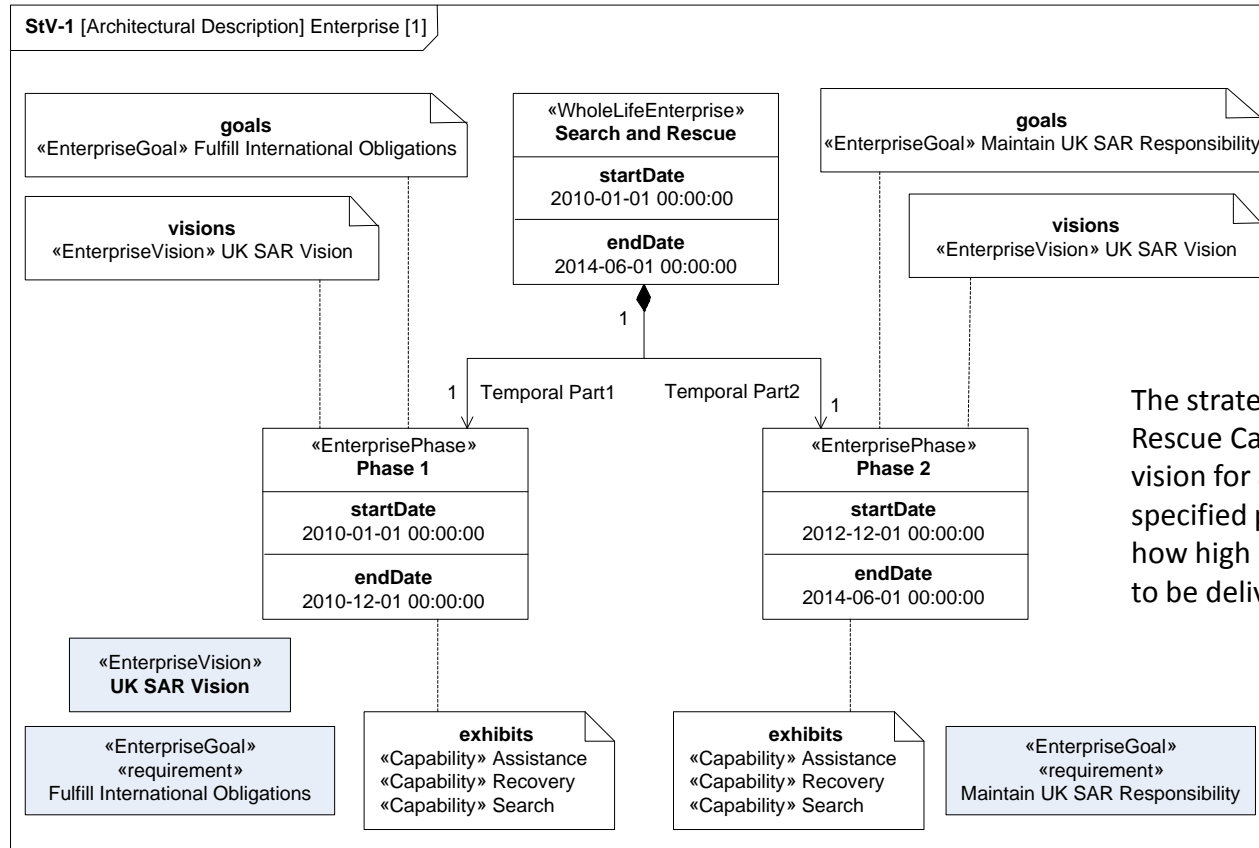


# OV-1: Operational Context Graphic





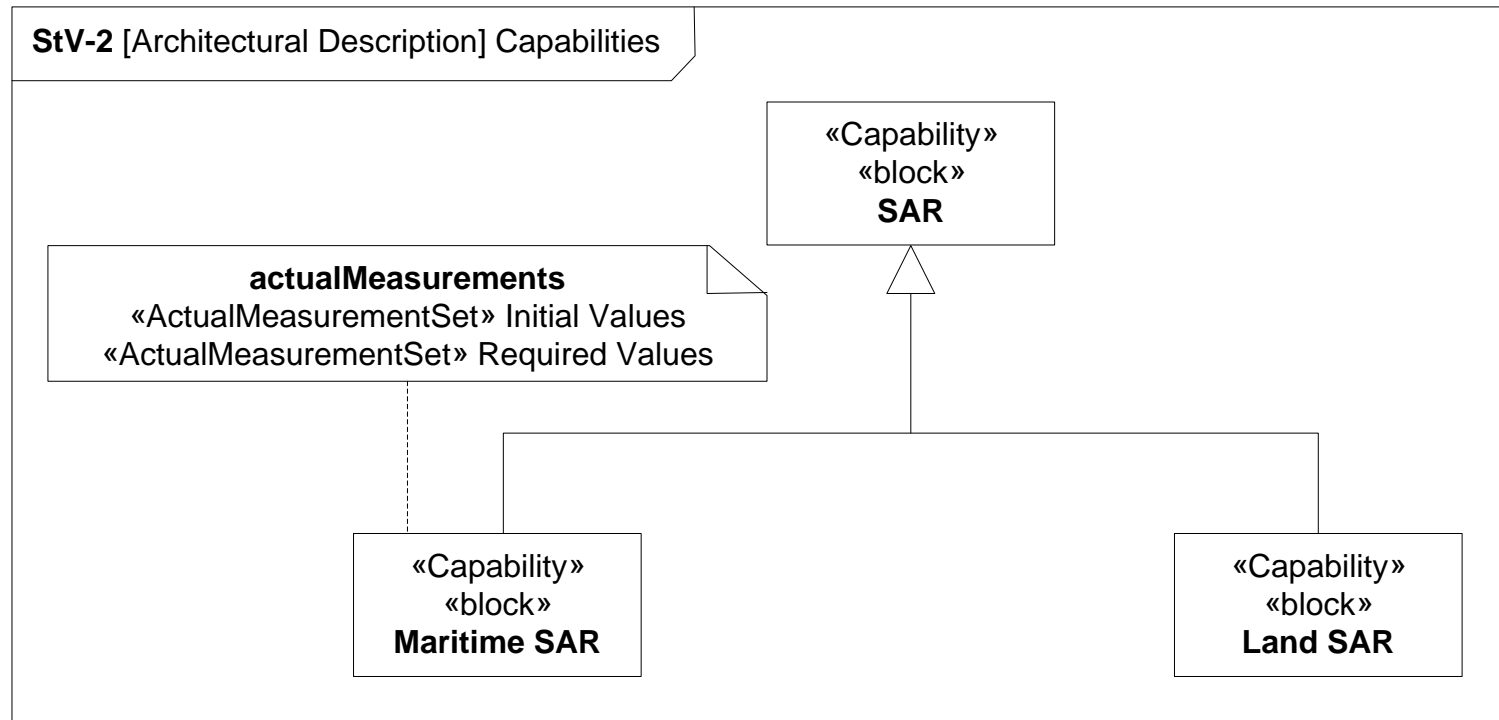
# StV-1: Capability Vision



The strategic context for Search and Rescue Capabilities outlining the vision for a capability area over a specified period of time. It describes how high level goals and strategy are to be delivered in terms of capability.



# StV-2: Capability Taxonomy

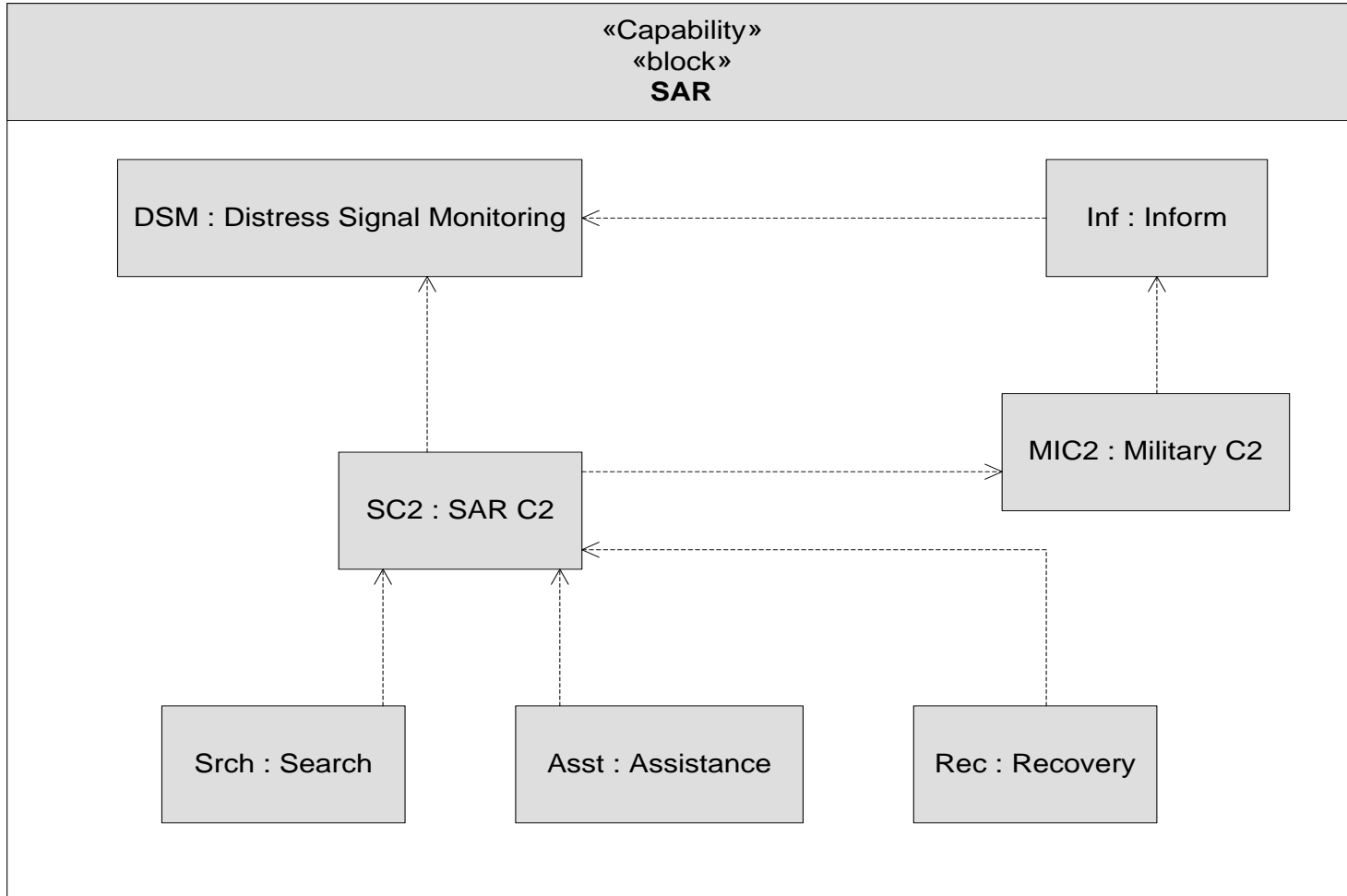




# StV-4: Capability Dependencies

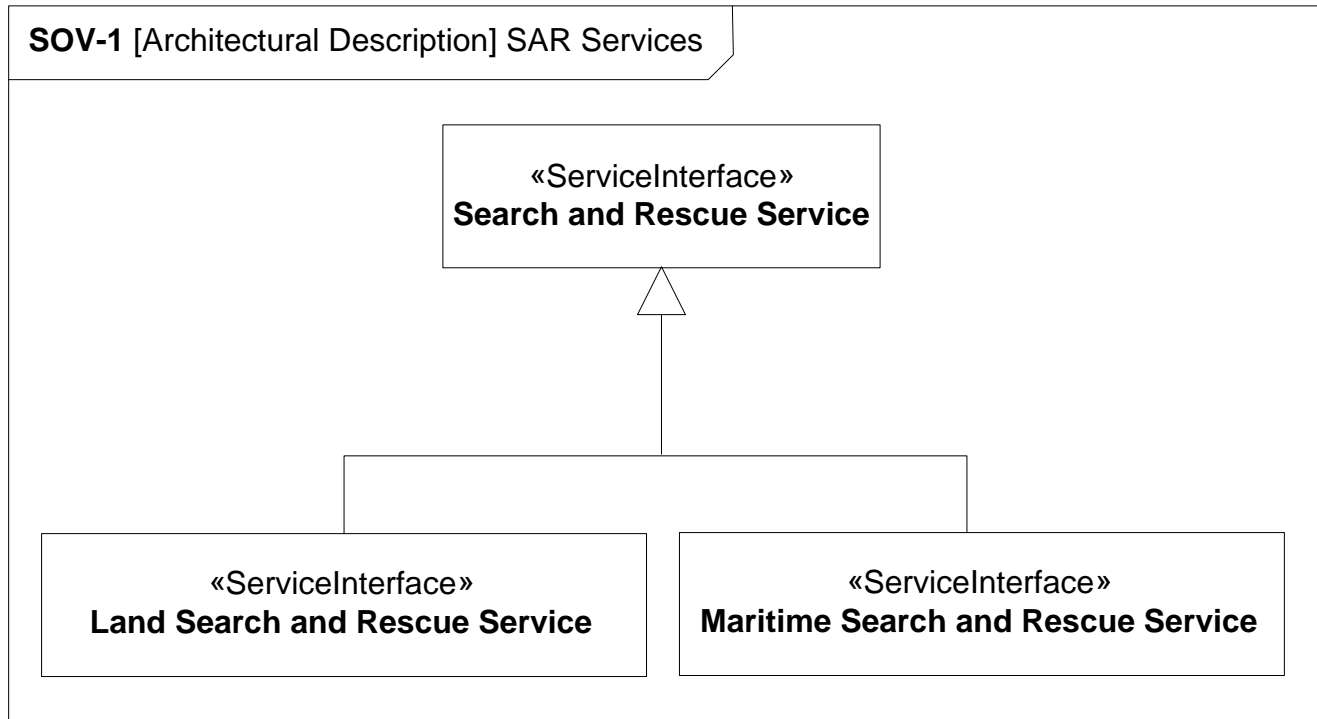


StV-4 [Capability] SAR Capability





# SOV-1: Service Taxonomy



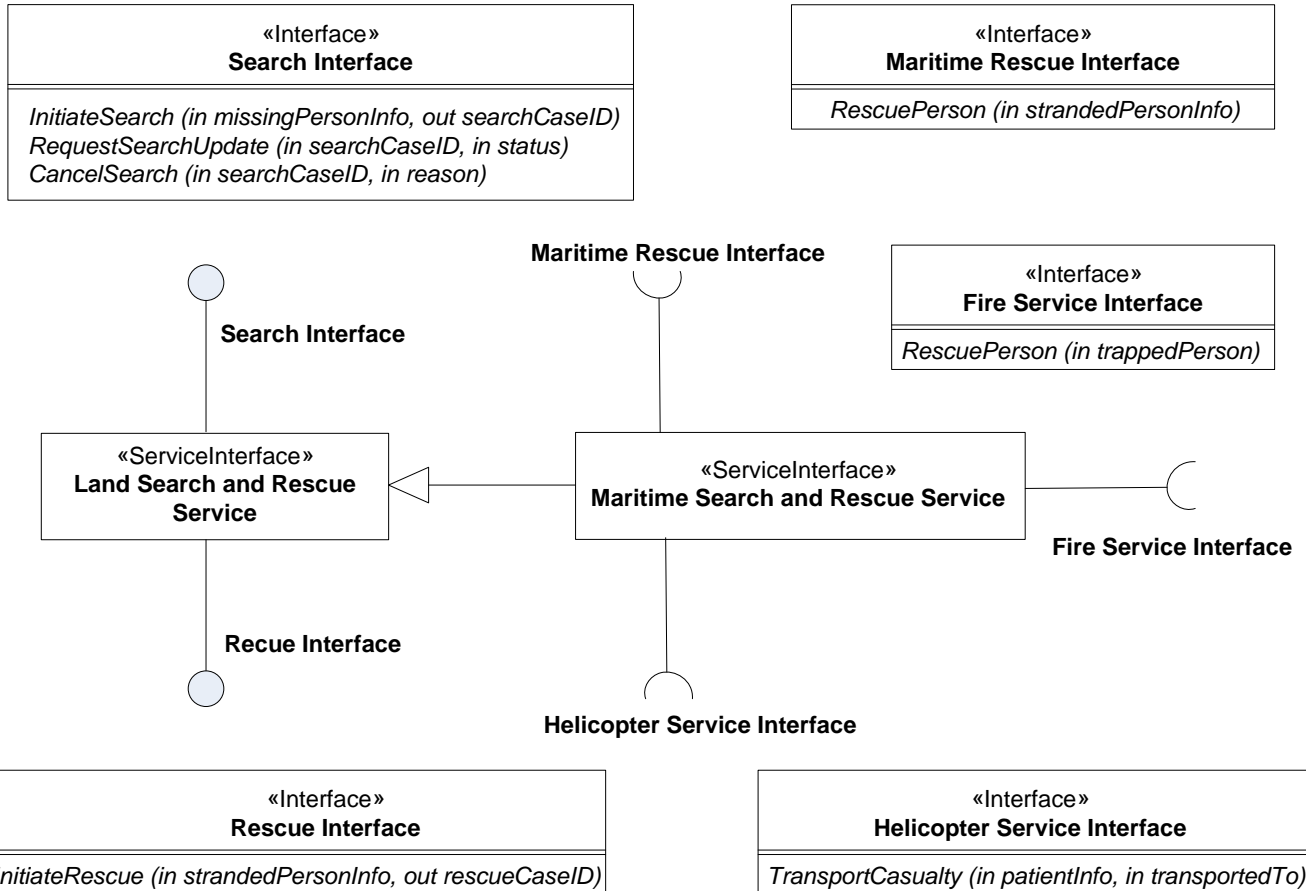
This view specifies the hierarchy of services as well as the relationships between them. In this case, the hierarchy of services within the Search and Rescue Service with Land and Maritime Search and Rescue Services as specializations of the SAR Service



# SOV-2: Service Interface Specification



SOV-2 [Architectural Description] SAR Services [1]



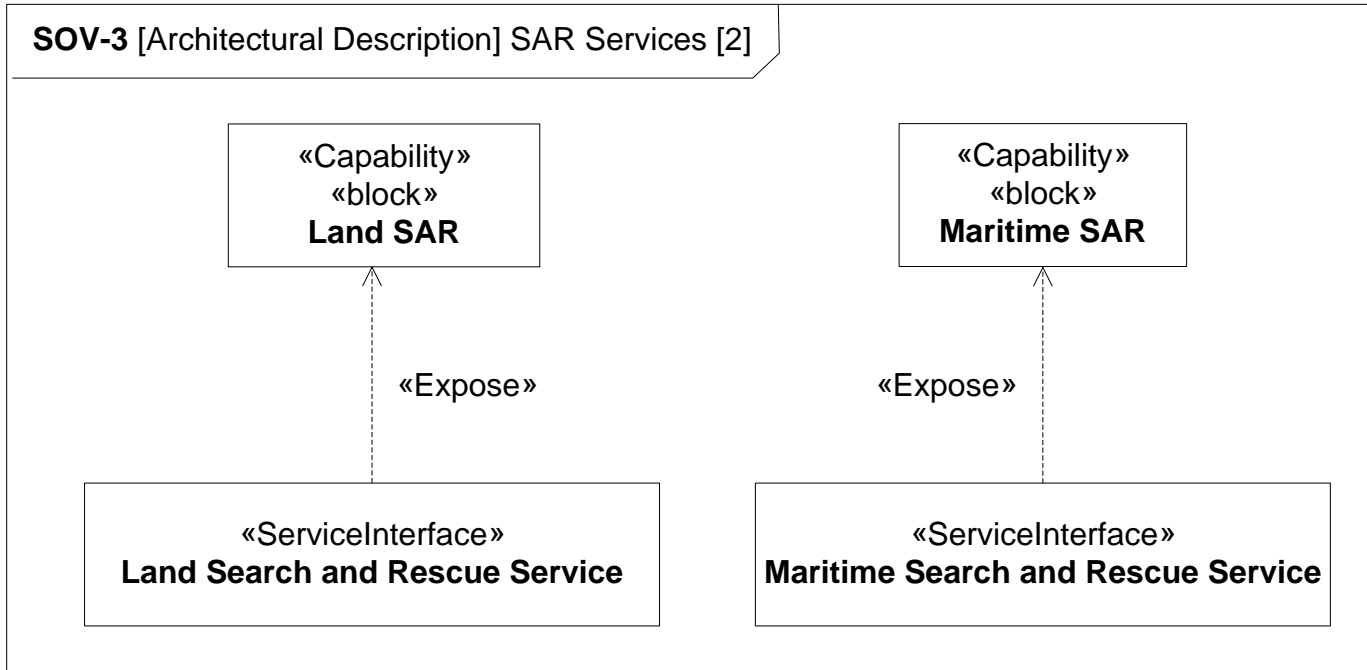
Defines the interfaces that will provide access to the services



# SOV-3: Capability to Service Mapping



Graphical Form



Tabular Form

	«Capability» Land SAR	«Capability» Maritime SAR
«ServiceInterface» Land Search and Rescue Service	X	
«ServiceInterface» Maritime Search and Rescue Service		X

Shows which services contribute to the achievement of a capability. The Land Search and Rescue Service achieves the Land SAR Capability, and the Maritime Search and Rescue Service achieves the Maritime SAR



# SOV-4: Service Behaviors and Constraints



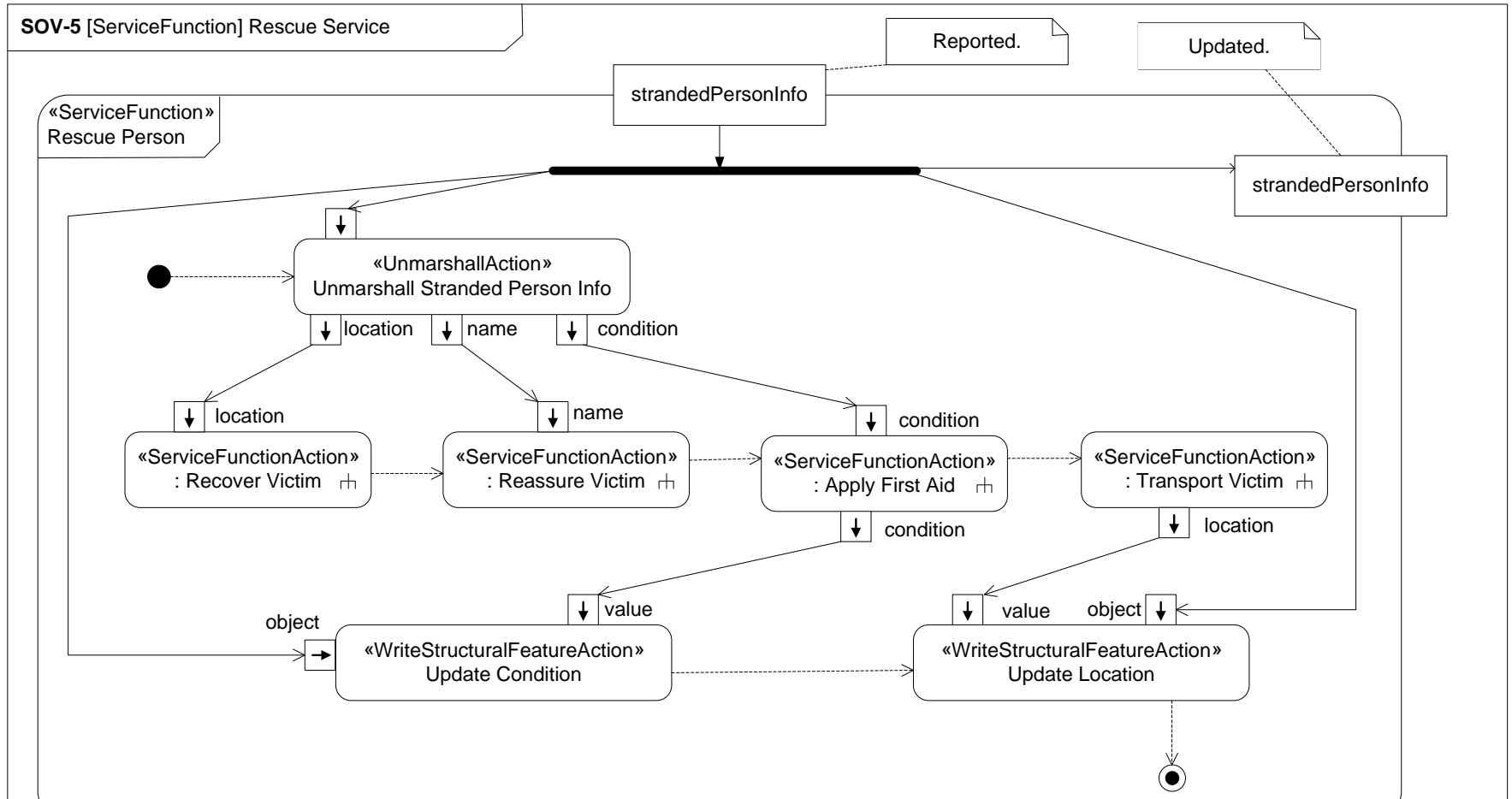
[Architectural Description] SAR Services [SOV-4a]

Service Interface	Service Policy	
Name	Name	Text
Land Search and Rescue Service	Driving Record	Any member involved in the operation of road vehicles must have a clean driving record.
Maritime Search and Rescue Service	Swim	All members of the rescue team must be able to swim.
Search and Rescue Service	First Aid	All members of the rescue team must be able to perform basic first aid.
	Danger	No member of the search and rescue team should put themselves in unnecessary danger.

Defines constraints that must be adhered to by Consumers and Providers of the Services via Service Policies.



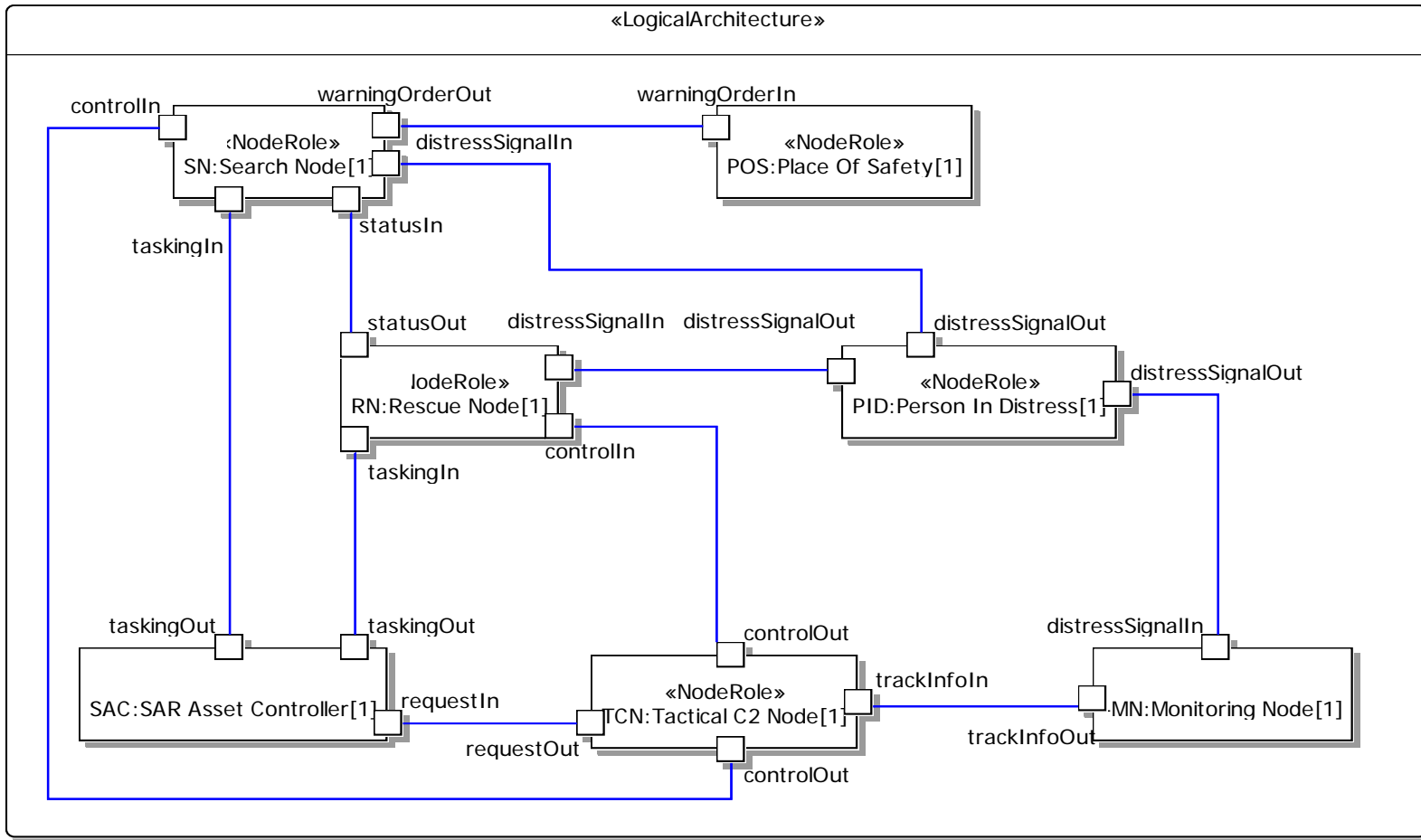
# SOV-5: Service Functionality Person Rescue Service



Defines the Service Functions to describe the abstract behavior of each Service Operation. It specifies the set of functions that the service implementation is expected to perform.



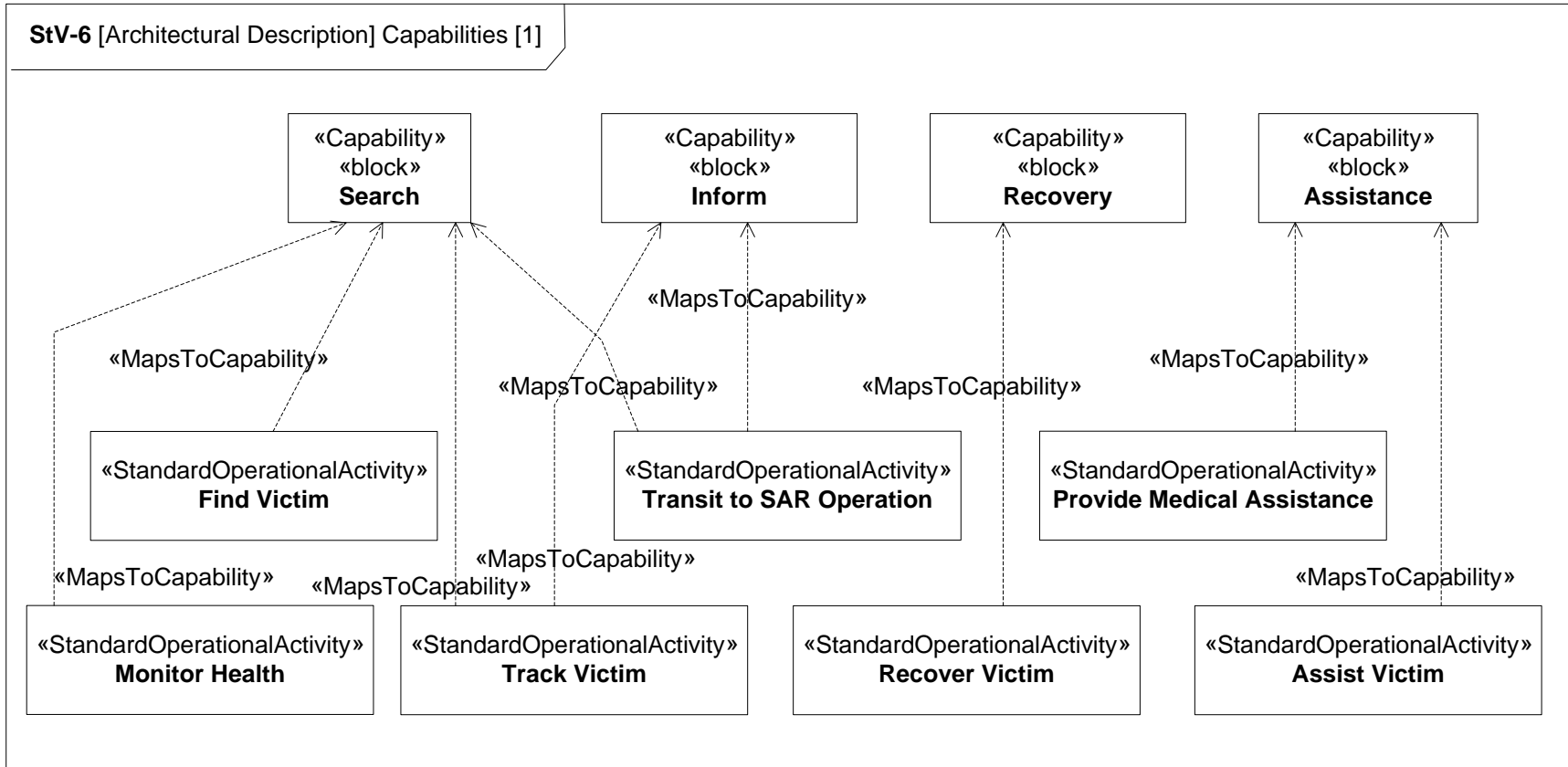
# OV-2 : Operational Context Graphic (Composite Structure)





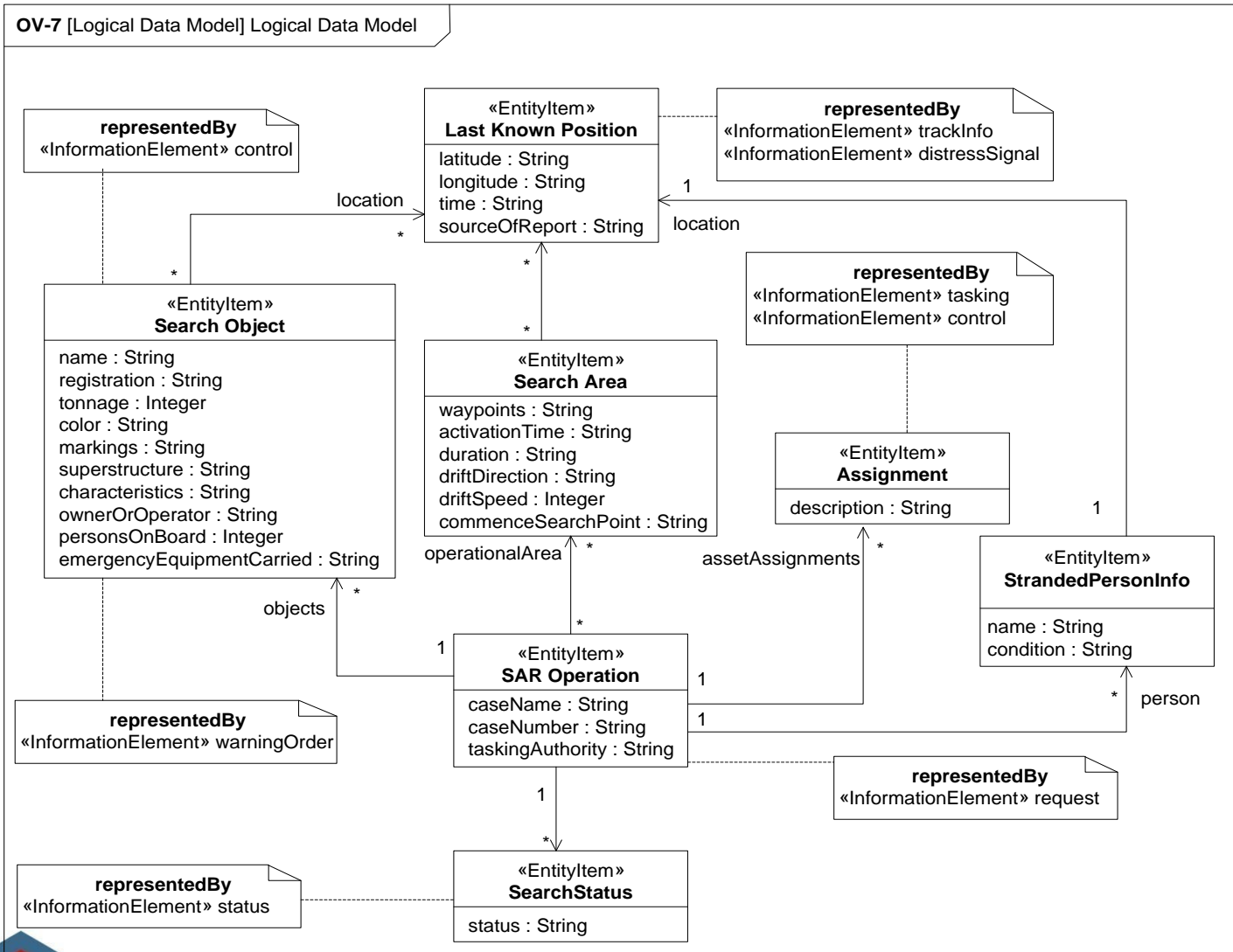


# StV-6: Operational Activity to Capability Mapping





# OV-7: Logical Data Model

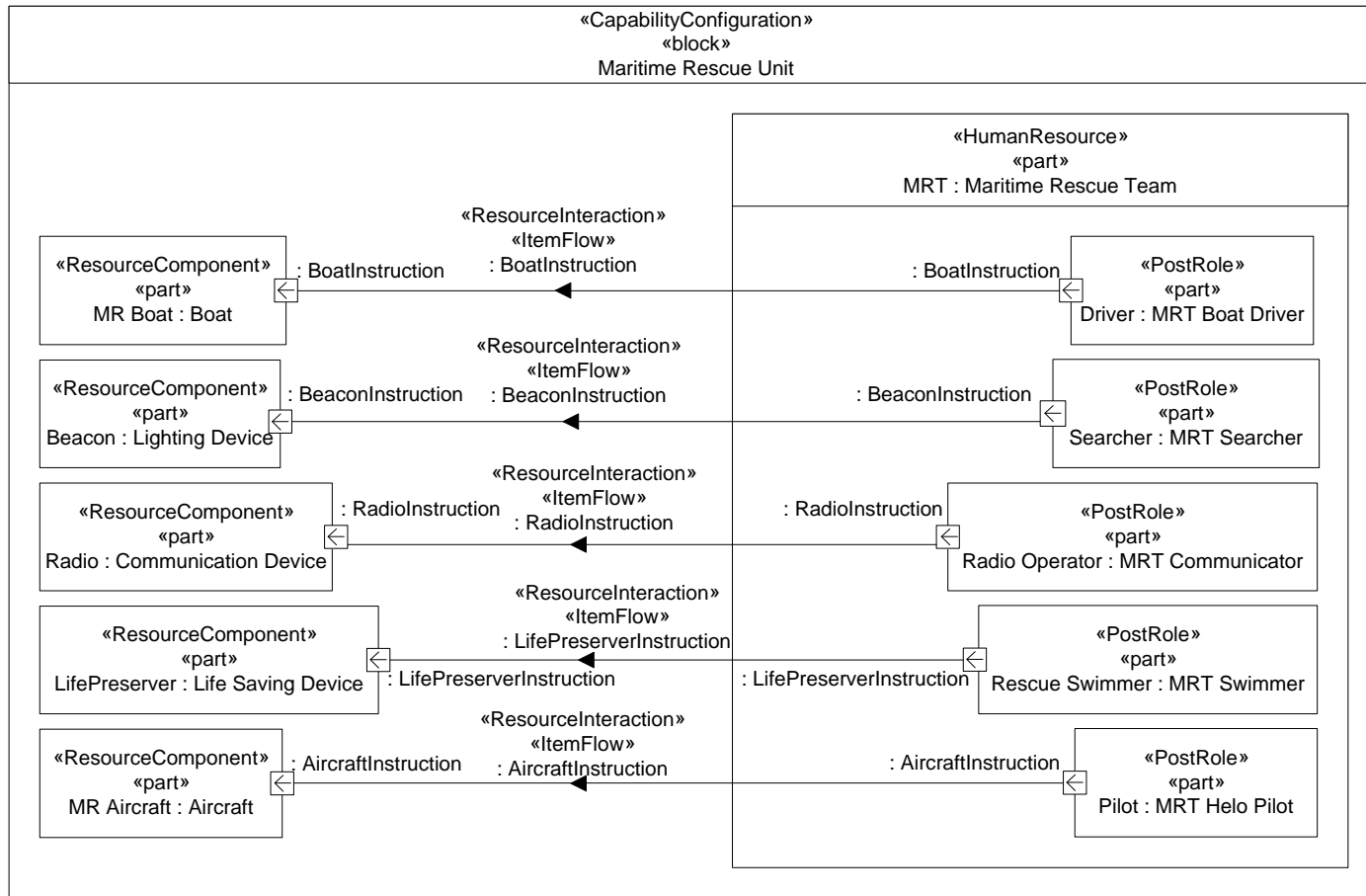




# SV-1: Resource Interaction Specification



SV-1 [Capability Configuration] Maritime Rescue Unit



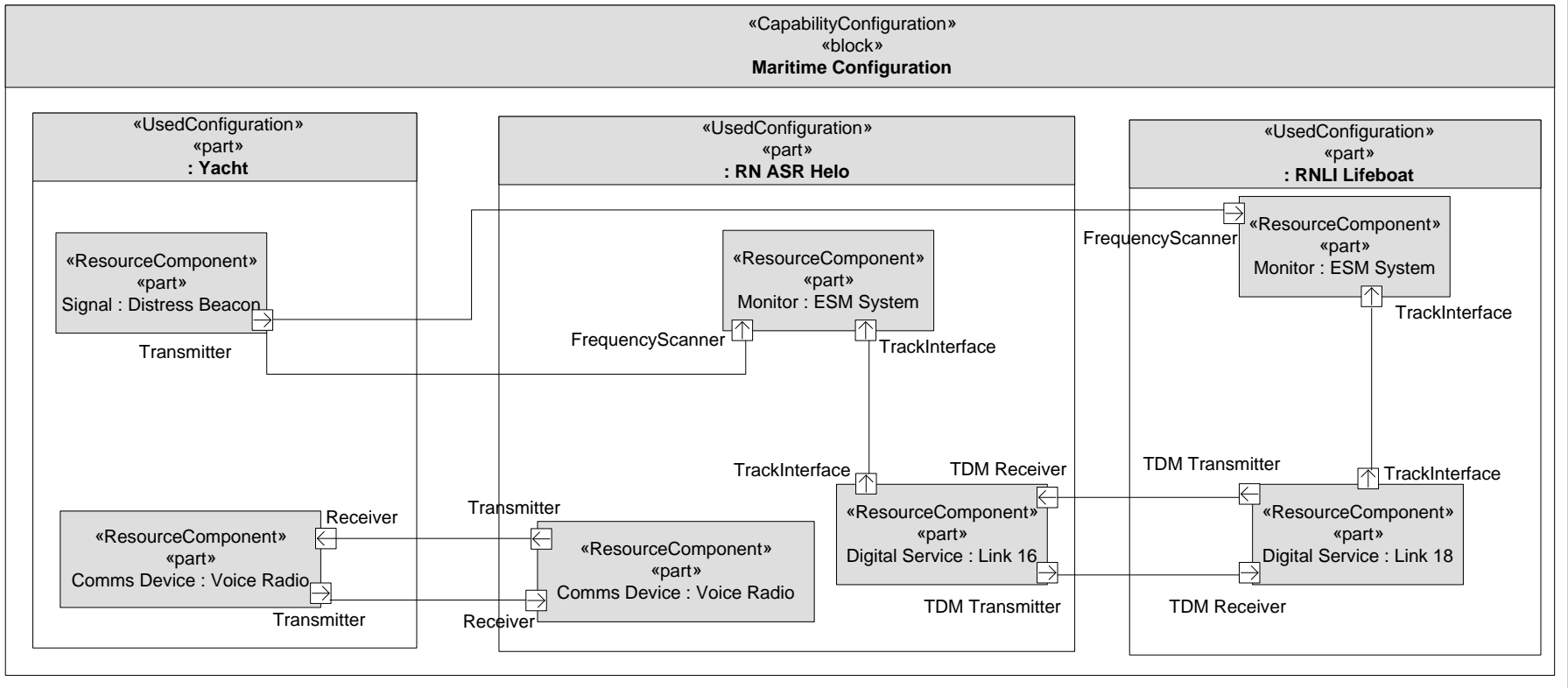
This view defines the structure and internal flows of the Capability Configuration. The figure shows the Capability Configuration of a Maritime Rescue Unit. It is comprised of the Maritime Rescue Team (MRT), and the roles that make up the MRT, as well as the components that enable them to fulfill their role. This example shows that the Role of Driver is filled by a MRT Member who must interact with a MR Boat.



# SV-2a: System Port Specification

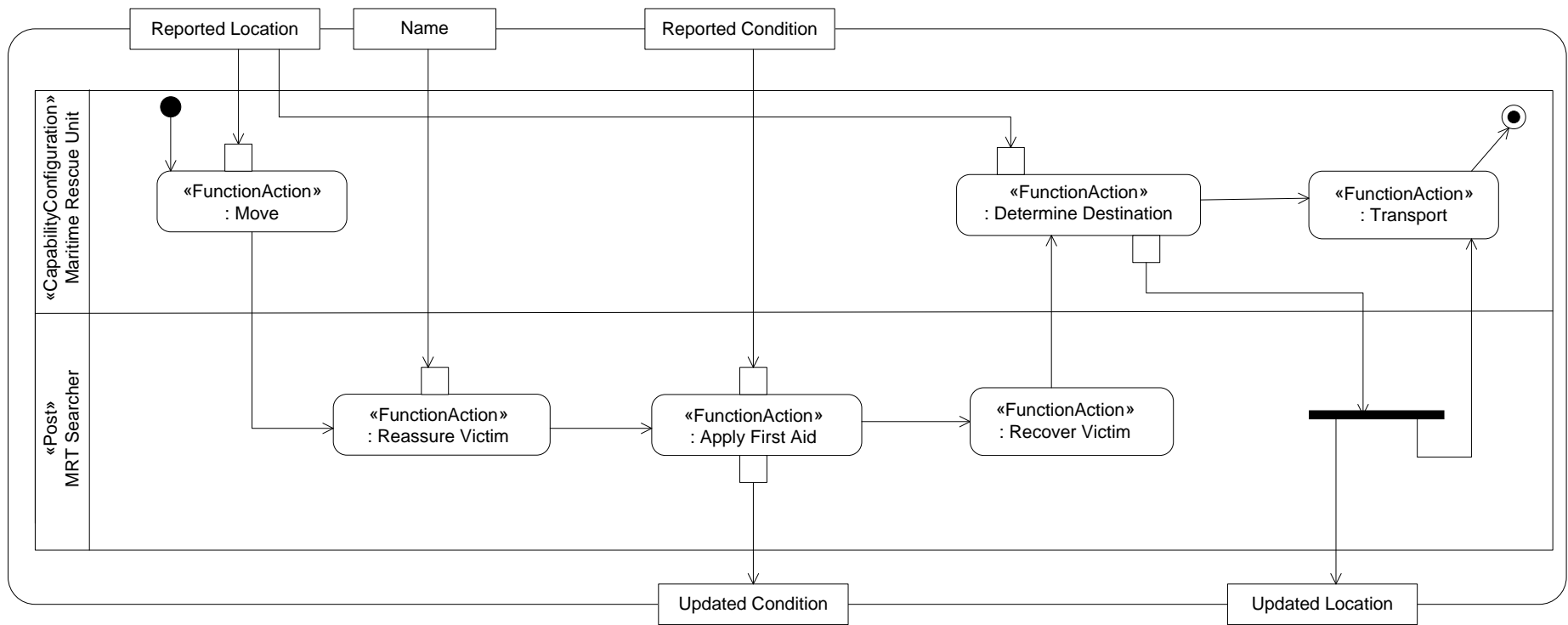


SV-2 [CapabilityConfiguration] Maritime Configuration





# SV-4: Functionality Description





# SV-7: Resource Performance Parameters



[Architectural Description] System View [SV-7]

Resource		Actual Measurement Set				
Type	Name	Name	Measurement	Actual Value	Unit	Dimension
«CapabilityConfiguration»	Maritime Configuration	Initial Values	seaConditions	Sea State 6	Meter	Wave Height
			areaCoverage	500	SquareKilometers	Area
			findTime	<8	Hours	Time
			persistence	>15	Hours	Time
			searchCoverage	400	SquareKilometers	Area
			weatherConditions	Heavy Rain	Weather Severity Index	
«CapabilityConfiguration»	Maritime Configuration V2	Final Values	seaConditions	sea state 8	Meter	Wave Height
			areaCoverage	650	SquareKilometers	Area
			findTime	<4	Hours	Time
			persistence	>20	Hours	Time
			searchCoverage	550	SquareKilometers	Area
			weatherConditions	Stormy	Weather Severity Index	
«CapabilityConfiguration»	Maritime Rescue Unit	Initial Values	seaConditions	Sea State 6	Meter	Wave Height
			areaCoverage	500	SquareKilometers	Area
			findTime	<8	Hours	Time
			persistence	>15	Hours	Time
			searchCoverage	400	SquareKilometers	Area
			weatherConditions	Heavy Rain	Weather Severity Index	
«CapabilityConfiguration»	Maritime Rescue Unit V2	Final Values	seaConditions	sea state 8	Meter	Wave Height
			areaCoverage	650	SquareKilometers	Area
			findTime	<4	Hours	Time
			persistence	>20	Hours	Time
			searchCoverage	550	SquareKilometers	Area
			weatherConditions	Stormy	Weather Severity Index	

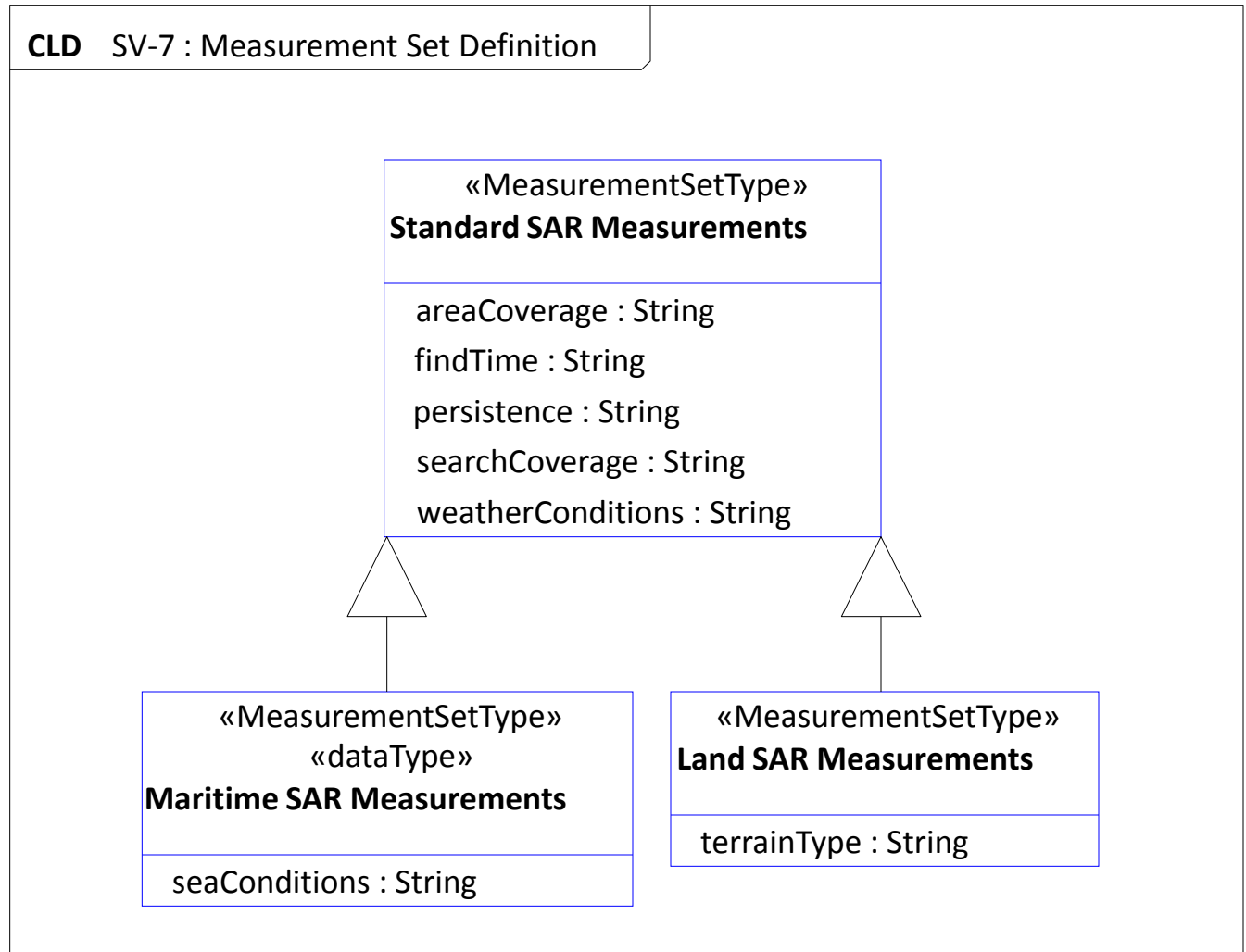


# SysML Example: SV-7



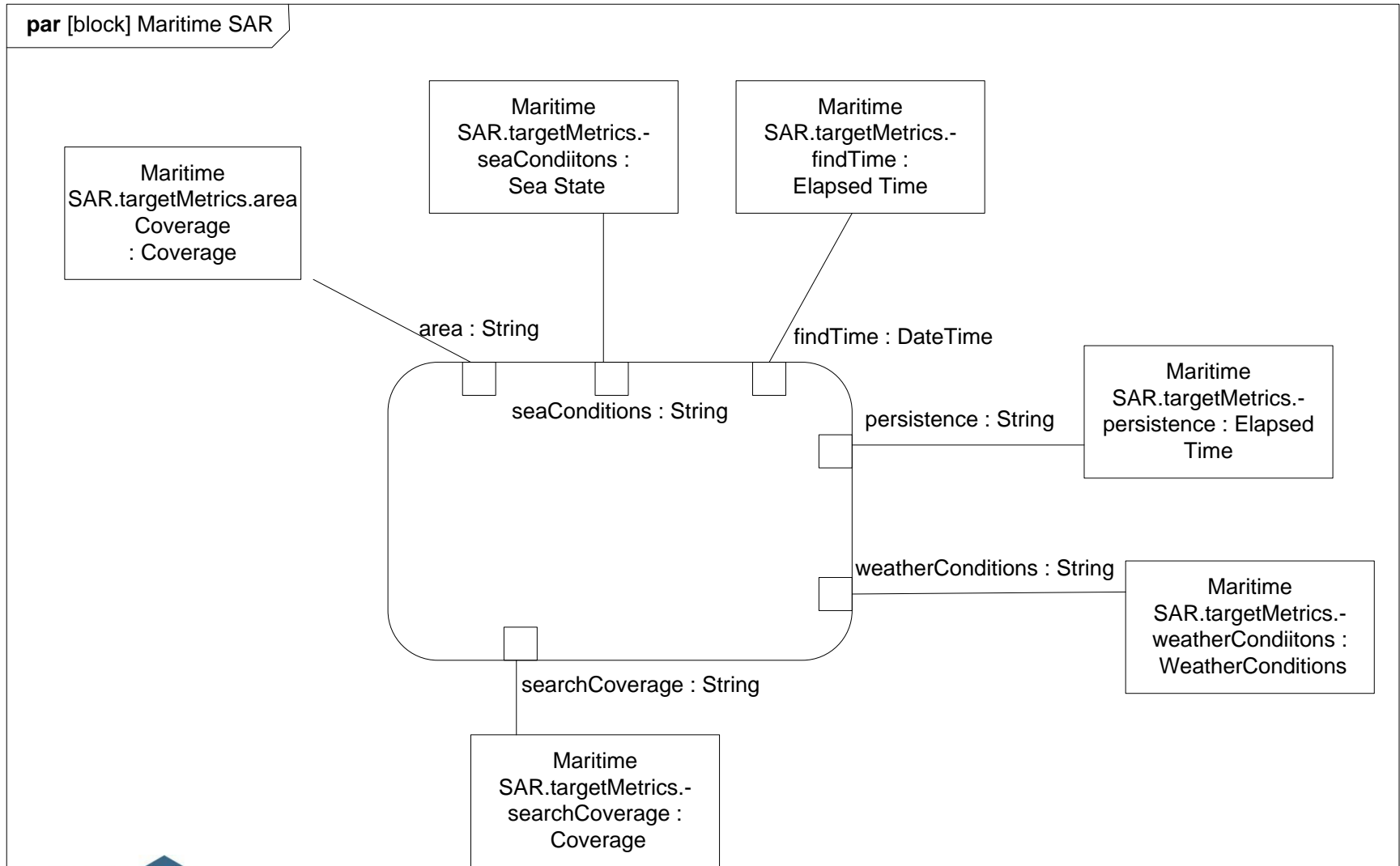
CLD SV-7 : Measurement Set Definition

Definition of the required measurements





# Parametrics Diagram





# UPDM Background



# UPDM 1.0 Roadmap



- Submission – Sept 2008
- OMG vote to adopt UPDM Dec 2008
  - Start of FTF process
- Completion of FTF/UPDM 1.0 June/Sept 2009



# The Case for UPDM



- The specification is technically sound
  - Model-based to ensure consistency
    - The specification was generated from the model
    - XMI generated from the same model
  - UPDM profile derived from the Domain Meta-Model (DMM)
  - Consensus based
    - Architects included major tool vendors who worked together to ensure an implementable solution
    - Domain experts ensured correctness
- Supports current architecture frameworks
  - Traceability analysis performed against DoDAF 1.5, MODAF 1.2, NAF 3.0
  - Largely convergent with DoDAF 2.0 current direction – reduces the risk of conflict with later DODAF 2.0 releases



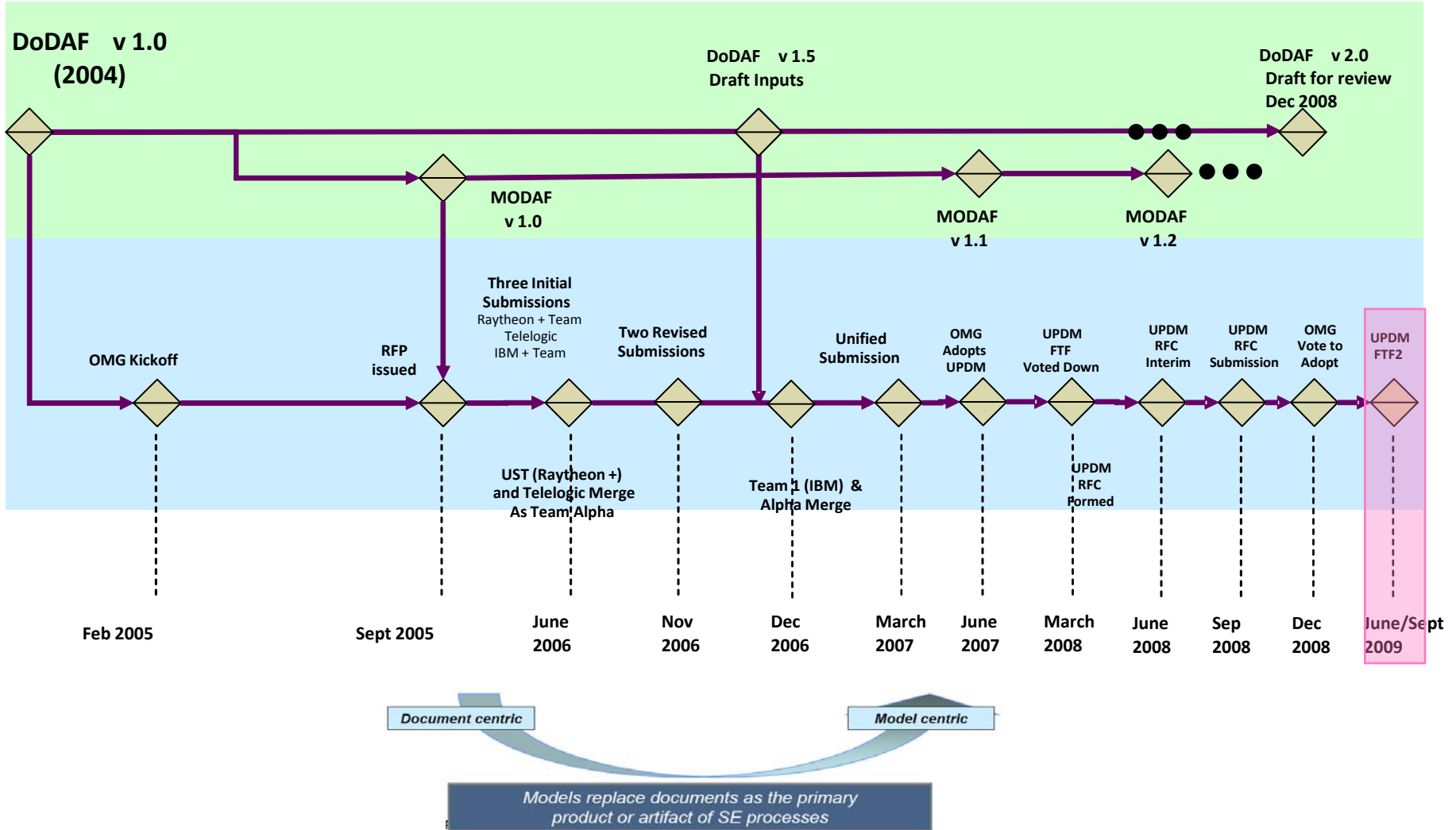
# The Case for UPDM



- Demonstrated to be practical, useful and correct
  - Example model demonstrates proof of concept
  - Profile already defined in Artisan, EmbeddedPlus, No Magic, and Visumpoint(Borland), and the implementation is actively under development. They all plan on releasing a commercially available product supporting this version of UPDM within the this year.
    - Implementation currently under way
- Major stakeholder support
  - DoD and MOD involvement throughout
    - DoDAF 2.0 and MODAF 1.2 teams
  - Guidance from NATO and the Canadian Dept of National Defence (DND)
- Integration with SysML and UML
  - Allows easy flow-down and traceability from architecture frameworks to system models.



# UPDM History





# The Current Status of UPDM



- Specification released for 60 day review in September, 2008
- Issues were resolved by the architecture group
  - Members are tool vendors Adaptive, Artisan, Embedded Plus, Mega, IBM, No Magic, Sparx
  - List of issues is available to the whole group
  - Solutions proposed for over 90% of issues
- Issue resolutions accepted by UPDM team
- UPDM finalized spec published, OMG vote in June/Sept. 2009



# The Future of UPDM



- Post submission
  - DoDAF 2.0 released June 2009
  - OMG vote to adopt UPDM June/Sept. 2009
  - UPDM available in tools available shortly after
  - Preparation of RFP for UPDM 2.0
    - Complete implementation of DoDAF 2.0
    - Security views from DNDAF
    - Support for NAF
    - Others?
  - Issue UPDM 2.0 RFP
  - ....