Date: June 18, 2019

Unified Architecture Framework (UAF) Sample Problem (Informative)

Version 1.1

OMG Document Number: Normative ditch/dtc/19-06-18

Standard document URL: http://www.omg.org/spec/UAF/1.1

Normative Machine Consumable File(s):

http://www.omg.org/spec/UAF/20190619/UAF.xmi

http://www.omg.org/spec/UAF/20190620/Measurements-Library.xmi

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Preface

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- CORBAServices
- CORBAFacilities
- OMG Domain Specifications
- CORBA Embedded Intelligence Specifications
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1. Purpose

This Annex [Unified Architecture Framework Sample Problem (Non-Normative)] is meant to illustrate the practical utility of using and implementing the UAF. While the Sample Problem is not normative, the sample does show the intent of the developers/submitters of the UAF specification relevant to its use and implementation. While the Annex is not by itself an introductory text of the subject, it does have three purposes that are similar and may form the basis of a future textbook:

- First, to support the End-User of the Unified Architecture Framework Profile (UAFP) initiating or evaluating an integrated Architecture Description of a relatively complex system;
- Second, to address Senior Architects implementing this specification on a specific project.
- Third, to guide potential Tool Vendors toward conformance with this specification.

The Sample is in the domain of Civilian Maritime Search and Rescue (CMSAR or SAR). It is divided into several parts and follows the general format of the UAF specification itself.

The purpose of this annex is to illustrate how the Unified Architecture Framework (UAF) formerly called UPDM, can develop required capabilities using the basic features of this specification. This example provides a model which illustrates a sample of UAF views addressing the problem space described below. The names for the diagrams are the UAF names. The DoDAF and MODAF names are NOT listed. For a mapping of the UAF to DoDAF, MODAF and NAF, please refer to the UAF Mapping specification, which is part of the UAF submission.

1.1 Assumptions

While the reader does not require a tool to read and understand this Sample Problem, we presume access to a UAF 1.1 conformant tool that will organize and store the data [building blocks] from which the architecture description will be generated. UAF also assumes the reader is familiar with the basic notations of SysML[1], particularly

- Five structural diagrams (block definition diagram, internal block diagram, package diagram, parametric diagram, and requirement diagram) and
- Four behavioral diagrams (use case diagram, sequence diagram, state machine diagram, and activity diagram).

1.2 End-User (or Customer)

The End-User (or Customer) of this specification for Architecture Descriptions is the person or organization at either "end" of the development process for systems (and similar capabilities) rather than the architect or tool vendor (see below). End-Users function in roles such as Executive, Sponsor, Program Manager, Domain Expert, Subject Matter, or surrogate for the User. Sometimes, they are referred to as Stakeholders. They require two-way communication with the architect.

[1] One easily accessible text on these SysML diagrams is Lenny Delligatti, "SysML Distilled: A Brief Guide to the Systems Modeling Language" [Addison-Wesley] [2013].

The End-User

- Sets the initial requirements, using less formal means such as business graphics (PowerPoint™ and the like)
- Uses UAF compliant tools to express such requirements in more formal language and expressing them in high-level architectural descriptions, including UAF products (primarily Views), to communicate within the End-User community and with prospective developers including system architects.
- Reviews UAF compliant products to validate that
  - Requirements are being properly captured
  - High-level design meets those requirements

Often End-Users are briefed by system architects, in accordance with the appropriate, specific architecture framework on the Taxonomy, the Domain Meta Model and various Viewpoints of the system or capability under development. But they are really in search of a different set of questions and answers: Does the system meet requirements (such as timely rescue, in the example)? Will the system enable accomplishment of the mission (search-and-rescue, in the example)? Will the system architecture prove compliance with a number of laws, rules, regulations, standard operating procedures, good practices, and the like for the building and operation of an enterprise?

The End-User can discern the basics of the Civilian Maritime Search and Rescue architecture in the following minimalist list of Viewpoints and corresponding Views. Such an end-user will be assumed to have with little familiarity with formal architecture. The End-User will have a passing knowledge of systems engineering methodologies. Most End-Users should readily be able to apply a simple methodology to begin the process of architecting a system or capability. In many organizations, the End-User will be supported by a Modeling Expert (such as a formally trained System Architect and/or Ontologist) and automated tools that conform to this specification. ***The accompanying table is not an exhaustive list of End-User Goals mapped to UAF Views.***

Table A End-User Perspective [Responsible for Program Initiation and Management]

End-User Goals	**Views**	**Comments**
Establish high-level requirements through Operational Views	Operational Views	"The Operational Views identify what needs to be accomplished in the SAR operation and who needs to accomplish it."
Mission	• The traditional OV-1 is a graphic and an accompanying textual description and can be expressed using the Ov-Sr diagrams.	What is Civilian Maritime Search and Rescue?
Requirements	• Operational Context Use Cases (Fit for Purpose	Establish "actors" (UML/SysML terminology) include the Actors: 1) Person in Distress and 2) Rescue Vessel. Establish system's boundaries
	• "SysML Requirements – Fit For Purpose View"	A formal requirements document
Establish time-phased Acquisition, Capabilities, and		Focus on Phase 1 of a 3 Phase approach

Standards corresponding to requirements		
	• St-Tx (CV-2) Strategic Taxonomy • St-Rm (CV-3) Strategic Phasing • St-Sr/CV-1 Enterprise Phases Instance Diagram o "Phase 1 is to Fulfill International Obligations" o Note Phase 1 Capabilities listed in StV-2/CV-2 Expanded Capabilities Diagram	
	• Pj-x	
	• Sd-Tx (StV-1)	List of standards or profiles of standards to be used.
Establish corresponding high-level measure of performance and the like	• Md-Tx (Metadata Taxonomy or measurement definition)	

1.3 Senior Architect

Senior architects typically work on one or more related projects. Such architects may need guidance beyond the normative UAF specification to properly model the end-user's requirements to Ontology and other parts of the UAF domain metamodel (DMM). ***The accompanying table is not an exhaustive list but a short sample of architects' concern of mapping UAF Elements to Views***.

Table B Map to Domain Meta Model

UAF Element [UAF::Metadata::Taxonomy]	**View**	**Comment**
DataModelKind	If (DIV-1, 2)	
Organization & ActualOrganization	Pr-Tx, Ar-Sr (Ov-4)	
OperationalActivity	Op-Pr (Ov-5)	
ResourceRole	Rs-Sr (SV-1)	
Capability	St-Tx Strategic Taxonomy (CV-2)	

1.4 Tool Vendor

Vendors implement the specification in commercial or specialized tools. Beyond the mission-oriented guidance provided for End Users and ontological-oriented guidance for Senior Architects, vendors need guidance in relating (implementing) the formal UAF Profile, particularly suggestions for integration with OMG SysML tools.

Each view in this document as well as the UAF profile documents contains the suggested implementation and shows an example. Alternative expresions of the views are also possible depending on architetct preference, the domain of the system to be developed, and the audience of the intended UAF architecture.

1.5 UAF View Matrix

The following is the UAF view matrix. It specifies the different model kinds across the top and the domains along the side.

	Taxonomy Tx	Structure Sr	Connectivity Cn	Processes Pr	States St	Interaction Scenarios Is	Information[c] If	Parameters[d] Pm	Constraints Ct	Roadmap Rm	Traceability Tr
Metadata[a] Md	Metadata Taxonomy Md-Tx[f]	Metadata Structure Md-Sr	Metadata Connectivity Md-Cn	Metadata Processes Md-Pr	Metadata States Md-St	-	Conceptual Data Model, Logical Data Model, Physical schema[e], real world results	Environment Pm-En, Measurements Pm-Me	Metadata Constraints Md-Ct	Metadata Roadmap Md-Rm	Metadata Traceability Md-Tr
Strategic St	Strategic Taxonomy St-Tx	Strategic Structure St-Sr	Strategic Connectivity St-Cn	-	Strategic States St-St	-			Strategic Constraints St-Ct	Strategic Deployment, St-Rm; Strategic Phasing St-Rm	Strategic Traceability St-Tr
Operational 0p	Operational Taxonomy Op-Tx	Operational Structure Op-Sr	Operational Connectivity Op-Cn	Operational Processes Op-Pr	Operational States Op-St	Operational Interaction Scenarios Op-Is			Operational Constraints Op-Ct	-	Operational Traceability Op-Tr
Services Sv	Service Taxonomy Sv-Tx	Service Structure Sv-Sr	Service Connectivity Sv-Cn	Service Processes Sv-Pr	Service States Sv-St	Service Interaction Scenarios Sv-Is			Service Constraints Sv-Ct	Service Roadmap Sv-Rm	Service Traceability Sv-Tr
Personnel Pr	Personnel Taxonomy Pr-Tx	Personnel Structure Pr-Sr	Personnel Connectivity Pr-Cn	Personnel Processes Pr-Pr	Personnel States Pr-St	Personnel Interaction Scenarios Pr-Is			Competence, Drivers, Performance Pr-Ct	Personnel Availability, Personnel Evolution, Personnel Forecast Pr-Rm	Personnel Traceability Pr-Tr
Resources Rs	Resource Taxonomy Rs-Tx	Resource Structure Rs-Sr	Resource Connectivity Rs-Cn	Resource Processes Rs-Pr	Resource States Rs-St	Resource Interaction Scenarios Rs-Is			Resource Constraints Rs-Ct	Resource evolution, Resource forecast Rs-Rm	Resource Traceability Rs-Tr
Security Sc	Security Taxonomy Sc-Tx	Security Structure Sc-Sr	Security Connectivity Sc-Cn	Security Processes Sc-Pr	-	-			Security Constraints Sc-Ct	-	Security Traceability Sc-Tr
Projects Pj	Project Taxonomy Pj-Tx	Project Structure Pj-Sr	Project Connectivity Pj-Cn	Project Processes Pj-Pr	-	-			-	Project Roadmap Pj-Rm	Project Traceability Pj-Tr
Standards Sd	Standard Taxonomy Sd-Tx	Standards Structure Sd-Sr	-	-	-	-			-	Standards Roadmap Sd-Rm	Standards Traceability Sd-Tr
Actual Resources Ar		Actual Resources Structure Ar-Sr	Actual Resources Connectivity Ar-Cn	Simulation[b]					Parametric Execution/ Evaluation[b]	-	-
Dictionary Dc											
Summary & Overview Sm-Ov											
Requirements Req											

Figure 1-1 - UAF View Matrix

Due to the complexity of managing the multiple viewpoints with overlapping concerns and metamodels, the standard viewpoints are refactored as described in the donor frameworks into a more manageable format. This decision led to the development of the UAF grid which is described above.

The grid is a way of showing how the various viewpoints (known as *view specifications* in the rest of document) correspond to *domains* (horizontal rows) and the *model kinds* (the columns) that describe the view specification. The intent of the grid is not to be complete, but to capture the information that is present in the frameworks that contributes to the UAF, consequently, some gaps are evident.

Notes related to suffixes in the grid

a. The view specifications in the Metadata Domain are not modeled as part of the UAF but are architectural artifacts that contribute to the success in defining and developing an architecture.

b. To be able to evaluate architecture behavior and constraints (i.e., non-functional requirements) it is necessary to define actual instances of the architectural elements. The expectation is that tool vendors intending to implement the UAF have capabilities native to their tools to enable behavioral simulation and the evaluation of measures and constraints through parametric diagrams or a proprietary equivalent.

c. The information model is a column across the domains and can be defined in any of its forms, i.e., Conceptual, Logical or Physical. The expectation is that most developers of the information model will use the Conceptual or Logical forms of the data model when using an abstract modeling tool.

d. The parameters column captures the measures and environments across the architecture in all the different domains.

e. The expectation is that the physical schema model would not be defined in the UAF. Any tool implementing the framework provides a means to import or link-to representations of the physical model.

f. The Metadata Taxonomy view specification provides a means to extend the framework to other domains.

The detailed mapping between the view specifications of the UAF shown in the grid and the viewpoints from the donor frameworks is described in dtc\2019-05-15. A definition for each view specification in the grid is described in the following chapters.

1.5.1 Descriptions of Domains and Model Kinds

Table 1:1 - Definitions for the Domains

Domain	Acronym	Description
Metadata	Md	Identifies the metadata required to develop a suitable architecture that is fit for its purpose.
Strategic	St	Capability management process. Describes the capability taxonomy, composition, dependencies and evolution.
Operational	Op	Illustrates the Logical Architecture of the enterprise. Describes the requirements, operational behavior, structure, and exchanges required to support (exhibit) capabilities. Defines all operational elements in an implementation/solution independent manner.
Services	Sv	The Service-Orientated View (SOV) is a description of services needed to directly support the operational domain as described in the Operational View. A service within MODAF is understood in its broadest sense, as a unit of work through which a provider provides a useful result to a consumer. DoDAF: The Service Views within the Services Viewpoint describe the design for service-based solutions to support operational development

		processes (JCIDS) and Defense Acquisition System or capability development within the Joint Capability Areas.
Personnel	Pr	Defines and explores organizational resource types. Shows the taxonomy of types of organizational resources as well as connections, interaction and growth over time.
Resources	Rs	Captures a solution architecture consisting of resources, e.g., organizational, software, artifacts, capability configurations, and natural resources that implement the operational requirements. Further design of a resource is typically detailed in SysML or UML.
Security	Sc	Security assets and security enclaves. Defines the hierarchy of security assets and asset owners, security constraints (policy, laws, and guidance) and details where they are located (security enclaves).
Projects	Pj	Describes projects and project milestones, how those projects deliver capabilities, the organizations contributing to the projects and dependencies between projects.
Standards	Sd	MODAF: Technical Standards Views are extended from the core DoDAF views to include non-technical standards such as operational doctrine, industry process standards, etc. DoDAF: The Standards Views within the Standards Viewpoint are the set of rules governing the arrangement, interaction, and interdependence of solution parts or elements.
Actual Resources	Ar	The analysis, e.g., evaluation of different alternatives, what-if, trade-offs, V&V on the actual resource configurations. Illustrates the expected or achieved actual resource configurations.

Table 1:2 - Definitions of the Model Kinds

Model Kind	Acronym	Description
Taxonomy	Tx	Presents all the elements as a standalone structure. Presents all the elements as a specialization hierarchy, provides a text definition for each one and references the source of the element
Structure	Sr	Describes the definitions of the dependencies, connections, and relationships between the different elements.
Connectivity	Cn	Describes the connections, relationships, and interactions between the different elements.
Processes	Pr	Captures activity-based behavior and flows. It describes activities, their Inputs/Outputs, activity actions and flows between them.
States	St	Captures state-based behavior of an element. It is a graphical representation of states of a structural element and how it responds to various events and actions.

Model Kind	Acronym	Description
Interaction Scenarios	Is	Expresses a time ordered examination of the exchanges as a result of a particular scenario. Provides a time-ordered examination of the exchanges between participating elements as a result of a particular scenario.
Information	If	Address the information perspective on operational, service, and resource architectures. Allows analysis of an architecture's information and data definition aspect, without consideration of implementation specific issues.
Constraints	Ct	Details the measurements that set performance requirements constraining capabilities. Also defines the rules governing behavior and structure.
Roadmap	Rm	Addresses how elements in the architecture change over time. Also, how at different points in time or different periods of time.
Traceability	Tr	Describes the mapping between elements in the architecture. This can be between different viewpoints within domains as well as between domains. It can also be between structure and behaviors.

2. Problem Scenario

2.1 Problem Domain Suitability

The problem domain is civilian maritime search and rescue (SAR). Civilian SAR was selected for several reasons:

- UK MODAF 1.1 has previously used this domain to illustrate its framework .
- The scenario and modeling were easily updated to include UAF concepts including US DoDAF 2.0.
- SAR is internationally recognized problem domain with easy-to-recognize typical scenarios.
- SAR is based on publicly available International Agreements implementing or conforming National Plans including the US and the UK.
- The documentation is generally unclassified as opposed to many equivalent defense or military plans.
- Subject matter experts and periodicals are readily available.
- The domain is sufficiently large and complex involving mixed human, software, and hardware solutions. As such, it will support the current specification that includes parametric modeling from systems engineering (SysML) as well as future evolutions of UAF which may include more national and multinational architecture frameworks. Several of the countries share usage of the same automated information systems and sensors.

2.1.1 References and Notes

International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual, 2007 ed., 6th ed. London: IMO; Montreal: ICAO, 2007. IAMSAR Manual is by jointly published by the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO). It consists of a three-volume set: Volume I am Organization and Management; Volume II is Mission Co-ordination; & Volume III is Mobile Facilities.

U.S. National Search and Rescue Supplement (NSS) to the International Aeronautical and Maritime Search and Rescue Manual. National Search and Rescue Plan of the United States (US National SAR Plan).
http://www.uscg.mil/hq/cg5/cg534/manuals/Natl_SAR_Plan(2007).pdf

Search and Rescue Framework for the United Kingdom of Great Britain and Northern Ireland, Queen's Printer and Controller, June 2002. (Published by MCGA - Maritime & Coastguard Agency, Spring Place, 105 Commercial Road, Southampton. SO15 1EG.) "The organisation for Search and Rescue (SAR) in the UK is an amalgam of separate Governments Departments, the emergency services and other organisations. A number of charities and voluntary organisations dedicated to SAR also play a significant role. The purpose of this document is to provide a management framework for SAR in the UK. (back cover)".
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/291770/mca_uksar.pdf
ON SCENE - The Journal of U. S. Coast Guard Search and Rescue. Summer 2008, "Exceptional SAR Stories", pp. 29 – 40 for more detailed scenarios similar to the Problem Scenario and Fall 2003, "SPECIAL SECTION - SAR Case Studies: A Review", pp. 18 -28 regarding performance standards.
https://www.uscg.mil/hq/cg5/cg534/On%20Scene/OSSum2008.pdf

USCG, "SAR System Performance Benchmark" – "Percent of lives saved from imminent danger in the maritime environment" and sub benchmarks. http://uscg.mil/hq/cg5/cg534/SAR_Program_Info.asp (Current as of 29 April 2009).

Acknowledgements

The scenario is derived from the UK Search and Rescue framework, which is publicly available on the internet. The sample problem is based on a concept derived by VEGA under contract for the UK MOD. The UAF Submission Team

acknowledges its debt owed to the authors of the original problem:

Ian Bailey of Model Futures, Peter Martin of Logica CMG, and Paul King of Vega

We have modified it to make it more generic to allow it to apply to SAR architecture for any country. This allows us to communicate the use of UAF without the need for too much detail or getting involved in the particular procedures of any given country. Consequently, there will be “errors” in the specifics of the procedures. Any suggestions on how to improve the model would of course be gratefully received by the authors.

2.2 Summary

We have included as many of the UAF diagrams as is possible given time and effort constraints. In addition, presenting an architecture is something like telling a story with the exception that in this case the elements interrelate to an extent that it is difficult to pick a natural order. Consequently, we have decided to present them by view as that will at least make them easier to find when attempting to cross reference them.

Fortunately, while DoDAF 2.0 and MODAF 1.2 often differ in specific names and other terminologies related to Views/Diagrams, the intent is similar enough to allow a description of simple variants of most of these. The DoDAF and MODAF diagrams have been integrated in such a way that the example diagrams reflect both architecture frameworks. The exception to this is the MODAF service views. They have been shown in their own section. For this reason, we have expressed the example in UAF format.

2.3 The “Yacht in Distress” Scenario

The Sample Problem applies UAF to a common scenario in civilian maritime Search and Rescue (SAR) operations -- 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 civilian voluntary sea rescue organization. This section is structured to show each diagram in the context of how it might be used in such an example problem.

3. Part One: Views

3.1 Package Overview (Structure of the Sample Model)

3.1.1 Acronyms

The table below provides definitions for acronyms used in this sample problem.

Table 3-1 - Acronyms

DoT	Department of Transport
NIMROD	Aircraft name
MRA	Maritime Role Aircraft
ESM	Electronic Signal Monitoring
TDM	Time Division Multiplex
MRT	Maritime Rescue Team
SAR	Search and Rescue
C2	Command and Control

3.1.2 Model Structure

The following diagram shows the package structure of the model. It reflects the main domains of the UAF.

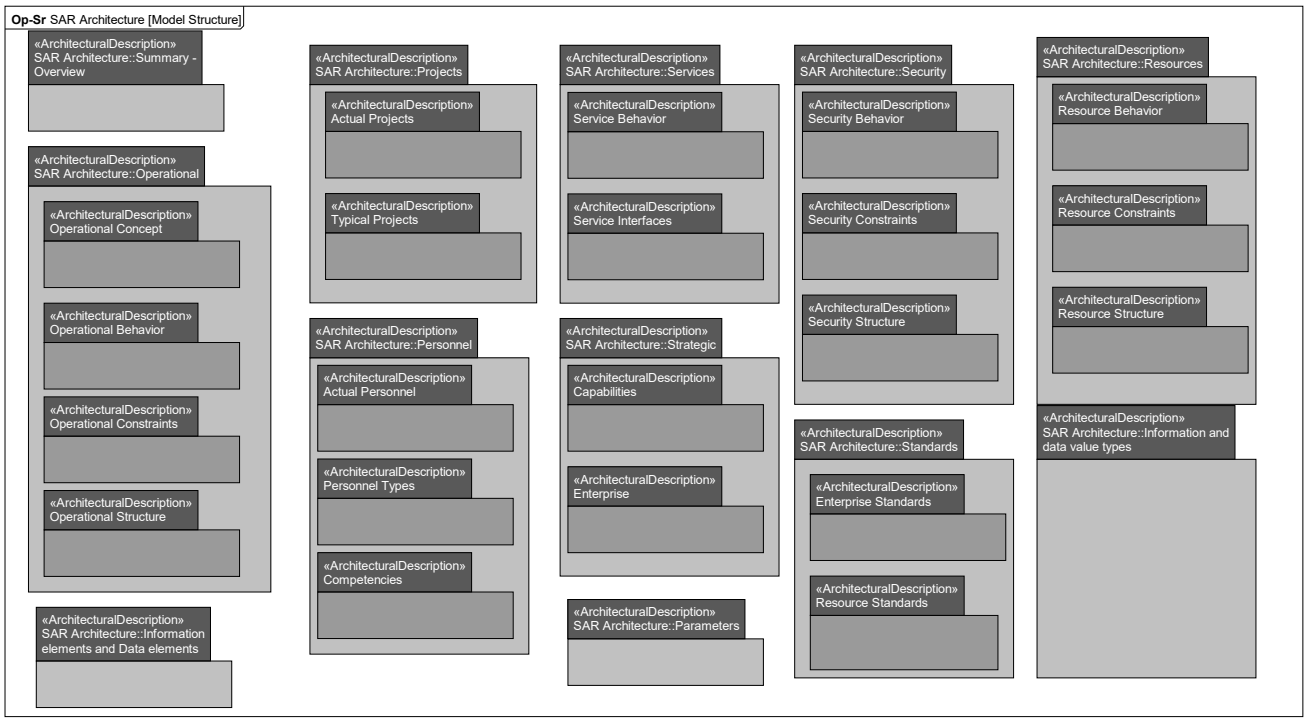

Figure 3:1 – Model Structure Package Diagram

Typical projects will reflect additional model structure such as process and possibly reusable components. Projects can use this structure as a starting point.

4. Summary and Overview

This view provides overview and summary information as well as an integrated dictionary. This information is provided in a consistent form that allows quick reference and comparison among architectures.

4.1 View Specifications::Summary & Overview (AV-1)

View Specifications::Summary & Overview::Summary & Overview

Stakeholders: Decision makers, Solution Providers, Systems Engineers, Software Architects, Business Architects.
Concerns: quick overview of an architecture description and summary of analysis. In the initial phases of architecture development, it serves as a planning guide. Upon completion of an architecture, it provides a summary of findings, and any conducted analysis.
Definition: provides executive-level summary information in a consistent form that allows quick reference and comparison among architectures. The Summary and Overview includes assumptions, constraints, and limitations that may affect high-level decision processes involving the architecture.
Recommended Implementation: text, free form diagram, table format.

The text shown in Figure 4-1 below provides executive-level summary information in a consistent form that allows quick reference and comparison between architectural descriptions. It includes assumptions, constraints, and limitations that may affect high-level decisions relating to an architecture-based work program.

Architecture Project Identification

Name:

SAR Architecture

Architect:

Bill Firenz

Developing Organization:

Maritime & Coastguard Agency

Assumptions & Constraints:

None.

Approval Authority:

Howard Overtree, Project Manager

Date Completed:

TBD

Scope

Views & Products Developed

Summary - Overview

[Architectural Description] Summary - Overview [SmOv]

SAR Architecture [Model Structure]

Resource Structure [DC Table]

Resource Structure [Dc]

[Architectural Description] Operational Use Cases [UCD]

[Architectural Description] Requirements [Req]

[Architectural Description] Requirements [Req Links]

[Architectural Description] Requirements [Req Table]

Capability/Strategic Views - Strategic

Enterprise Definitions [St-Sr]

Capabilities Taxonomy [St-Tx]

Capabilities Connectivity [St-Sr Definition]

Capabilities States [St-St]

Capabilities States [St-St Actual]

Strategic Constraints [St-Ct]

Capabilities Roadmap [St-Rm-Ph]

Capabilities [St-Rm-De]

Actual Enterprise [St-Sr Actual]

Capabilities Connectivity [St-Cn Def]

Maritime SAR Phase 1 [St-Cn]

Maritime SAR Phase 2 [St-Cn]

Maritime SAR Phase 3 [St-Cn]

Maritime SAR Phase 4 [St-Cn]

Operational Behavior Traceability [St-Tr]

Capabilities Traceability [St-Tr Matrix]

Data and Information Views

[Architectural Description] Security Measurements [bdd]

[Package] 01 Data structures [bdd]

[Package] 02 Integer value types [bdd]

[Package] 04 String value types [bdd]

[Package] 05 Enumerations [bdd]

[Package] Common arrays [bdd]

[Package] Maritime SAR C2 [bdd]

[Package] Maritime SAR C2 if [bdd]

[Package] Maritime search and rescue [bdd]

[Package] Maritime search and rescue [bdd]

[Package] Medical assistance [bdd]

[Package] Medical assistance [bdd]

[Package] Monitoring [bdd]

[Package] Monitoring [bdd]

[Package] Patient transportation [bdd]

[Package] Patient transportation [bdd]

[Package] Primitive Value Types [Primitive Value Type model library]

[Package] Rescuing [bdd]

[Package] Rescuing [bdd]

[Package] Safe place handling [bdd]

[Package] Safe place handling [bdd]

[Package] Searching [bdd]

[Package] Searching [bdd]

[Package] SysML Types [bdd]

Operational Data Model [IF - Phase 1 Taxonomy]

Resource Data Model [IF Data Mapping]

Resource Data Model [IF Definition]

Operational Data Model [Pm-Me - Phase 1 Structure]

Parameter Views

Environment [Definition] [Pm-En]

Environment [Actual] [Pm-En]

Measurement Sets [Definition] [Pm-Me]

Security Measurements [Pm-Me]

Measurement Sets [Actual] [Pm-Me]

Required service levels [Pm-Me]

Security Measurements Actual [Pm-Me Security]

Service Specifications [Pm-Me]

Operational Views

Operational Concept [Op-Tx]

SAR High Level Operational Concept [Op-Sr Graphic]

SAR High Level Operational Concept [Op-Sr]

Operational Structure Taxonomy [Op-Tx]

Operational Structure [Op-Sr Exchanges]

Operational Structure [Op-Sr Structure]

SAR Architecture ph1 [Op-Sr Internal]

Operational Structure [Op-Cn Table]

SAR Architecture [Op-Cn Table]

Operational Constraints [Op-Ct Definition]

[Architectural Description] Operational Constraints [Op-Ct Matrix]

SAR Architecture [Op-Is Distress Signal]

Operational Behavior [Op-Pr Rescue]

[Operational Activity] Rescue [Op-Pr]

Operational Behavior [Op-Pr Search]

[Operational Activity] Search [Op-Pr]

[Searcher Ph1] States [Op-St]

Operational Behavior Traceability [Op-Tr Def]

Operational BehaviorTraceability [Op-Tr Matrix]

Operational Structure Traceability[Op-Tr Def]

Operational StructureTraceability [Op-Tr Matrix]

Actual Resources [Ar-Sr]

Actual Resources [Ar-Cn]

Actual Resources [Ar-Cn Matrix]

Project/ Acquisition Views

Typical Projects Definition [Pj-Sr Project Structure]

Typical Projects Taxonomy [Pj-Tx]

SAR Development Project [Pj-Sr]

[Architectural Description] Timeline Actual Projects [Pj-Rm]

Typical Projects Traceability [Pj-Tr]

Typical Projects Traceability [Pj-Tr Matrix]

Service Orientated Views

Service Specifications [Sv-Tx Measurement Def]

Service Specifications [Sv-Tx Policy Definition]

01 Search and Rescue Interface Definition

02 Monitoring Interface Definition

03 Maritime SAR C2 Interface Definition

04 Rescuing Interface Definition

05 Searching Interface Definition

06 Safe place handling interface definition

07 Medical Assistance Interface Definition

08 Patient transportation interface definition

Service Specifications Maritime S&R [Sv-Sr]

Service Specifications [Sv-Sr Measurement Def]

Service Specifications [Sv-Cn]

Maritime Search and Rescue version 1 [Sv-Cn]

Service Specifications [Sv-Tr]

Service Specifications [Sv-Tr Matrix]

[Architectural Description] Service Specifications [Sv-Ct]

Maritime Search and Rescue [Sv-Is]

Safe place handling [Sv-Is]

Service Functions Monitoring Functions [Sv-Pr]

[Service Function] Monitoring Function [Sv-Pr]

Service Functions [Sv-Pr Matrix]

Service Specifications [Sv-Rm Def Monitoring]

Service Specifications [Sv-Rm Definition MSAR]

Maritime search and rescue services [Sv-Rm]

Monitoring services [Sv-Rm]

Maritime Search and Rescue [Sv-Sr]

Maritime Search and Rescue Version 1 [Sv-Sr]

Maritime Search and Rescue Version 2 [Sv-Sr]

Maritime Search and Rescue version 3 [Sv-Sr]

[Service State Description] Safe place handling [Sv-St]

[Service State Description] Monitoring Service Version 1 State Description [Sv-St]

[Service State Description] Monitoring Service Version 2 State Description [Sv-St]

[Service State Description] Monitoring Service Version 3 State Description [Sv-St]

Resource Views

Resource Structure [Rs-Tx]

[Architectural Description] Resource Structure [Rs-Tx]

Resource Structure [Rs-Sr Maritime Rescue Unit v1]

Resource Structure [Rs-Sr Marine Arch v1]

Resource Interfaces [Rs-Sr Interfaces]

Maritime Rescue Architecture [Rs-Sr]

Maritime Rescue Unit v1 [Rs-Sr]

Resource Structure [Rs-Ct Applied]

Resource Constraints [Rs-Ct Definition]

Actual Resource Constraints [Rs-Ct Actual]

[Architectural Description] Resource Structure [Rs-Ct Matrix]

Resource Structure [Rs-Cn Table]

Maritime Rescue Architecture v1 [1Rs-Is]

Resource Behavior [Rs-Pr Helicopter]

Helicopter State Description] [Rs-St]

Resource Behavior [Rs-Pr]

Access SAR System [Rs-Pr Security]

Resource Forecast [Rs-Rm-Fo Definition]

Resource Behavior [Rs-Tr]

Resource Structure [Rs-Tr Behavior Matrix]

Personnel Views

Personnel Types [Pr-Tx Rescue Team]

Personnel Types [Pr-Tx]

Personnel Types [Pr-Sr Rescue Team]

Personnel Types [Pr-Sr Responsibility]

SAR Rescue Team [Pr-Sr IBD]

SAR Rescue Team [Pr-Is Rescue Order]

SAR Rescue Team [Pr-Is Search Order]

Actual Personnel [Ar-Sr Fills Posts]

Personnel Processes [Pr-Tr]

Personnel Processes [Pr-Tr Matrix]

SAR Rescue Team [Pr-Cn Table]

Personnel Competencies [Pr-Ct-Co]

Personnel Drivers [Pr-Ct-Dr]

[Architectural Description] Personnel Types [Pr-Ct-Dr Table]

Actual Personnel [Pr-Ct-Pe Competencies]

Actual Personnel Meas [Pr-Ct-Pe Actual]

Personnel Performance Measures [Pr-Ct-Pe Definition]

Personnel Processes [Pr-Ct-Pe Performance]

Personnel Processes [Pr-Pr]

[Function] Rescue Victim [Pr-Pr]

Actual Personnel [Pr-Rm-Av Structure]

Personnel Types [Pr-Rm-Av]

Actual Personnel [Pr-Rm-Av]

[SAR Rescue Team State Description] [Pr-St]

Security Views

Security Structure [Sc-Tx Taxonomy]

Security Structure [Sc-Sr Structure]

Security Constraints [Sc-Tr Def]

Security Constraints [Sc-Tr Risk]

Communication Redundancy [Sc-Cn Table]

Security Constraints [Sc-Ct]

Security Behavior [Sc-Pr]

[Architectural Description] Security Structure [Sc-Ct]

Communication Redundancy [Sc-Sr]

Standards Views

Enterprise Standards [Sd-Tx]

Enterprise Standards [Sd-Rm Definition]

Resource Standards [Sd-Rm Definition]

Resource Standards [Sd-Rm Timeline]

Resource Standards [Sd-Tr Matrix]

Resource Standards [Sd-Tr]

Time Frames Addressed:

Present.

Organizations Involved:

Department of Transport, Maritime & Coast Guard Agency

Purpose and Viewpoint

Purpose of the Architecture:

To detect and locate mariners, aviators and recreational enthusiasts in distress.

Architecture Viewpoint:

Users of the system.

Context

Mission:

Manage, coordinate and implement SAR activities.

Doctrine, Goals & Vision:

TBD

Rules, Criteria & Conventions:

TBD

Tools and File Formats

Tools:

Integrity Modeler, Word and Excel.

File Formats:

DOCX, XLS and Integrity Modeler Models.

Findings

Analysis Results:

TBD

Recommendations:

TBD

Figure 4:1 – Summary and Overview (Sm-Ov)

5. View Specifications::Dictionary

Stakeholders: Architects, users of the architecture, Capability Owners, Systems Engineers, Solution Providers.
Concerns: Definitions for all the elements in the architecture, libraries of environments and measurements.
Definition: Presents all the elements used in an architecture. Can be used specifically to capture:

- Elements and relationships that are involved in defining the environments applicable to capability, operational concept or set of systems.
- Measurable properties that can be used to support analysis such as KPIs, MoEs, TPIs etc.

Recommended Implementation: Tabular format, SysML Block Definition Diagram.

5.1 View Specifications::Dictionary::Dictionary

Stakeholders: Solution Providers, Systems Engineers, Software Architects, Business Architects.
Concerns: provides a central reference for a given architecture's data and metadata. It enables the set of architecture description to stand alone, with minimal reference to outside resources.
Definition: contains definitions of terms used in the given architecture. It consists of textual definitions in the form of a glossary, their taxonomies, and their metadata (i.e., data about architecture data), including metadata for any custom-tailored views. Architects should use standard terms where possible (i.e., terms from existing, approved dictionaries, glossaries, and lexicons).
Recommended Implementation: text, table format.

Architecture development projects not using model-based techniques would often create an initial dictionary defining terms and names for the different model elements. Diagrams created in Microsoft PowerPoint or Visio would then be checked against this dictionary to ensure compliance. A model-based architecture using UAF has in-built consistency in that elements appearing on different diagrams will have the same name as they are the same object. Consequently, the Dc diagrams are reports generated from the model, which itself is the architecture dictionary. Table 5-1 shows a generated report of the Capability Configurations in the model. There are fields for the name, the complete name in the model package hierarchy, the definition of the element.

The table below is a list of the Capability Configurations in the model.
Table 5-1 – Resource Structure [Dc Table]

Capability Configuration		
Name	**Full Scoped Name**	**Description**
Civilian Boat	SAR Architecture::Resources::Resource Structure::Civilian Boat	
Helicopter	SAR Architecture::Resources::Resource Structure::Helicopter	
Maritime Rescue Unit v1	SAR Architecture::Resources::Resource Structure::Maritime Rescue Unit v1	
Monitoring System	SAR Architecture::Resources::Resource Structure::Monitoring System	
Naval Ship	SAR Architecture::Resources::Resource Structure::Naval Ship	
Rescue Ship	SAR Architecture::Resources::Resource Structure::Rescue Ship	

6. View Specifications::Requirements

6.1 View Specifications::Requirements::Requirements

Stakeholders: Requirement Engineers, Solution Providers, Systems Engineers, Software Engineers, Systems Architects, Business Architects.
Concerns: provides a central reference for a set of stakeholder needs expressed as requirements, their relationship (via traceability) to more detailed requirements and the solution described by the architecture that will meet those requirements.
Definition: used to represent requirements, their properties, and relationships (trace, verify, satisfy, refine) between each other and to UAF architectural elements.
Recommended Implementation: SysML Requirement Diagram, tabular format, matrix format.

One of the two principal extensions to OMG SysML is support for requirements. The «requirement» stereotype extends class to specify the textual "shall" statement and capture the requirement id#. The requirement diagram is used to integrate the system models with text-based requirements that are typically captured in requirements management tools. The UML containment relationship (circle with a plus sign) is used to decompose a requirement into its constituent requirements. A requirement is related to other key modeling artifacts via a set of stereotyped dependencies. The «deriveReqt» and «satisfy» dependencies describe the derivation of requirements from other requirements and the satisfaction of requirements by design, respectively. The «verify» dependency shows the link from a test case to the requirement or requirements it verifies. In addition, the UML «refine» dependency is used to indicate that an OMG SysML model element is a refinement of a textual requirement, and «a copy» relationship is used to show reuse of a requirement within a different requirement hierarchy. The «rationale» concept can be used to annotate any model element to identify supporting rationale including analysis and trade studies for a derived requirement, a design or some other decision.

As UAF has been built upon SysML, requirements can be integrated into the model as their own viewpoint as shown in Figure 6-1. SysML traceability relationships can be used as shown in Figure 6-2. The capabilities trace to the requirements and the Activities refine the requirements. System elements developed later in the design cycle will satisfy these requirements.

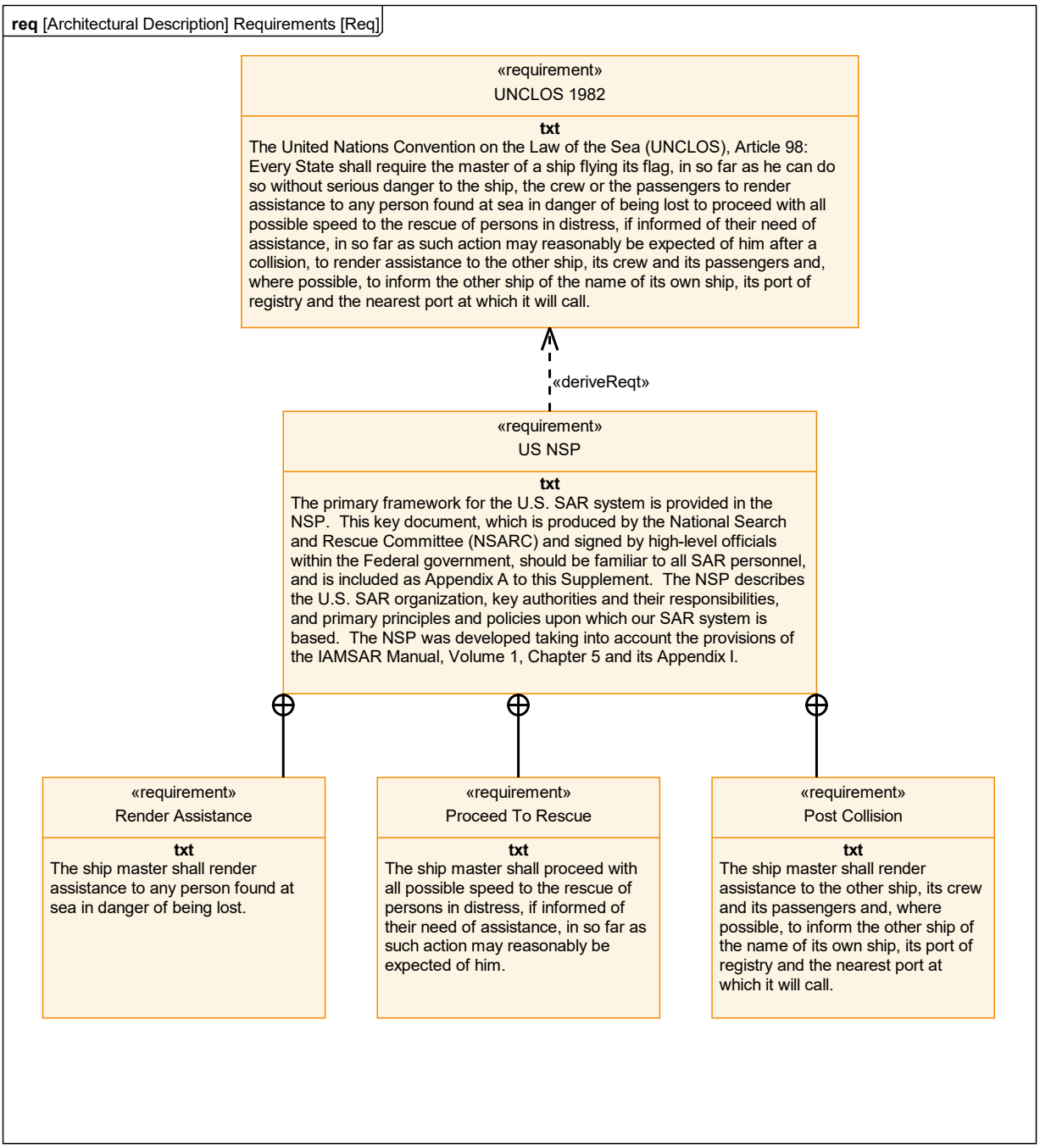

Figure 6:1 – SAR Requirements

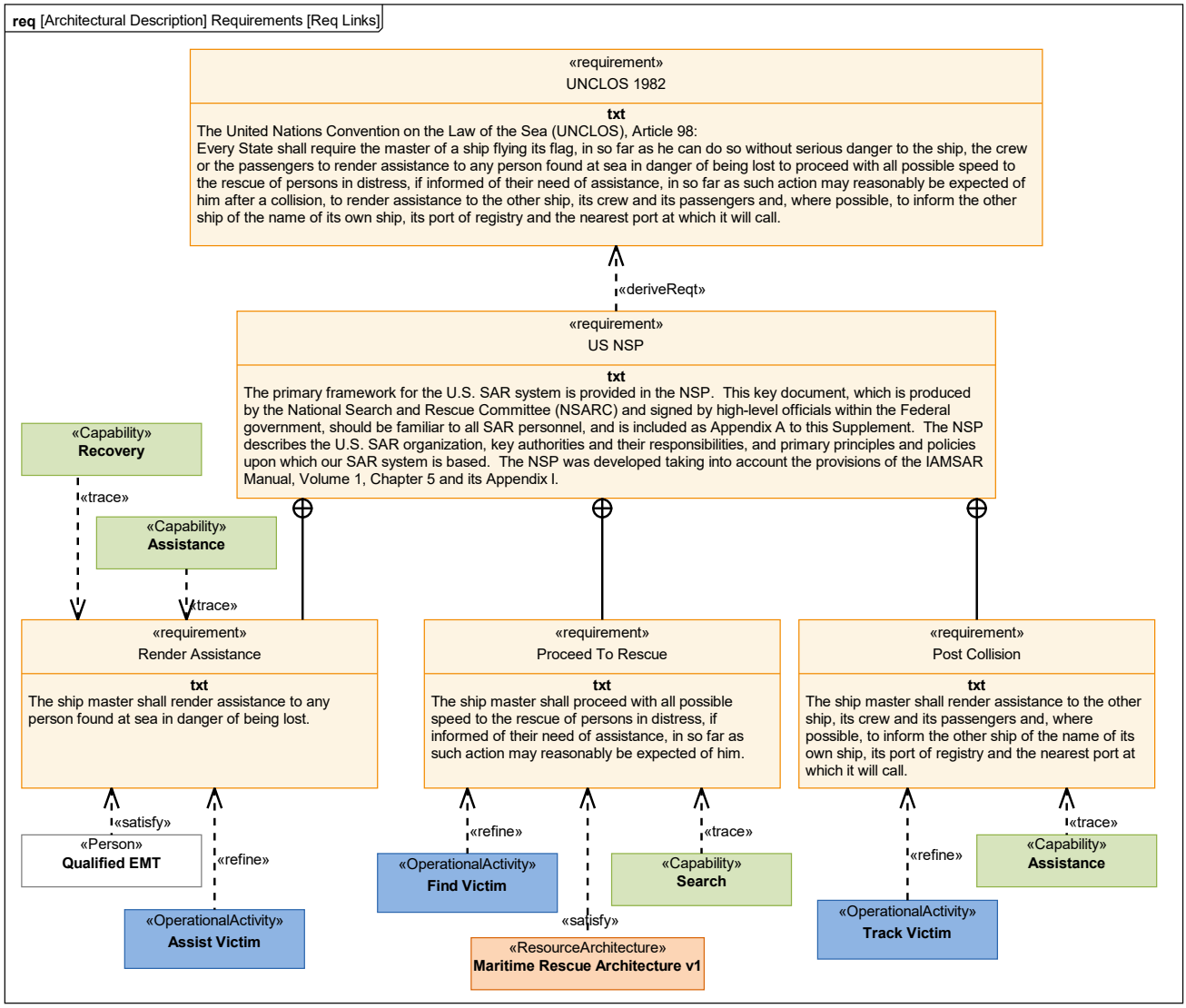

Figure 6:2 – SAR Requirements with Links

A Requirement Table presents traceability information in a tabular format. Tables can be automatically generated from the model with the traceability information such as satisfied by, refined by, and traces from as shown in Table 6-1. .

Table 6-1 Requirements Table

[Architectural Description] Requirements [Req Table]

Name	Txt	Satisfied By	Refined By	Traces From
UNCLOS 1982	The United Nations Convention on the Law of the Sea (UNCLOS), Article 98: Every State shall require the master of a ship flying its flag, in so far as he can do so without serious danger to the ship, the crew or the passengers to render assistance to any person found at sea in danger of being lost to proceed with all possible speed to the rescue of persons in distress, if informed of their need of assistance, in so far as such action may reasonably be expected of him after a collision, to render assistance to the other ship, its crew and its passengers and, where possible, to inform the other ship of the name of its own ship, its port of			
US NSP	The primary framework for the U.S. SAR system is provided in the NSP. This key document, which is produced by the National Search and Rescue Committee (NSARC) and signed by high-level officials within the Federal government, should be familiar to all SAR personnel, and is included as Appendix A to this Supplement. The NSP describes the U.S. SAR organization, key authorities and their responsibilities, and primary principles and policies upon which our SAR system is based. The NSP was developed taking into account the provisions of the IAMSAR			
Render Assistance	The ship master shall render assistance to any person found at sea in danger of being lost.	«Person» Qualified EMT	«OperationalActivity» Assist Victim	«Capability» Assistance «Capability» Recovery
Proceed To Rescue	The ship master shall proceed with all possible speed to the rescue of persons in distress, if informed of their need of assistance, in so far as such action may reasonably be expected of him.	«ResourceArchitecture» Maritime Rescue Architecture v1	«OperationalActivity» Find Victim	«Capability» Search
Post Collision	The ship master shall render assistance to the other ship, its crew and its passengers and, where possible, to inform the other ship of the name of its own ship, its port of registry and the nearest port at which it will call.		«OperationalActivity» Track Victim	«Capability» Assistance

7. View Specifications::Strategic

The diagrams in the Strategic View (DoDAF 2.0 Capability Model) provide a capability view of the SAR operation. These views will show the relationships between these capabilities and between the capabilities and the resources required to realize them.
Stakeholders: Capability Portfolio Managers.
Concerns: capability management process.
Definition: describe capability taxonomy, composition, dependencies and evolution.

7.1 View Specifications::Strategic::Taxonomy

Stakeholders: PMs, Enterprise Architects, Executives.
Concerns: capability needs.
Definition: shows the taxonomy of capabilities.
Recommended Implementation: SysML Block Definition Diagram.

Capabilities need to be characterized in terms of the properties they need to exhibit which enable the enterprise to use them to achieve the enterprise goals, as well as their relationships in an inheritance hierarchy.

Figure 7-1 shows the taxonomy for the capabilities in the SAR model.

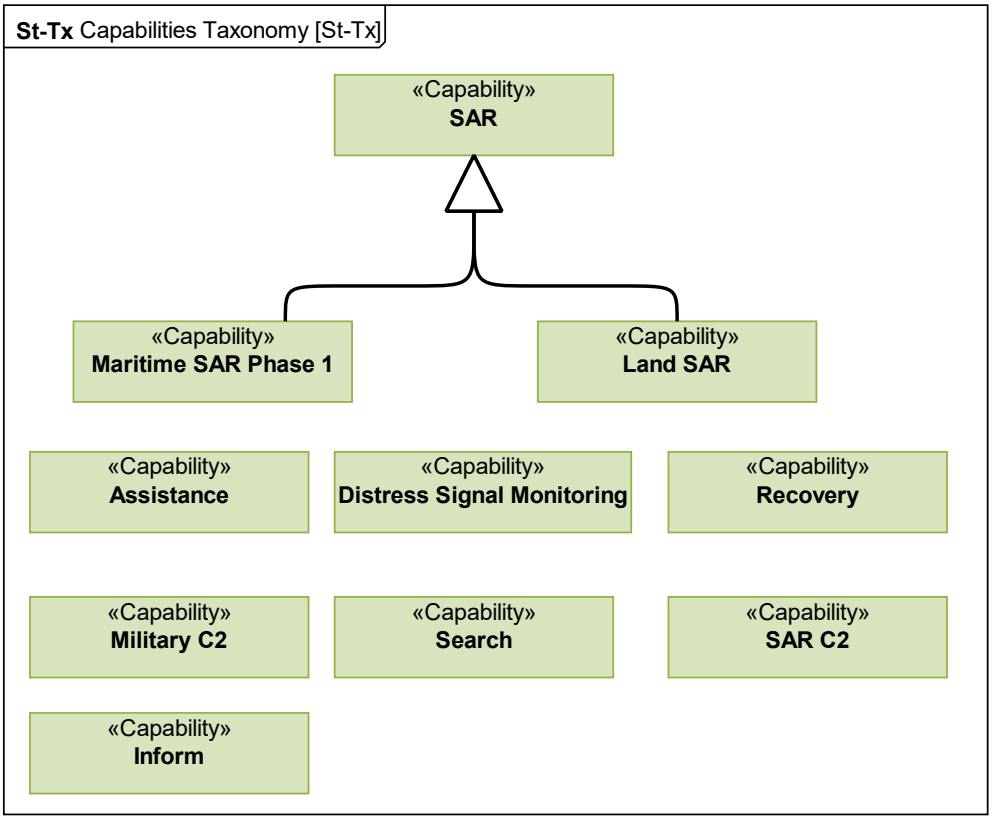

Figure 7:1 - Strategic Taxonomy [St-Tx]

7.2 View Specifications::Strategic::Structure

Stakeholders: PMs, Enterprise Architects, Executives.
Concerns: capability needs.
Definition: shows the relationship between EnterprisePhases and the Capabilities that are intended to be developed during the enterprise phases, and the organizations involved in the enterprise.
Recommended Implementation: SysML Block Definition Diagram.

Figure 7-2 shows the class diagram version of the capability clusters. Maritime SAR Phase 1 is made up of the other capabilities. That is, to achieve the Maritime SAR Phase 1 capability, all other capabilities must also be achieved.

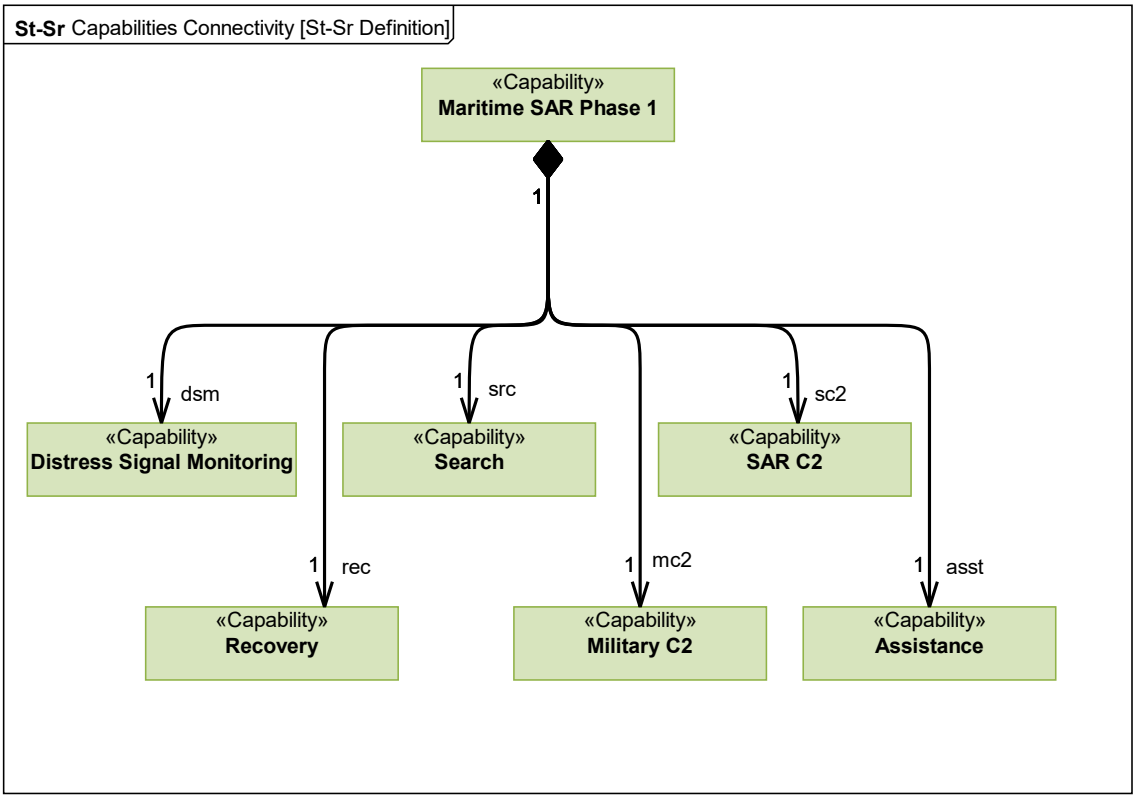

Figure 7:2 - Strategic Structure of Capabilities [St-Sr]

Figure 7.3 shows the definition of the strategic structure enterprise phases. These will be instantiated as actual enterprise phases with values associated with the instances.

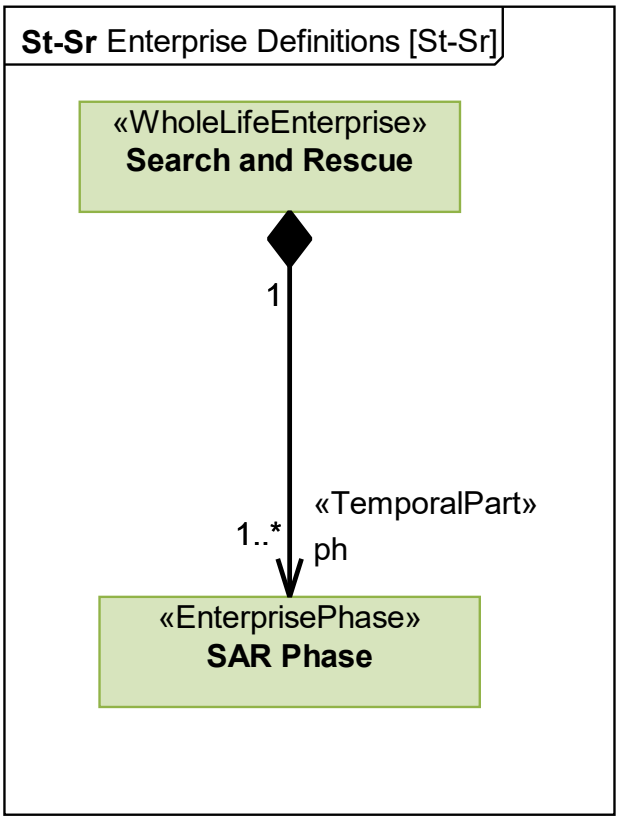

Figure 7:3 - Strategic Structure of Enterprise Phases [St-Sr]

Figure 7-4 shows the instantiation of the enterprise phases. Starting and ending times can be defined for each of these as well as capabilities delivered, resource architectures, goals, visions and other elements.

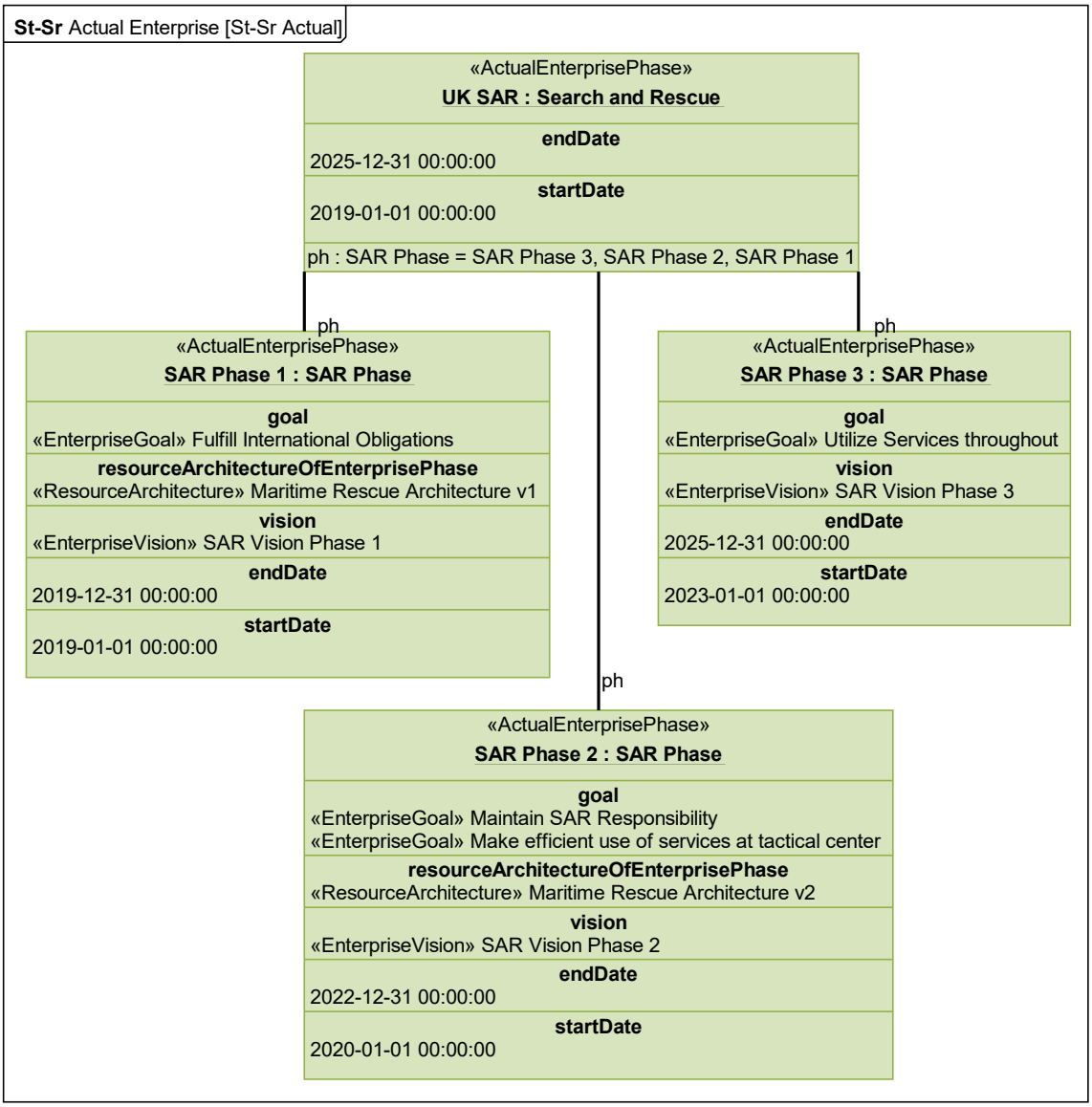

Figure 7:4 - Strategic Structure Whole Life Enterprise [St-Sr Actual]

7.3 View Specifications::Strategic::Connectivity

Stakeholders: PMs, Executives, Enterprise Architects.
Concerns: capability dependencies.
Definition: describes the dependencies between planned capabilities.
Recommended Implementation: SysML Block Definition Diagram. SysML Internal Block Diagram.

This St-Cn view addresses the logical grouping of capabilities and the dependencies between them. In Figure 7-5, SAR Command and Control (C2) depends on the Military C2 Capability. Similarly, the Assistance, Search and Recovery Capabilities are dependent upon the SAR C2 Capability, which in turn is dependent upon the Distress Signal Monitoring Capability.

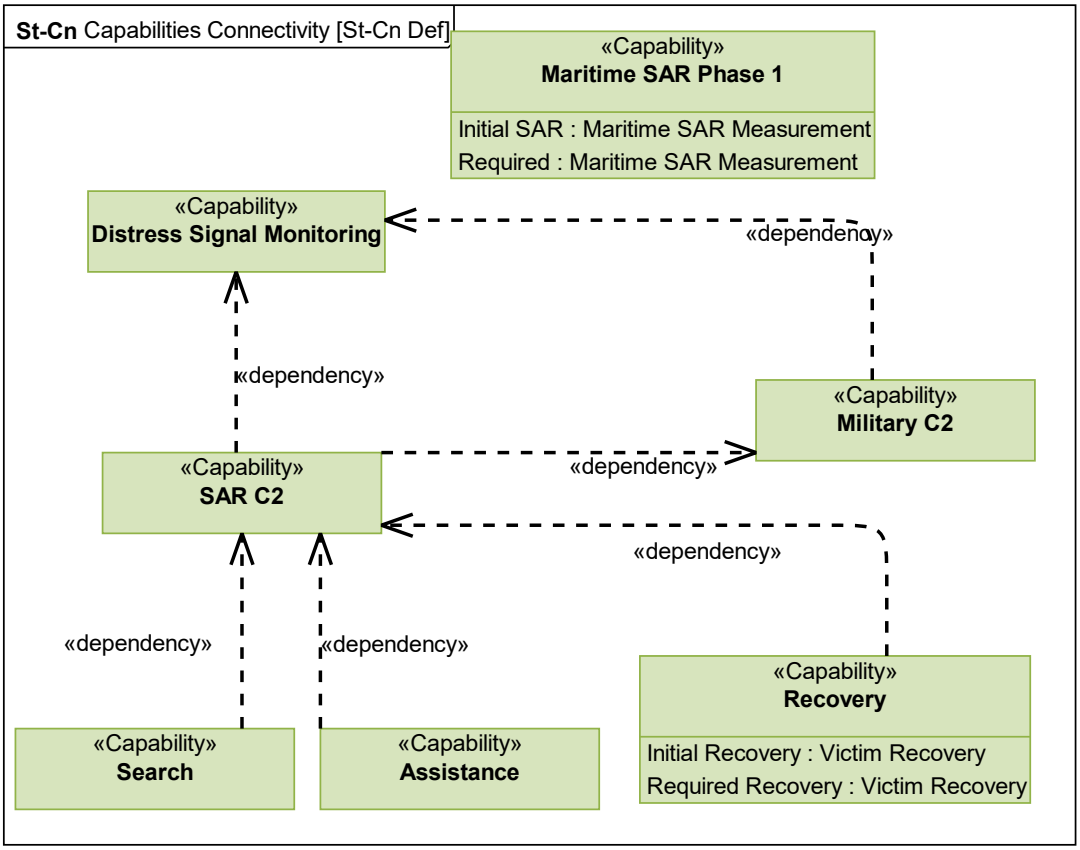

Figure 7:5 - Strategic Connectivity Class Diagram [St-Cn]

The SysML internal block diagram diagram in Figure 7-6 provides a means to define capabilities within a specific context, in this case search and rescue. The dependencies are scoped to this context.

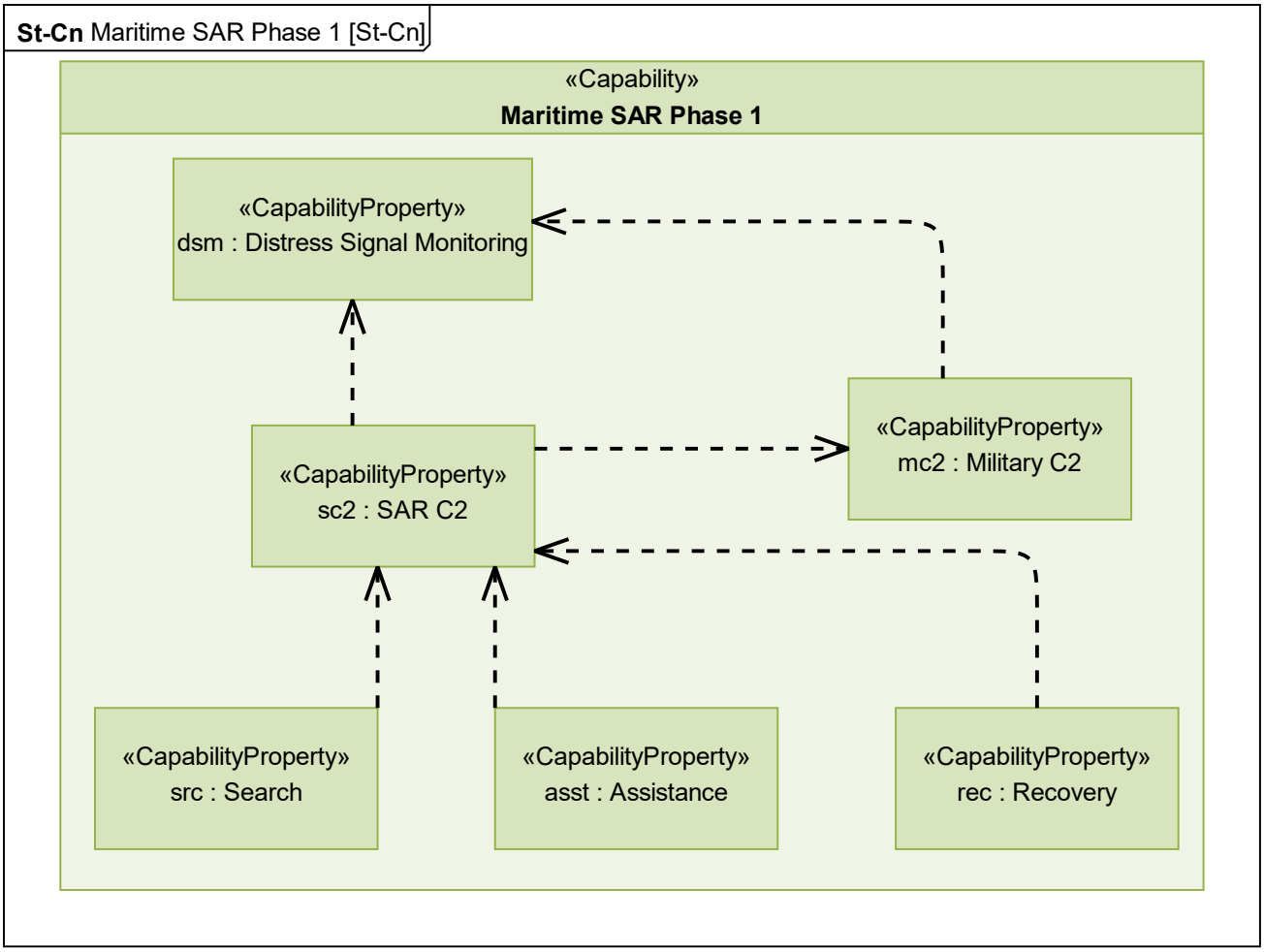

Figure 7:6 - Strategic Connectivity Internal Diagram [St-Cn]

7.4 View Specifications::Strategic::States

Stakeholders: PMs, Enterprise Architects.
Concerns: effects that the implementation(s) of capabilities are expected to deliver.
Definition: captures the relationships between capability(ies) and desired effect(s) that implementation(s) of capability(ies) should achieve.
Recommended Implementation: SysML Block Definition Diagram.

Figure 7-7 defines the different measurements required to define what the architecture is meant to achieve in quantitative measures.

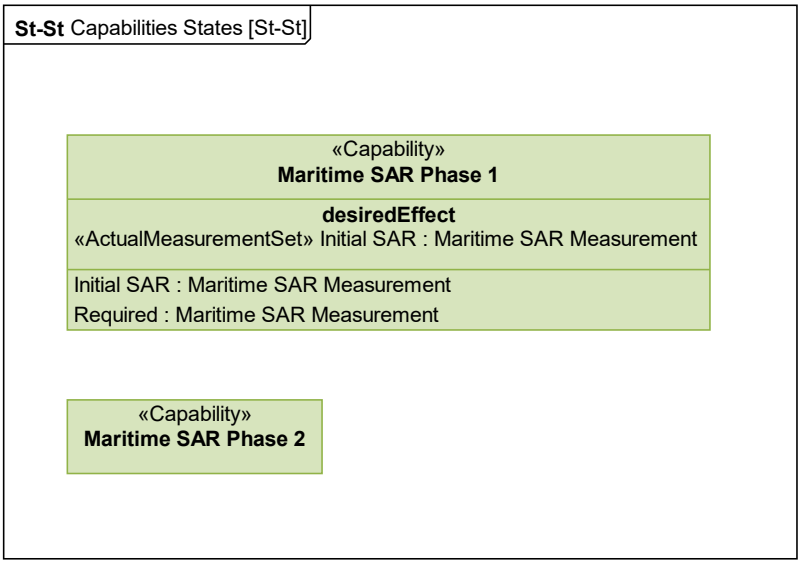

Figure 7:7 - Strategic States Definition [St-St]

Figure 7-8 defines the fielded capabilities, actual resources and achieved states of these. Actual property sets and other metrics can also be defined.

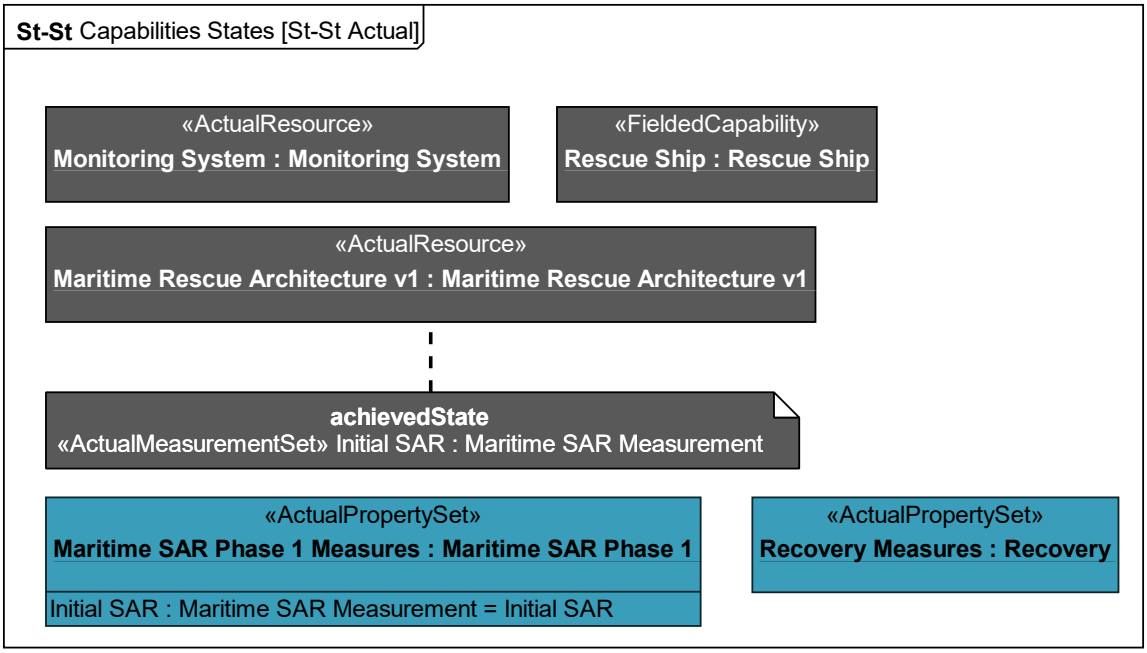

Figure 7:8 - Strategic States Actual [St-St]

7.5 View Specifications::Strategic::Constraints

Stakeholders: PMs, Enterprise Architects.
Concerns: capability constraints.
Definition: details the measurements that set performance requirements constraining capabilities.
Recommended Implementation: tabular format, SysML Block Definition Diagram.

The Strategic Constraints Domain provides a means of defining system constrains and measurements. Figure 7-9 defines the Maritime SAR Phase 1 and Recovery capabilities and their metrics.

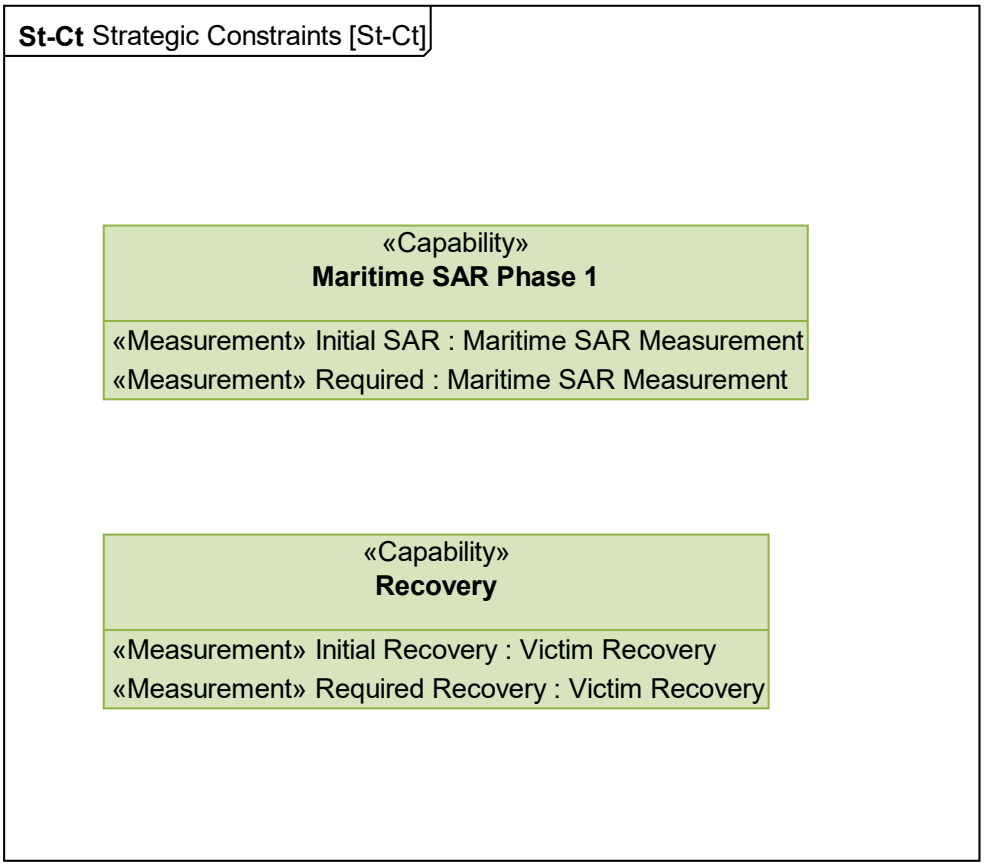

Figure 7:9 - Strategic Constraints Definition [St-Ct]

7.6 View Specifications::Strategic::Roadmap

Stakeholders: PMs, Executives, Enterprise Architects.
Concerns: capability deployment to organizations over time.
Definition: addresses the deployment of capability(ies) to actual organizations over time.
Recommended Implementation: timeline, tabular format, SysML Block Definition Diagram.

St-Rm addresses the planned achievement of capability at different points in time or during specific periods of time, i.e. capability phasing. The example shown in Table 7-1 is a generated report showing the capabilities, the systems that realize these capabilities and when they will be deployed and taken out of service, and the measurements that they are expected to achieve. Information for this report is defined using the Pr-Rm Actual Projects diagram, the Md-Tx measurements diagram, and the St-Tx Capability Taxonomy diagram.

Stakeholders: PMs, Executives, Enterprise Architects.
Concerns: capability(ies) achievement over time.
Definition: the planned achievement of capability(ies) at different points in time or during specific periods of time.
Recommended Implementation: timeline, tabular format, SysML Block Definition Diagram.

Table 7-1 Strategic Roadmap: Phasing

Capabilities Roadmap [St-Rm-Ph]

	2019												2020											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Assistance																								
[no measurements]	**Rescue Ship** (SAR Project 1 Sustainment)																							
Distress Signal Monitoring																								
[no measurements]	**Monitoring System** (SAR Project 1 Sustainment)																							
[no measurements]	**SAR HQ** (SAR Project 1 Sustainment)																							
Inform																								
[no measurements]	**C2 System** (SAR Project 1 Sustainment)																							
[no measurements]	**Monitoring System** (SAR Project 1 Sustainment)																							
[no measurements]	**SAR HQ** (SAR Project 1 Sustainment)																							
Land SAR																								
Maritime SAR Phase 1																								
[no measurements]	**Maritime Rescue Architecture v1** (SAR Project 1 Sustainment)																							
Maritime SAR Phase 2																								
Maritime SAR Phase 3																								
Maritime SAR Phase 4																								
Military C2																								
[no measurements]	**Naval Ship** (SAR Project 1 Sustainment)																							
Recovery																								
[no measurements]	**Rescue Ship** (SAR Project 1 Sustainment)																							
SAR																								
SAR C2																								
[no measurements]	**C2 System** (SAR Project 1 Sustainment)																							
[no measurements]	**SAR HQ** (SAR Project 1 Sustainment)																							
Search																								
[no measurements]	**Rescue Ship** (SAR Project 1 Sustainment)																							
[no measurements]	**Search System** (SAR Project 1 Sustainment)																							

7.7 View Specifications::Strategic::Traceability

Stakeholders: PMs, Enterprise Architects, Business Architects.
Concerns: traceability between capabilities and operational activities.
Definition: describes the mapping between the capabilities required by an Enterprise and the supporting operational activities.
Recommended Implementation: matrix format, SysML Block Definition Diagram.

This view identifies how operational activities support capabilities. Figure 7-10 shows that to achieve Recovery and Assistance Capabilities, certain Standard Operational Activities must be performed, including Monitor Health and Provide Medical Assistance.

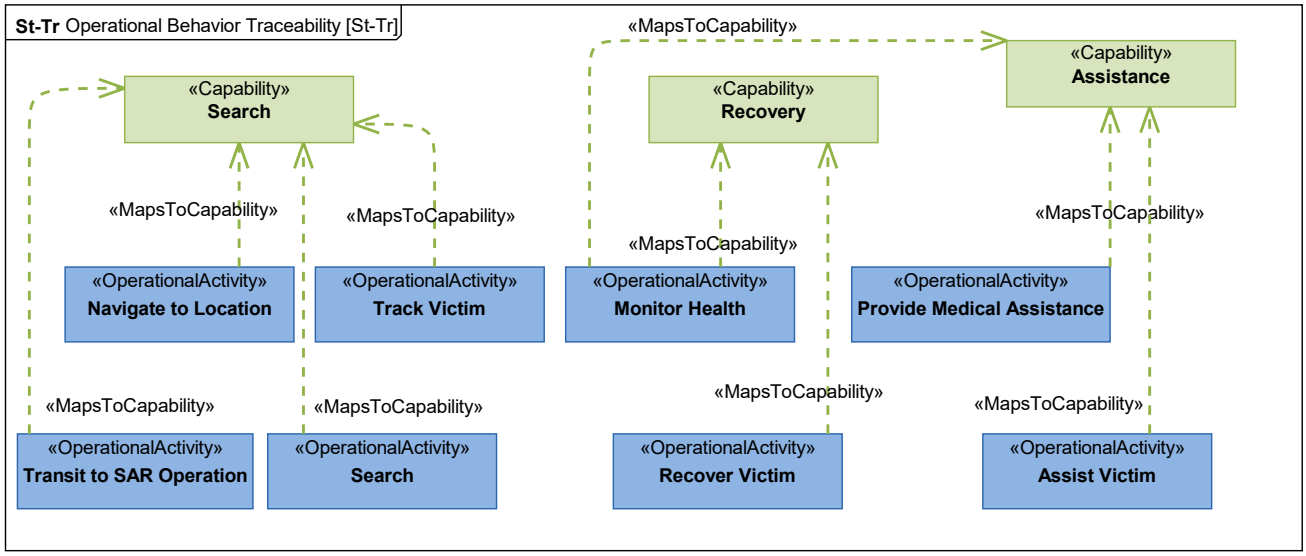

Figure 7:10 - Strategic Traceability Definition [St-Tr]

Table 7-2 is an automatically generated table showing the relationships between the capabilities and the activities that implement them.

Table 7-2 Strategic Traceability [St-Tr Table]

Capabilities Traceability [St-Tr Matrix]

		Mapped Activity														
		«OperationalActivity» Assist Victim	«OperationalActivity» Monitor Health	«OperationalActivity» Provide Medical Assistance	«OperationalActivity» Rescue	«OperationalActivity» Monitor for Distress Signals	«OperationalActivity» Process Warning Order	«OperationalActivity» Receive Distress Signal	«OperationalActivity» Send Warning Order	«OperationalActivity» Recover Victim	«OperationalActivity» Find Victim	«OperationalActivity» Navigate to Location	«OperationalActivity» Search	«OperationalActivity» Track Victim	«OperationalActivity» Transit to SAR Operation
Mapped Capability	«Capability» Assistance	X	X	X	X										
	«Capability» Distress Signal Monitoring					X	X	X							
	«Capability» Inform								X						
	«Capability» Recovery		X							X					
	«Capability» Search										X	X	X	X	X

8. View Specifications::Parameters

Stakeholders: Capability owners, Systems Engineers, Solution Providers.
Concerns: identifies measurable properties that can be used to support engineering analysis and environment for the Capabilities
Definition: Shows the measurable properties of something in the physical world and elements and relationships that are involved in defining the environments applicable to capability, operational concept or set of systems.

This view defines the types of measurements that are important to the system resources. It consists of measurable, qualitative properties. These measurements can be linked to the various elements in the model and summary reports can be generated. It is normally shown in tabular form. View Specifications::Parameters::Parameters: Environment

8.1 View Specifications::Parameters::Parameters: Environment

Stakeholders: Capability owners, Systems Engineers, Solution Providers.
Concerns: defines the environment for the capabilities.
Definition: shows the elements and relationships that are involved in defining the environments applicable to capability, operational concept or set of systems.
Recommended Implementation: SysML Block Definition Diagram.

The following diagram defines some of the environmental and condition element types to be found in a Search and Rescue context.

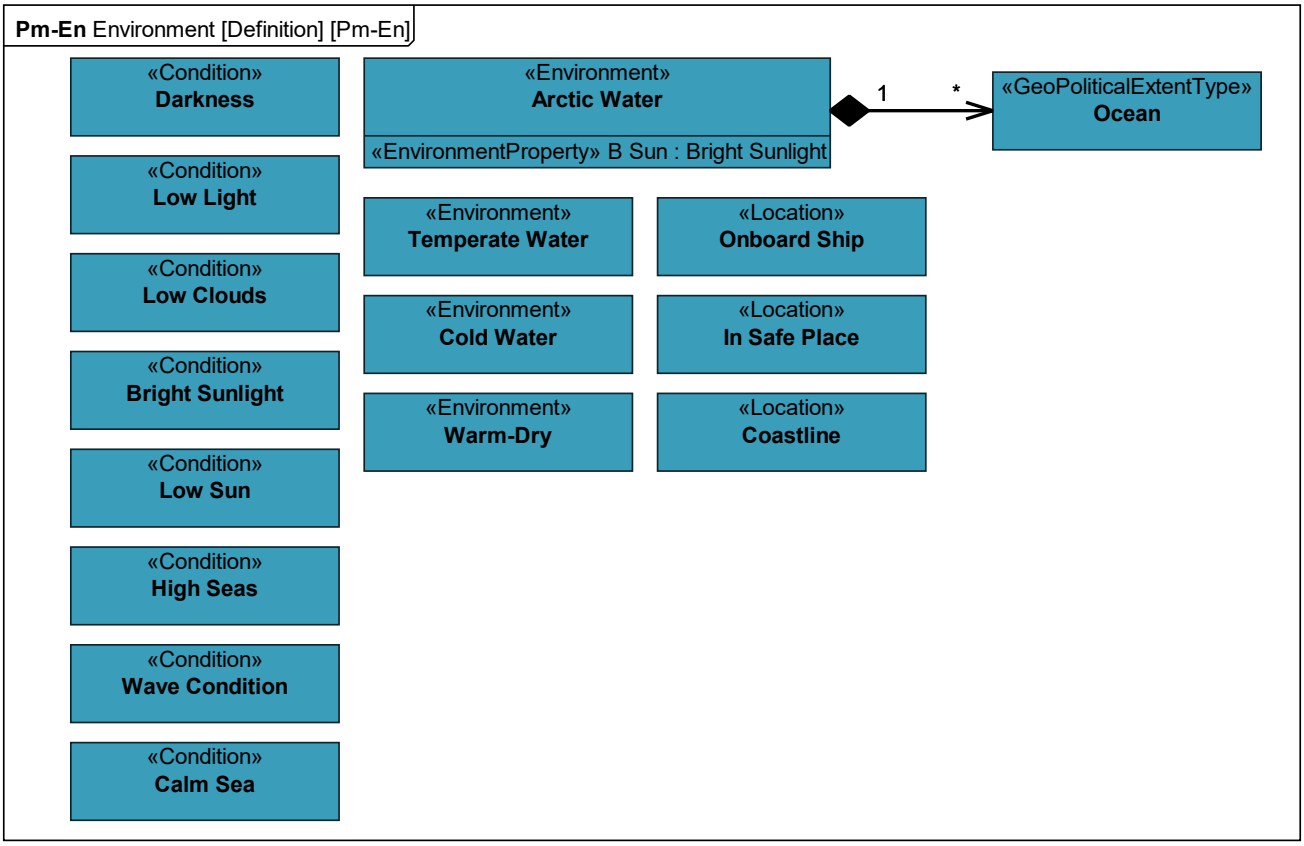

Figure 8:1 - Parameters: Environment

The following diagram defines some of the actual environmental and condition elements to be found in a Search and Rescue context.

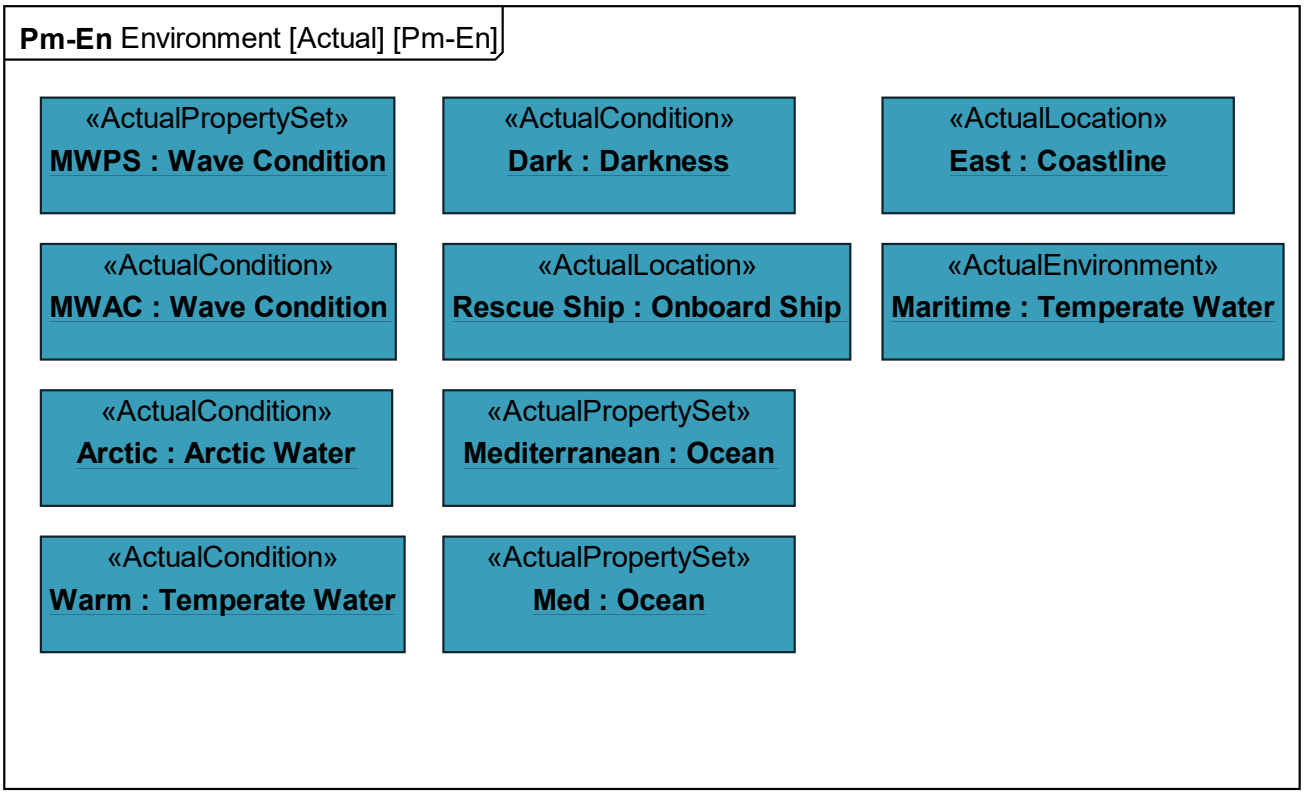

Figure 8:2 - Parameters: Environment Actual

8.2 View Specifications::Parameters::Parameters: Measurements

Stakeholders: Capability owners, Systems Engineers, Solution Providers.
Concerns: identifies measurable properties that can be used to support analysis such as KPIs, MOs, TPIs etc.
Definition: Shows the measurable properties of something in the physical world, expressed in amounts of a unit of measure that can be associated with any element in the architecture.
Recommended Implementation: SysML Block Definition Diagram.

Figure 8-3 shows the class diagram version of the measurements diagram. This provides a means of defining types of measurements that are important to the system. These consist of measurable quantitative measurements. It defines the measurements that are important to the capabilities in the strategic view such as find time and persistence, shown later. These concepts are defined in their own Views, as they can pertain to all elements in all views of the model. This is an example of the extensibility features provided by SysML enabling the easy creation of fit for purpose views.

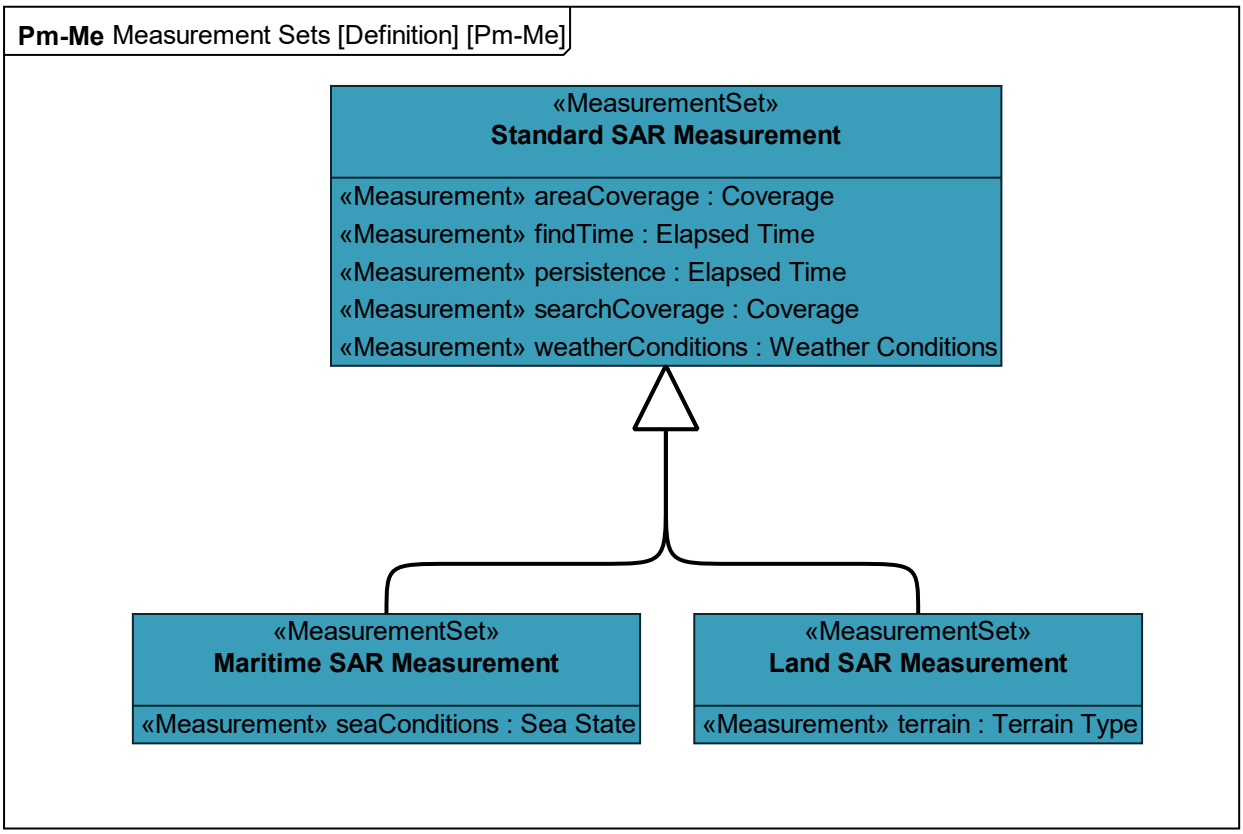

Figure 8:3 - Parameters: Measurements

In Figure 8-3 we have characterized Maritime SAR in terms of values. These include the length of a Maritime SAR operation, the sea conditions in which Maritime SAR must be deliverable, the search area covered by an operation and the time to find a victim. Figure 8-4 shows the instance diagram version of the measurements diagram. Instances of the measurements can be created and associated with architecture elements. In this case, they define the initial, and required values for SAR capabilities.

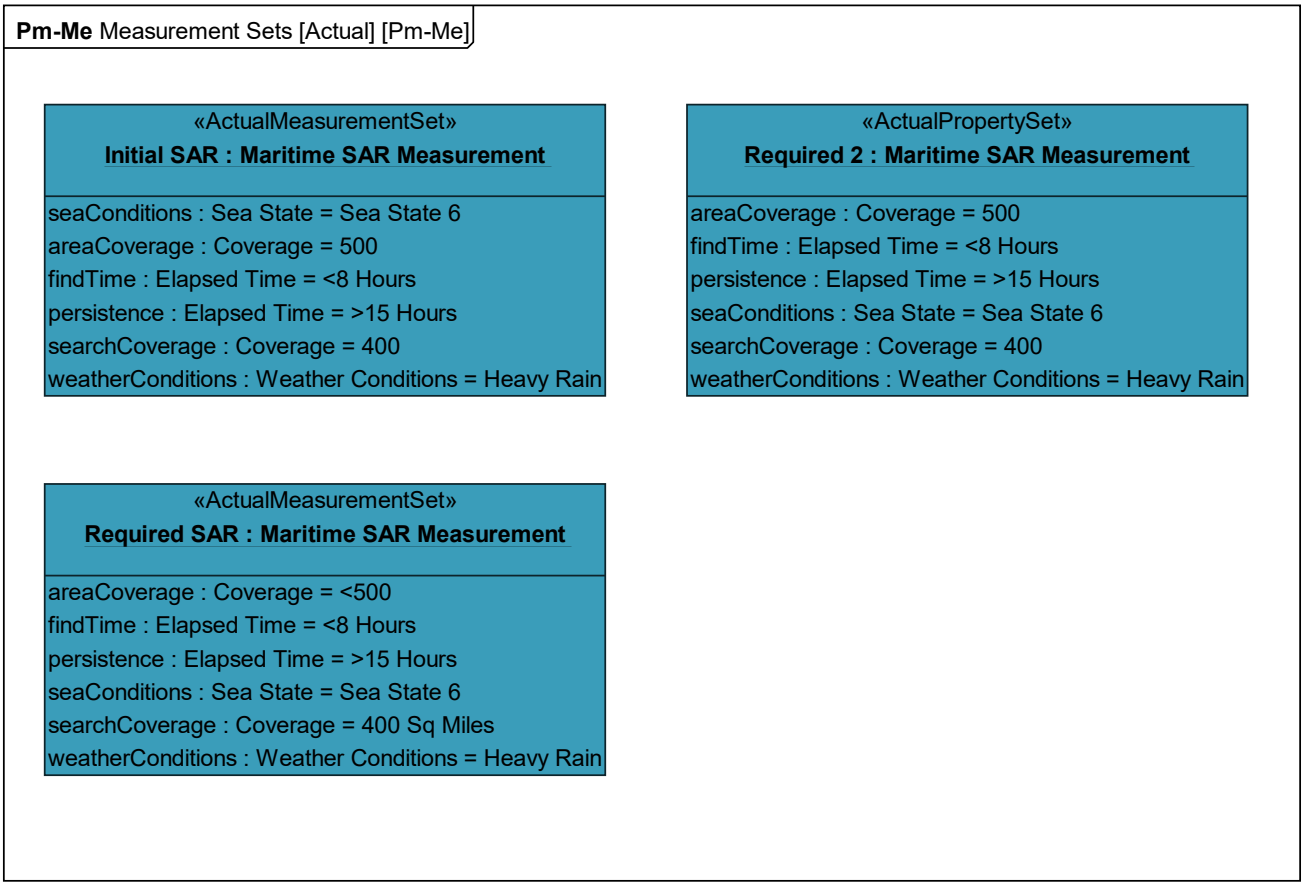

Figure 8:4 - Parameters: Measurements Actual

This SysML Block Definition Diagram (BDD) in Figure 8-5 is used to define the value types, units and quantity kinds used in the measurements for the typical and actual measurements. This allows a more precise definition of the values and eliminates ambiguity.

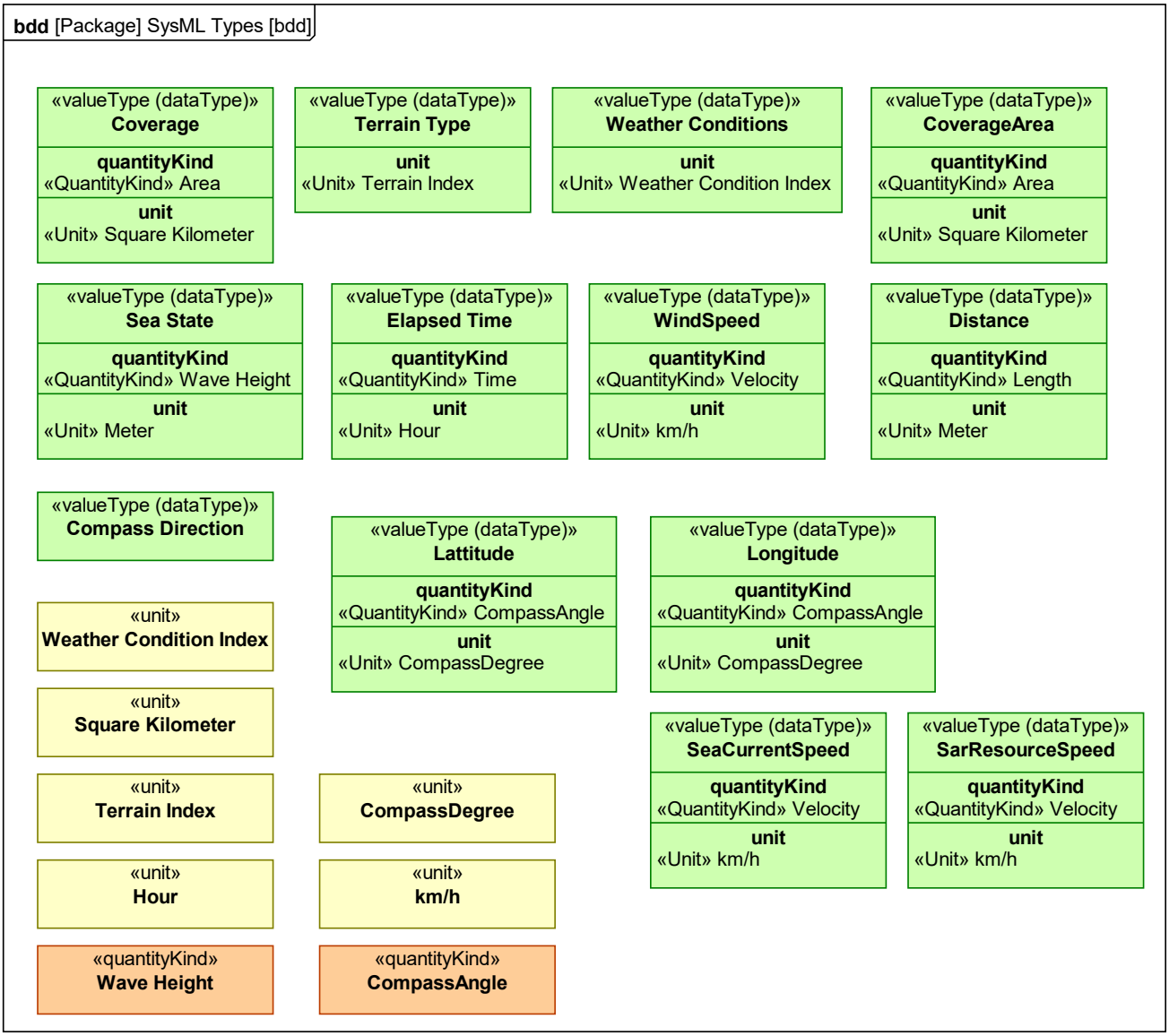

Figure 8:5 - Parameters: Measurements

9. View Specifications::Operational

Stakeholders: Business Architects, Executives
Concerns: illustrate the Logical Architecture of the enterprise.
Definition: describe the requirements, operational behavior, structure, and exchanges required to support (exhibit) capabilities. Defines all operational elements in an implementation/solution independent manner.

The Operational Views identify what needs to be accomplished in the SAR operation and who needs to accomplish it. These views describe the tasks and activities, operational elements and exchanges of information, systems and energy that are required to conduct the operations.

9.1 View Specifications::Operational::Taxonomy

Stakeholders: Business Architects, Systems Engineers, Enterprise Architects, Owners responsible for Operational Agents.
Concerns: OperationalAgent types.
Definition: shows the taxonomy of types of OperationalAgents.
Recommended Implementation: SysML Block Definition Diagram, SysML Internal Block Diagram.

Figure 9-1 defines the Taxonomy of OperationalPerformers to be used in the SAR phases.

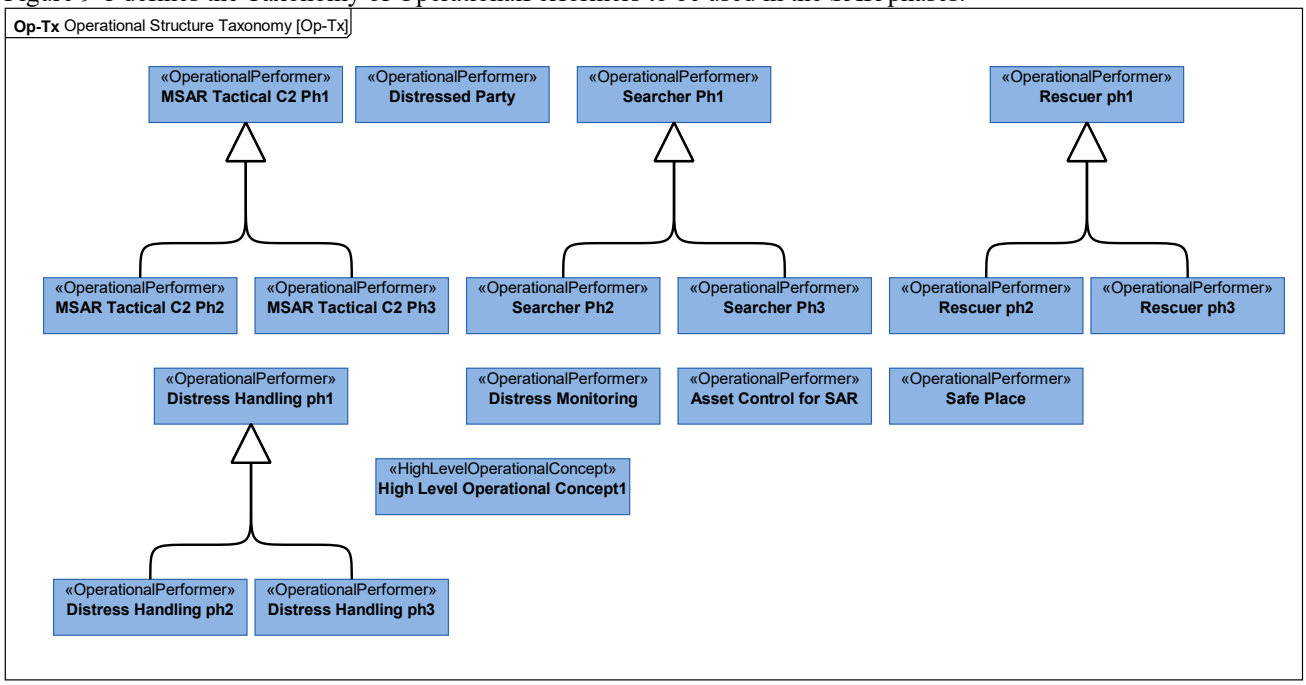

Figure 9:1 - Operational Taxonomy

Figure 9-2 defines the elements that will be used in the SAR High Level Operational Concept. This is further defined in Figures 9-3 and 9-4.

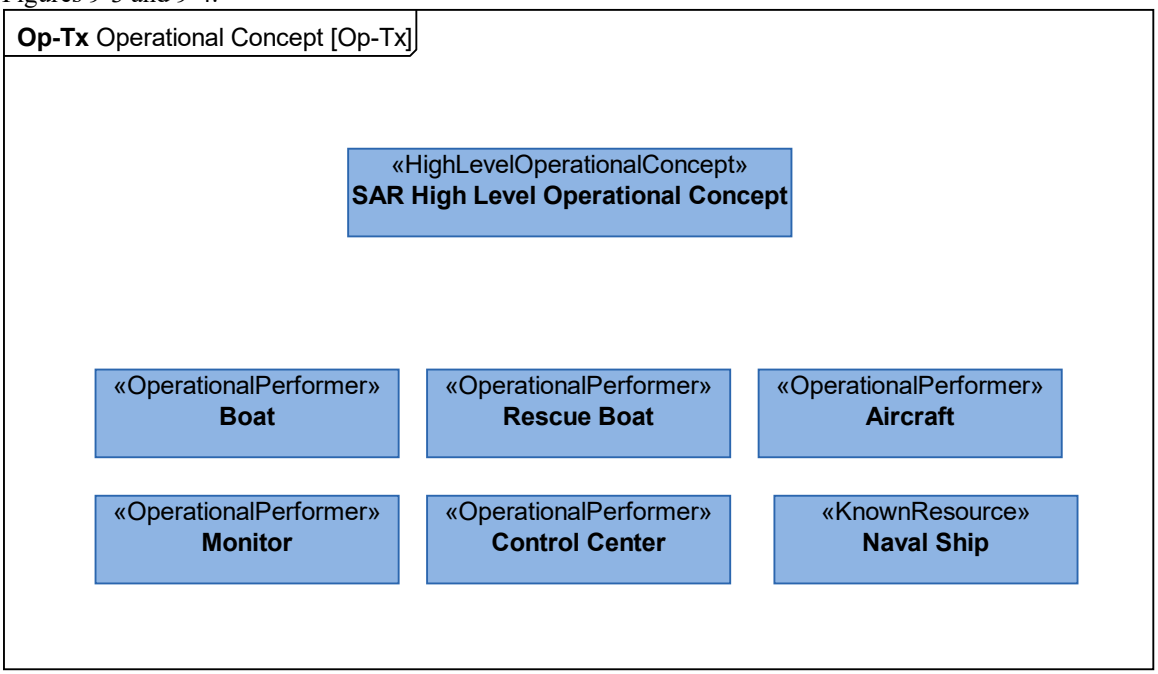

Figure 9:2 - Operational Structure

9.2 View Specifications::Operational::Structure

Stakeholders: Business Architects, Systems Engineers, Enterprise Architects, Owners responsible for Operational Agents.
Concerns: identifies the operational exchange requirements between OperationalPerformers.
Definition: defines operational architecture and exchange requirements necessary to support a specific set of Capability(ies).
Recommended Implementation: SysML Block Definition Diagram, SysML Internal Block Diagram.

Figure 9-3, sets the context of the Maritime rescue by illustrating the search and rescue operation at sea involving a yacht in distress. The diagram shows that the monitoring unit picks up the distress calls of the yacht and sends them to a Command and Control (C2) center, which coordinates the operation among helicopters, a naval ship and a rescue boat.

Each model element depicted may include a graphical depiction to help convey its intended meaning. The spatial relationships of the elements on the diagram sometimes convey their relative position, although this is not specifically captured in the semantics. A brief description of the interactions between the elements is provided. It may represent abstract conceptual relationships and will be refined in subsequent diagrams.

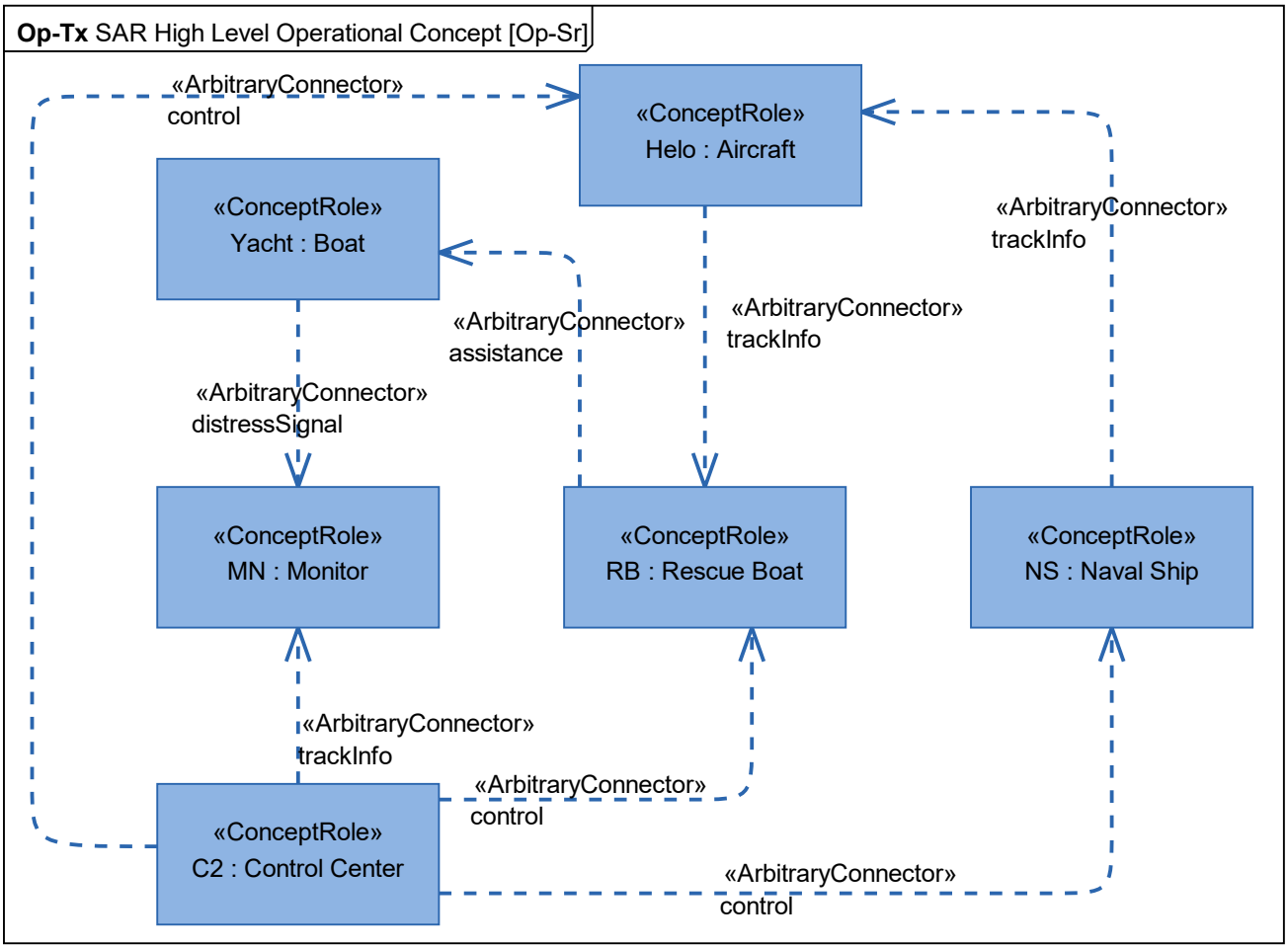

Figure 9:3 - Operational Structure of High-Level Concept

As shown below in Figure 9-4, graphics can be included to provide additional context. The elements on the diagram are exactly the same. They are simply represented as graphics rather than boxes. This helps to communicate with domain experts who may not be familiar with architectural frameworks. They are shown as graphics, symbols, and photos to demonstrate that any graphic can be used. The yacht is shown pictured as a lifeboat to emphasize that they are in distress.

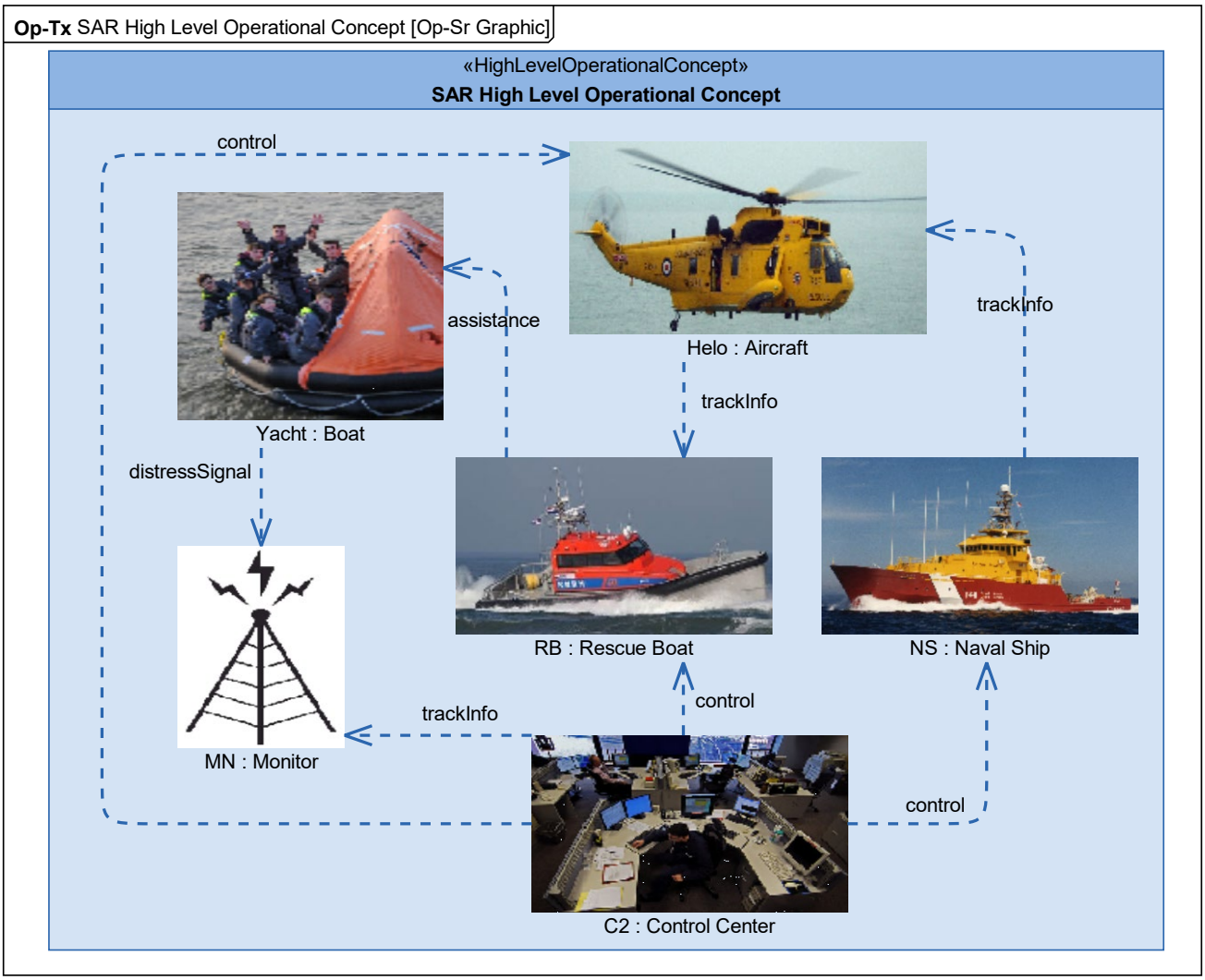

Figure 9:4 - Operational Structure of High-Level Concept with Graphics

Figure 9-5 shows the structural decomposition of the SAR Architecture. This is shown in the format of an internal block diagram in Figure 9-7.

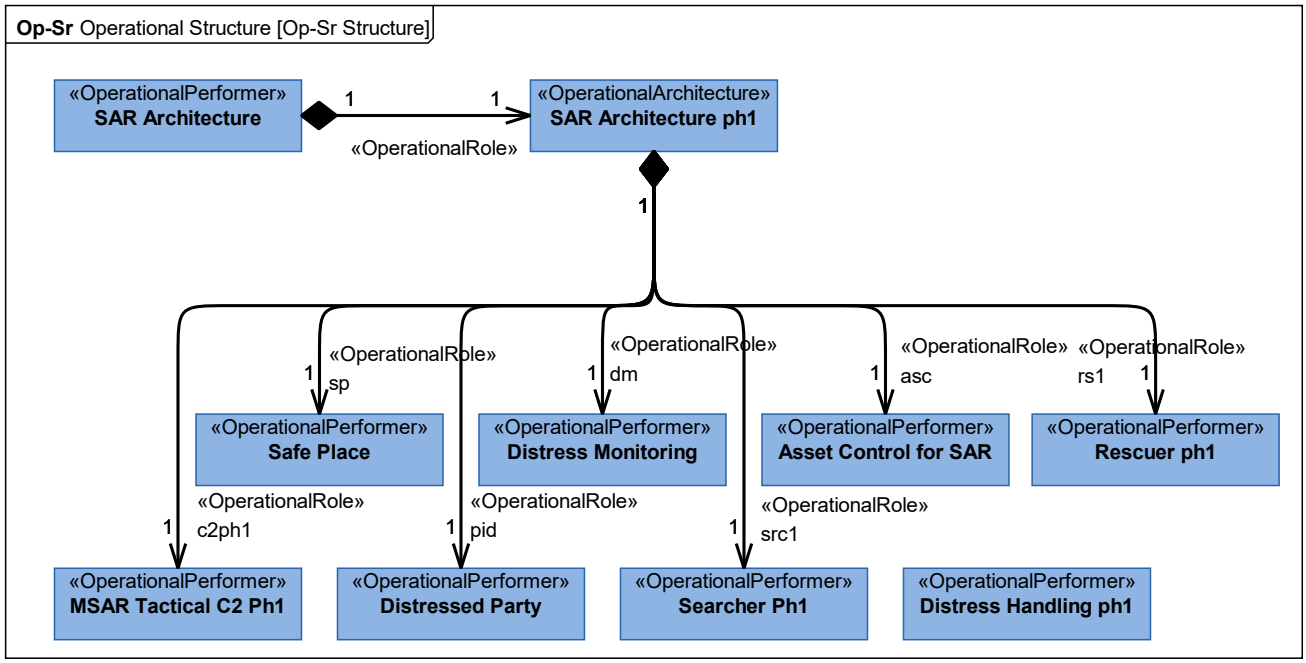

Figure 9:5 - Operational Structure SAR Structural Decomposition

The Operational diagrams in Figures 9-6 and 9-7 depict the key players in the SAR operation and the interactions for information exchange. It identifies the different types of Operational Performers (Performer in DoDAF) in the SAR operation: Person in Distress, Monitoring Node, Tactical C2 Node, SAR Asset Controller, Search Node, Rescue Node, and Place of Safety. This diagram indicates the need to exchange information between the Operational Performers and shows the interactions between these Operational Performers. Other interactions can be exchanged between the Operational Performers such as equipment, energy, and so forth. The Op-Sr view shows the operational activities undertaken by a few select Operational Performers. Figure 9-6 is in the form of a BDD and Figure 9-7 is in the form of an IBD.

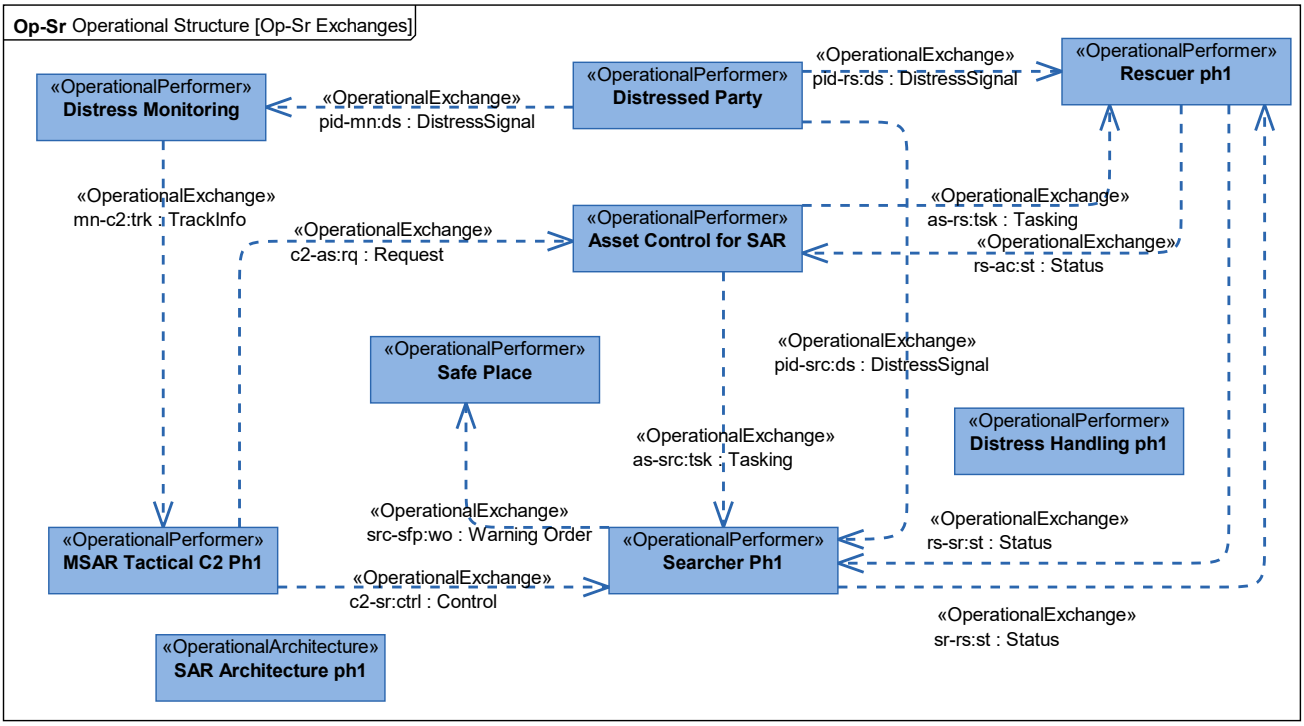

Figure 9:6 - Operational Structure with Exchanges

Figure 9-7 shows an alternate way to display the Op-Sr. It is the implementation of Figure 9-6 in an IBD format. This diagram can also be shown with ports if this is deemed useful.

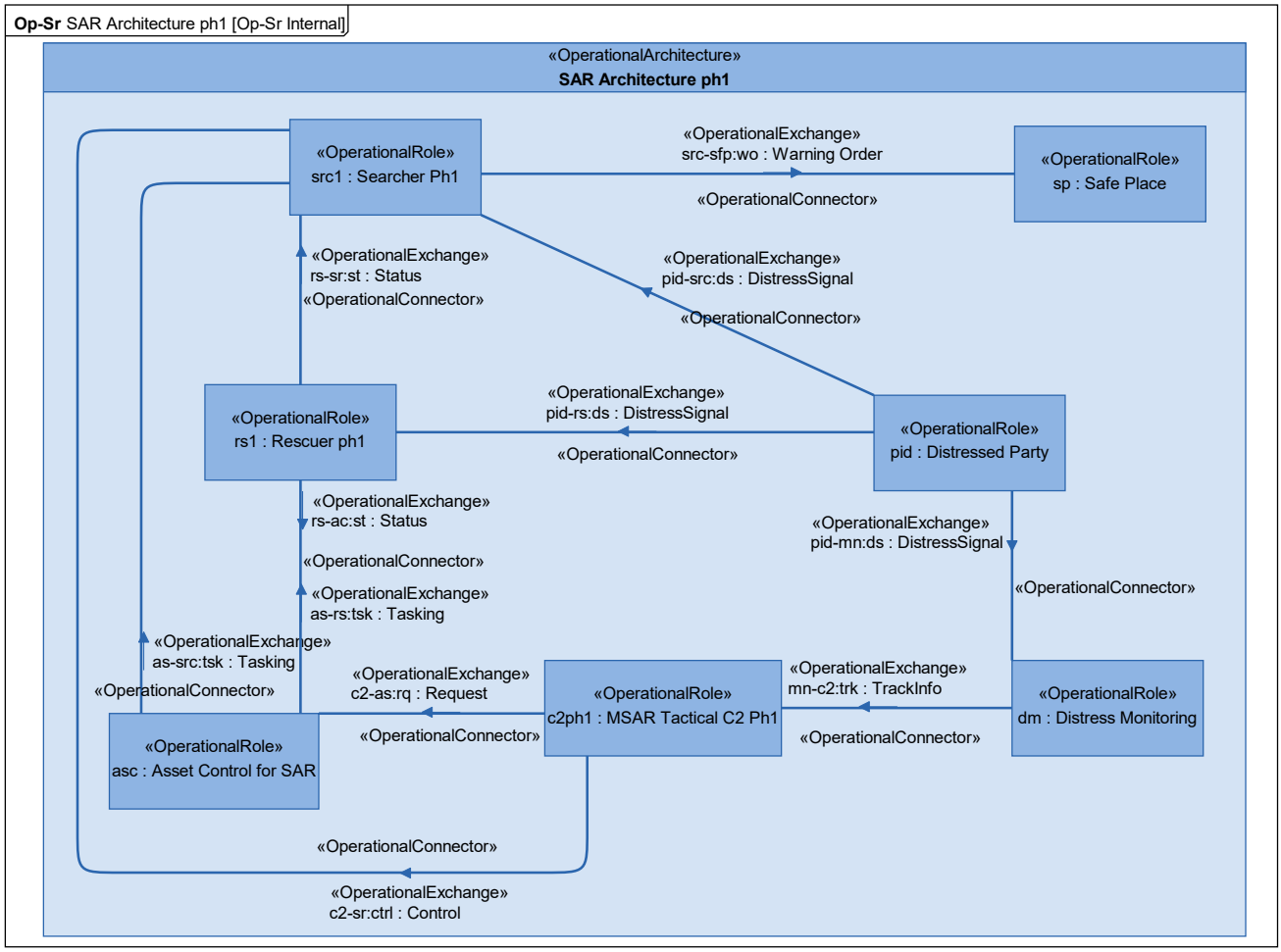

Figure 9:7 - Operational Structure Internal Block Diagram

9.3 View Specifications::Operational::Connectivity

Stakeholders: Systems Engineers, Architects, Solution Providers.
Concerns: capture the interfaces between OperationalPerformers.
Definition: summarizes logical exchanges between OperationalPerformers of information, systems, personnel, energy etc. and the logical activities that produce and consume them. Measurements can optionally be included.
Recommended Implementation: SysML Internal Block Diagram, tabular format.

Table 9-1 shows the operational exchanges between Operational Performers. The Op-Cn can include Information Exchanges associated with a Needline as well as Information Elements carried by one or more Information Exchange. Reports can also be generated summarizing other types of exchanges. The report shows the producing and consuming Operational Performers, and the activities performed by those Operational Performers that produced and consumed the interchange. This provides a validation capability for the architecture in that the blank boxes for the producing and consuming activities indicates that further work needs to be done on the architecture: exchanges are being made for no apparent purpose. There is an important distinction between DoDAF and MODAF in this regard. Exchanges (activityConsumesResource in DoDAF) can only take place because of an activity.

Table 9:1 - Operational Connectivity
Operational Structure [Op-Cn Table]

Operational		Producer		Operational Connector	Consumer	
Name	Conveyed	Operational Performer	Operational Activity	Name	Operational Performer	Operational Activity
c2-as:rq	«Information Element» Request	«Operational Performer» MSAR Tactical C2 Ph1		asc - c2ph1	«Operational Performer» Asset Control for SAR	
as-rs:tsk	«Information Element» Tasking	«Operational Performer» Asset Control for SAR		rs1 - asc	«Operational Performer» Rescuer ph1	
rs-ac:st	«Information Element» Status	«Operational Performer» Rescuer ph1		rs1 - asc	«Operational Performer» Asset Control for SAR	
as-src:tsk	«Information Element» Tasking	«Operational Performer» Asset Control for SAR		src1 - asc	«Operational Performer» Searcher Ph1	
mn-c2:trk	«Information Element» TrackInfo	«Operational Performer» Distress Monitoring		c2ph1 - dm	«Operational Performer» MSAR Tactical C2 Ph1	
c2-sr:ctrl	«Information Element» Control	«Operational Performer» MSAR Tactical C2 Ph1		src1 - c2ph1	«Operational Performer» Searcher Ph1	
pid-mn:ds	«Information Element» DistressSignal	«Operational Performer» Distressed Party		dm - pid	«Operational Performer» Distress Monitoring	
pid-rs:ds	«Information Element» DistressSignal	«Operational Performer» Distressed Party		pid - rs1	«Operational Performer» Rescuer ph1	
pid-src:ds	«Information Element» DistressSignal	«Operational Performer» Distressed Party		src1 - pid	«Operational Performer» Searcher Ph1	
rs-sr:st	«Information Element» Status	«Operational Performer» Rescuer ph1		src1 - rs1	«Operational Performer» Searcher Ph1	
src-sfp:wo	«Information Element» Warning Order	«Operational Performer» Searcher Ph1		src1 - sp	«Operational Performer» Safe Place	

Table 9:2 - Operational Connectivity
SAR Architecture [Op-Cn Table]

Operational		Producer		Operational Connector	Consumer	
Name	Conveyed	Operational Performer	Operational Activity	Name	Operational Performer	Operational Activity
c2-as:rq	«Information Element» Request	«Operational Performer» MSAR Tactical C2 Ph1		asc - c2ph1	«Operational Performer» Asset Control for SAR	
as-rs:tsk	«Information Element» Tasking	«Operational Performer» Asset Control for SAR		rs1 - asc	«Operational Performer» Rescuer ph1	
rs-ac:st	«Information Element» Status	«Operational Performer» Rescuer ph1		rs1 - asc	«Operational Performer» Asset Control for SAR	
as-src:tsk	«Information Element» Tasking	«Operational Performer» Asset Control for SAR		src1 - asc	«Operational Performer» Searcher Ph1	
mn-c2:trk	«Information Element» TrackInfo	«Operational Performer» Distress Monitoring		c2ph1 - dm	«Operational Performer» MSAR Tactical C2 Ph1	
c2-sr:ctrl	«Information Element» Control	«Operational Performer» MSAR Tactical C2 Ph1		src1 - c2ph1	«Operational Performer» Searcher Ph1	
pid-mn:ds	«Information Element» DistressSignal	«Operational Performer» Distressed Party		dm - pid	«Operational Performer» Distress Monitoring	
pid-rs:ds	«Information Element» DistressSignal	«Operational Performer» Distressed Party		pid - rs1	«Operational Performer» Rescuer ph1	
pid-src:ds	«Information Element» DistressSignal	«Operational Performer» Distressed Party		src1 - pid	«Operational Performer» Searcher Ph1	
rs-sr:st	«Information Element» Status	«Operational Performer» Rescuer ph1		src1 - rs1	«Operational Performer» Searcher Ph1	
src-sfp:wo	«Information Element» Warning Order	«Operational Performer» Searcher Ph1		src1 - sp	«Operational Performer» Safe Place	

9.4 View Specifications::Operational::Processes

Stakeholders: Business Architect, Systems Engineers, Enterprise Architects
Concerns: captures activity-based behavior and flows.
Definition: describes the activities that are normally conducted in the course of achieving business goals that support a capability. It describes operational activities, their Inputs/Outputs, operational activity actions and flows between them.
Recommended Implementation: SysML Activity Diagram, SysML Block Definition Diagram, BPMN Process Diagram.

Figure 9-8 describes the operations that are normally conducted by the different Operational Performers of a Search and Rescue operation. This view shows the operational activities which are performed by the Search Node. The class diagram views provide a means of breaking down activities to lower level activities as well as indicating the Operational Performers that perform the activities.

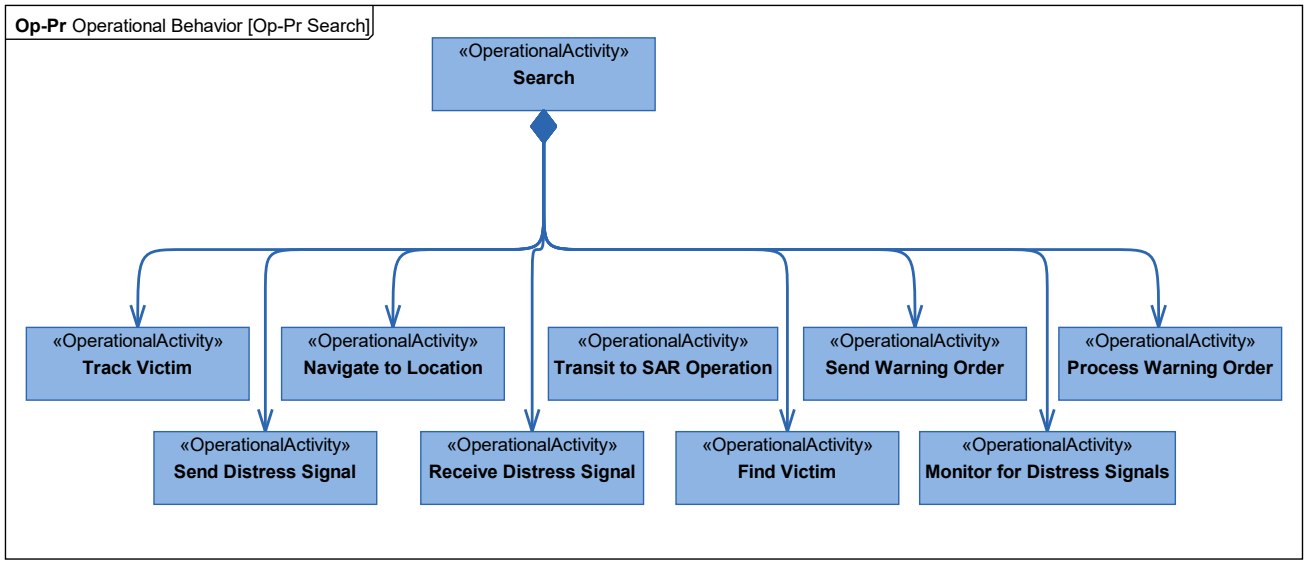

Figure 9:8 - Operational Processes for the Search Activity

Figure 9-9 shows the Op-Pr as an activity diagram. It describes Operational Activity Actions, Input/output flows between activities and to/from activities that are outside the scope of the context of the activity diagram. The example shows the execution of the search activity. It is shown without the swimlanes as a means of defining the required behavior without constraining it to a solution space.

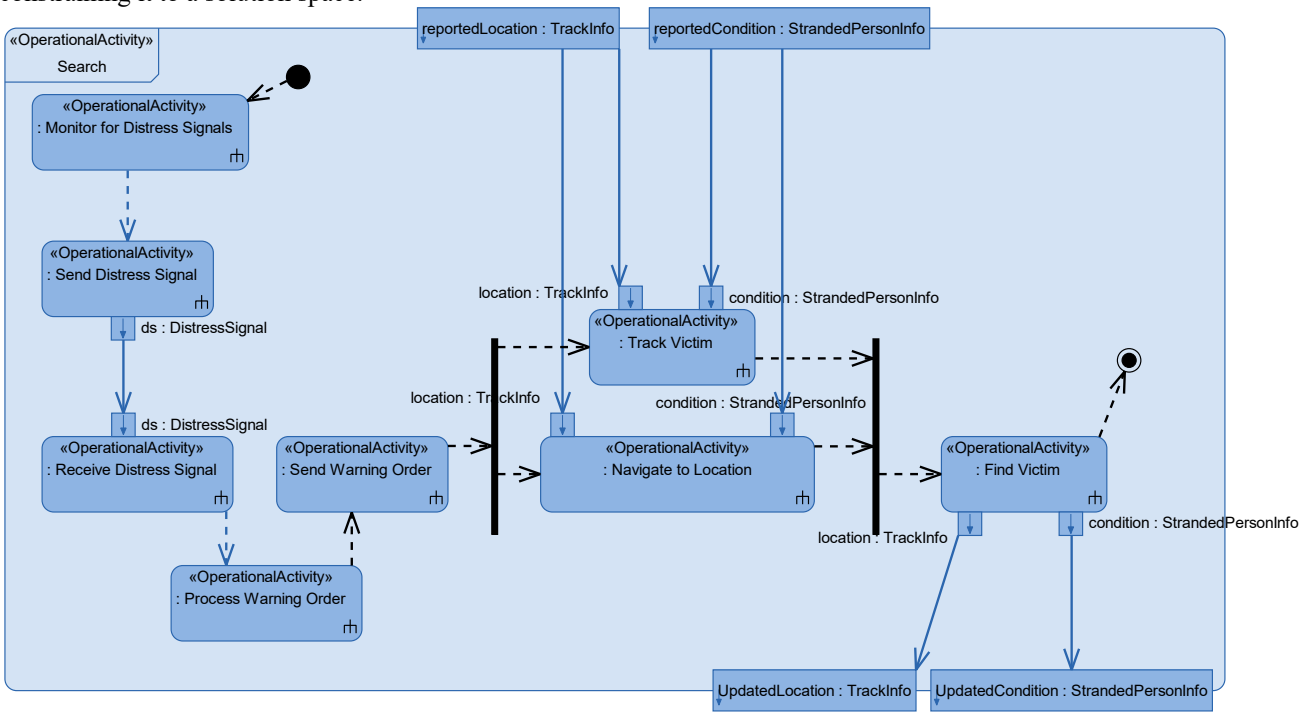

Figure 9:9 - Operational Processes for the Search Activity (Activity Diagram)

Figure 9-10 shows the functional breackdown of the activities required to implement the Rescue activity.

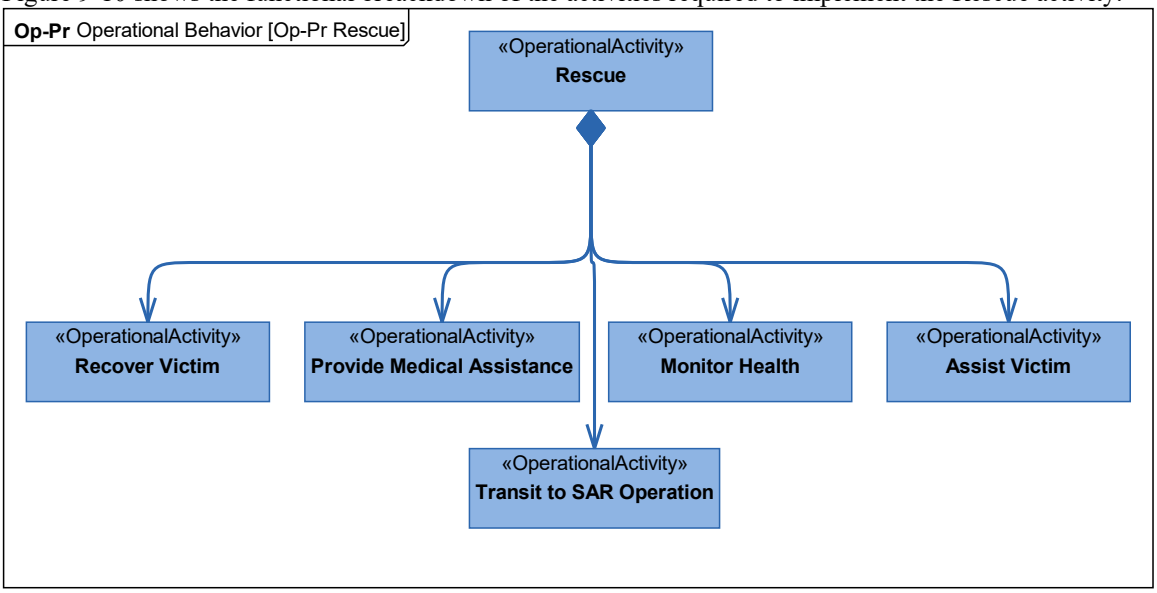

Figure 9:10 - Operational Processes

There is a vertically nested swim lane which is the search and rescue context. Inside this context are the Operational Performers that were defined within the Op-Sr. This is an example of how UAF ensures structural consistency across the model. Activities displayed within the swimlanes are allocated to the node that owns the swim lane.

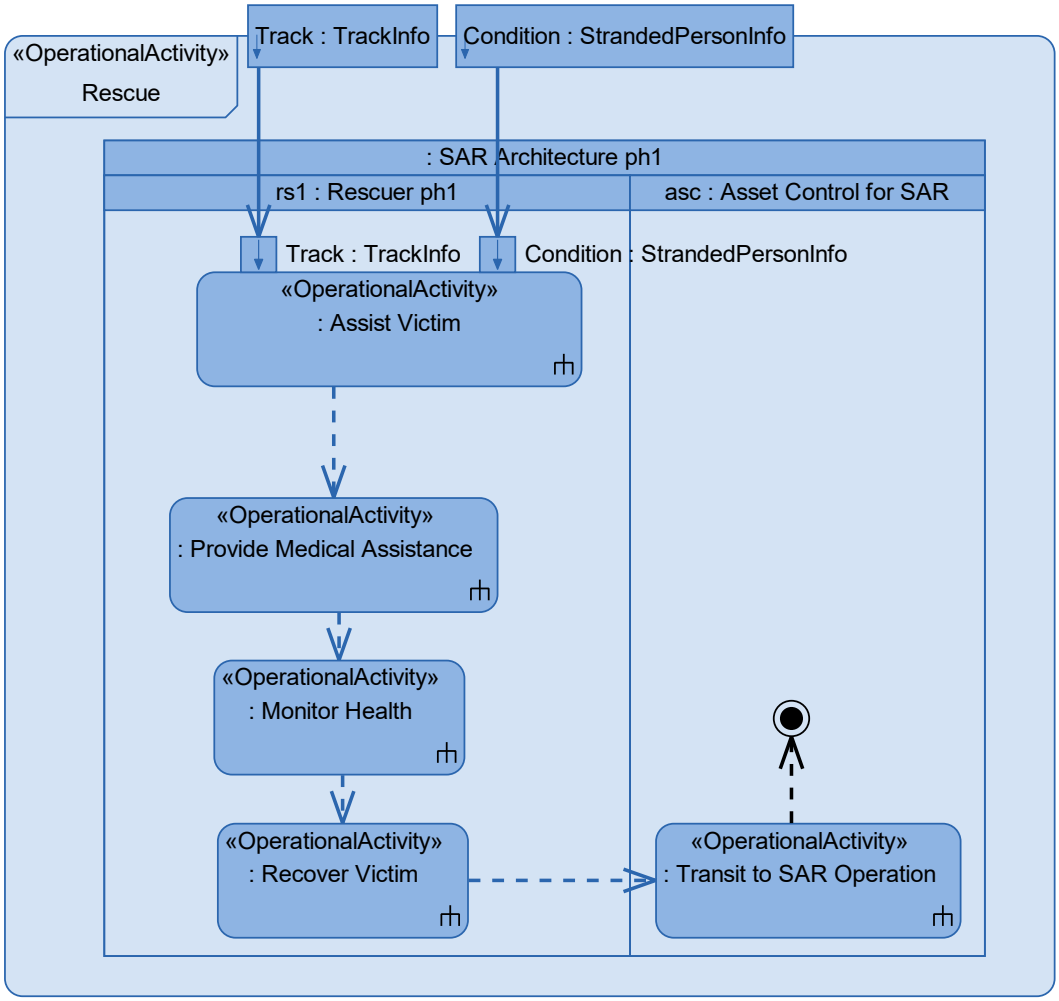

Figure 9:11 - Operational Processes for the Rescue Activity

9.5 View Specifications::Operational::States

Stakeholders: Systems Engineers, Software Engineers.
Concerns: capture state-based behavior of an operational OperationalPerformer.
Definition: it is a graphical representation of states of an operational OperationalPerformer and how that operational OperationalPerformer responds to various events and actions.
Recommended Implementation: SysML State Machine Diagram.

Figure 9-12 describes the operational states of the Searcher phase 1, the behaviors that take place within those states, the transitions between the states and the events and guards that cause those transitions to take place. For example, the search node is waiting for a distress signal resulting in an assignment control. When one is received, the assignment is validated and the Searcher node transitions to searching for victim.

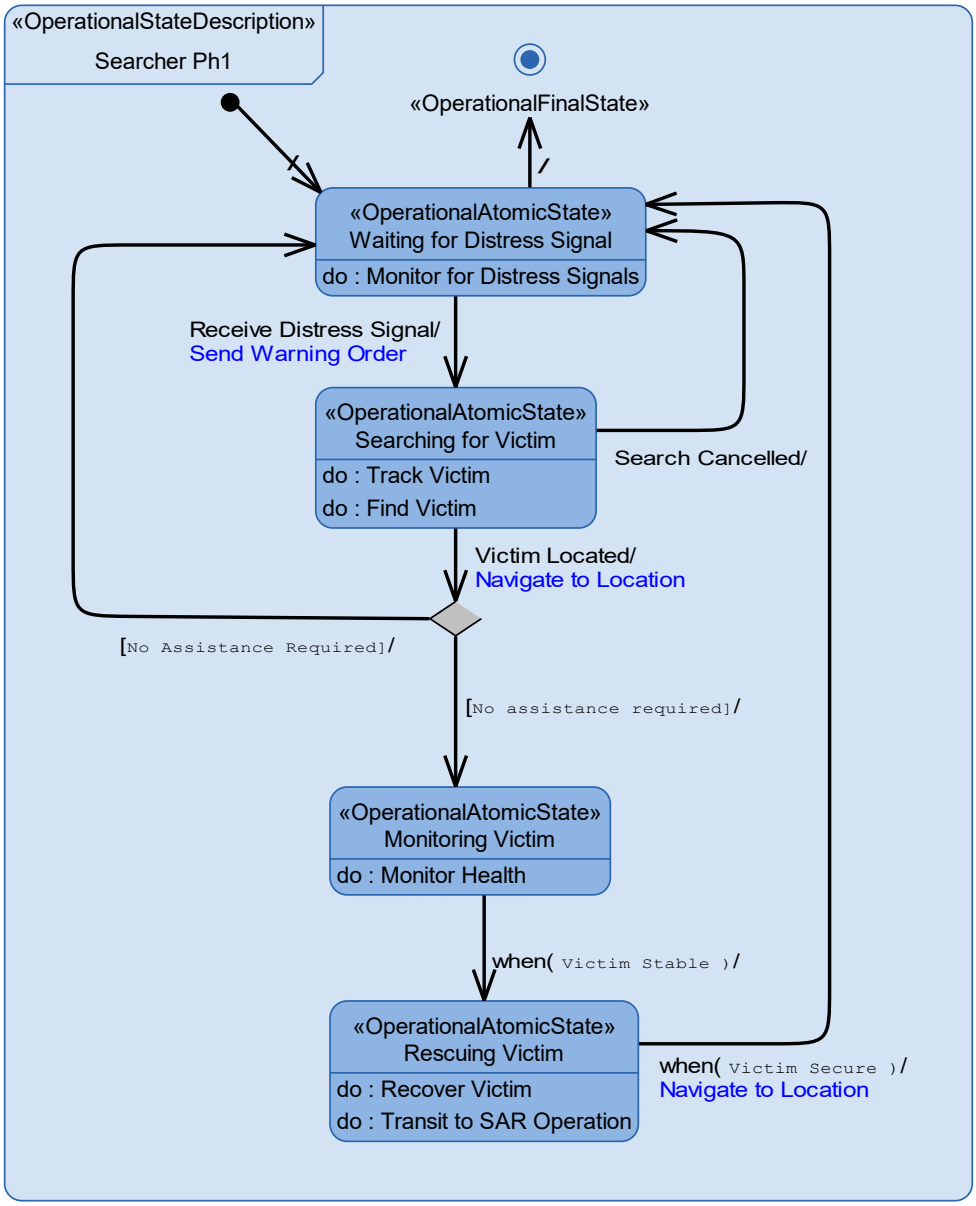

Figure 9:12 - Operational States for a Searcher

9.6 View Specifications::Operational::Interaction Scenarios

Stakeholders: Systems Engineers, Business Architects.
Concerns: express a time ordered examination of the operational exchanges as a result of a particular operational scenario.
Definition: provides a time-ordered examination of the operational exchanges between participating nodes (OperationalPerformer roles) as a result of a particular operational scenario.

The Op-Is is used to define time based behavioral scenarios between operational elements. The interactions can be service operations as well as the interactions defined on the Op-Sr and Op-Pr diagrams. Figure 9-13 shows the sequence of interactions for a search and rescue scenario.

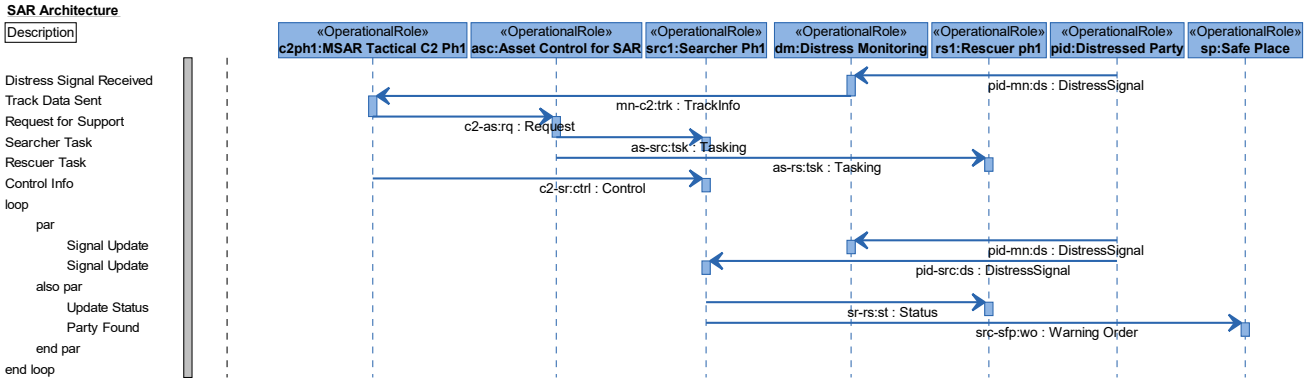

Figure 9:13 - Operational Interaction Scenario for SAR Initiation.

9.7 View Specifications::Operational::Constraints

Stakeholders: Systems Engineers, Architects, Program Sponsors
Concerns: define operational limitations, constraints and performance parameters for the enterprise.
Definition: specifies traditional textual operational or business rules that are constraints on the way that business is done in the enterprise. The addition of SysML parametrics provides a computational means of defining operational constraints across the enterprise or within a specific operational context.
Recommended Implementation: tabular format, SysML Block Definition Diagram, SysML Parametric Diagram.

Figure 9-14 defines some of the operational constraints and the operational activities to which they are linked. These are shown in tabular form in Table 9-3.

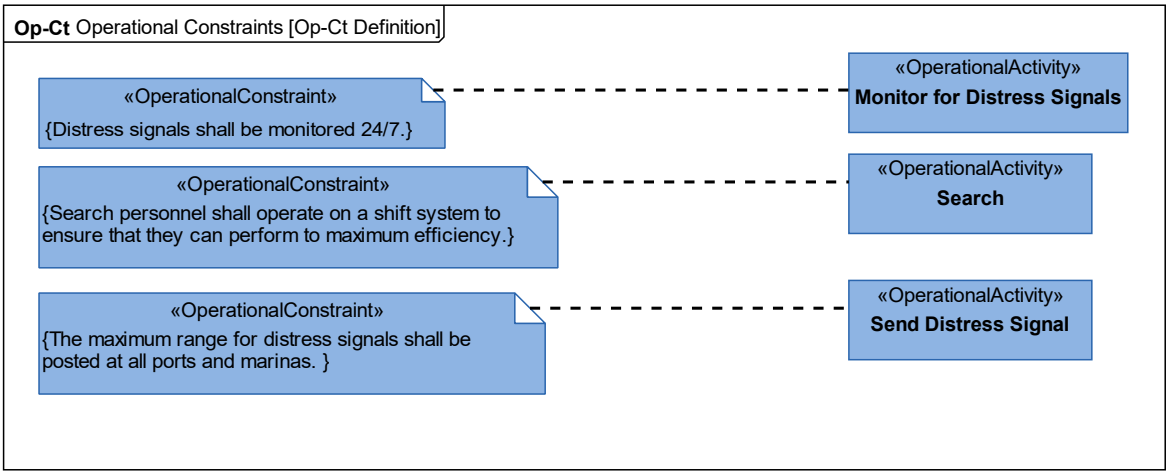

Figure 9:14 - Operational Constraints Definition and Link

Table 9-3 is a generated report showing the operational constraints associated with operational elements such as Operational Performers, organizations, Activities, etc.

Table 9:3 - Operational Constraints Tabular Form
[Architectural Description] Operational Constraints [Op-Ct Matrix]

Operationally Constrained Element		Operational Constraint	
Type	**Name**	**Name**	**Text**
«OperationalActivity»	Assist Victim	[none]	[none]
«OperationalActivity»	Find Victim	[none]	[none]
«OperationalActivity»	Monitor for Distress Signals	Distress Signal Monitoring	Distress signals shall be monitored 24/7.
«OperationalActivity»	Monitor Health	[none]	[none]
«OperationalActivity»	Navigate to Location	[none]	[none]
«OperationalActivity»	Process Warning Order	[none]	[none]
«OperationalActivity»	Provide Medical Assistance	[none]	[none]
«OperationalActivity»	Receive Distress Signal	[none]	[none]
«OperationalActivity»	Recover Victim	[none]	[none]
«OperationalActivity»	Rescue	[none]	[none]
«OperationalActivity»	Search	Personnel Safety	Search personnel shall operate on a shift system to ensure that they can perform to maximum efficiency.
«OperationalActivity»	Send Distress Signal	Distress Signal Range	The maximum range for distress signals shall be posted at all ports and marinas.
«OperationalActivity»	Send Warning Order	[none]	[none]
«OperationalActivity»	Track Victim	[none]	[none]
«OperationalActivity»	Transit to SAR Operation	[none]	[none]

9.8 View Specifications::Operational::Traceability

Stakeholders: PMs, Enterprise Architects, Business Architects.
Concerns: traceability between capabilities and operational activities and capabilities and operational agents.
Definition: describes the mapping between the capabilities required by an Enterprise and the supporting operational activities and operational agents.
Recommended Implementation: matrix format, SysML Block Definition Diagram.

Figure 9-15 shows the mapping between the capabilities and operational activities in the enterprise.

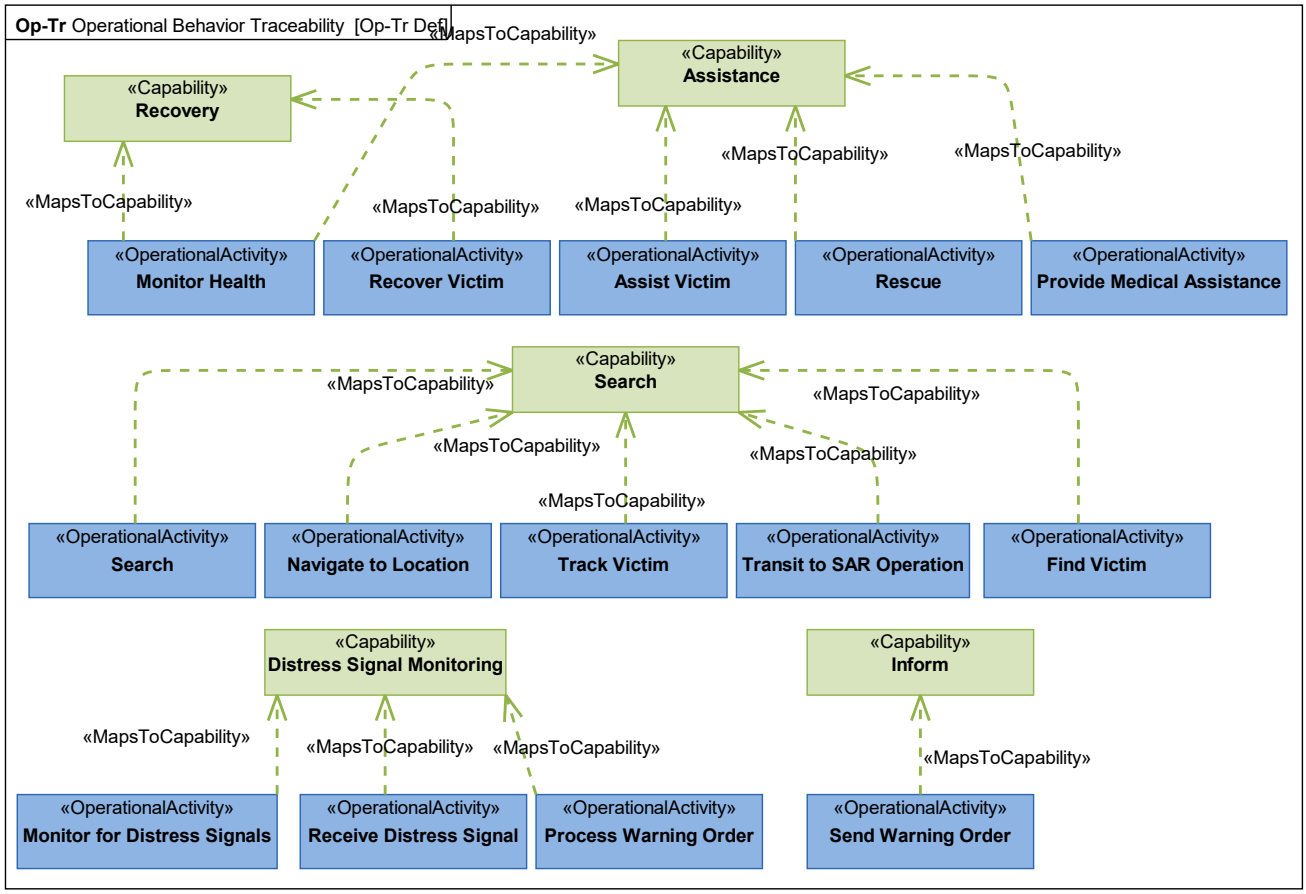

Figure 9:15 - Operational Traceability between Operational Activities and Capabilities

Table 9-4 shows the traceability between the capabilities and operational activities in tabular form.

Table 9:4 - Operational Traceability between Operational Activities and Capabilities

Operational BehaviorTraceability [Op-Tr Matrix]

		Mapped Activity													
		«OperationalActivity» Assist Victim	«OperationalActivity» Find Victim	«OperationalActivity» Monitor for Distress Signals	«OperationalActivity» Monitor Health	«OperationalActivity» Navigate to Location	«OperationalActivity» Process Warning Order	«OperationalActivity» Provide Medical Assistance	«OperationalActivity» Receive Distress Signal	«OperationalActivity» Recover Victim	«OperationalActivity» Rescue	«OperationalActivity» Search	«OperationalActivity» Send Warning Order	«OperationalActivity» Track Victim	«OperationalActivity» Transit to SAR Operation
Mapped Capability	«Capability» Assistance	X			X			X			X				
	«Capability» Search		X			X						X		X	X
	«Capability» Distress Signal Monitoring			X			X		X						
	«Capability» Recovery				X					X					
	«Capability» Inform												X		

Figure 9-16 shows the mapping between the capabilities and operational performers in the enterprise.

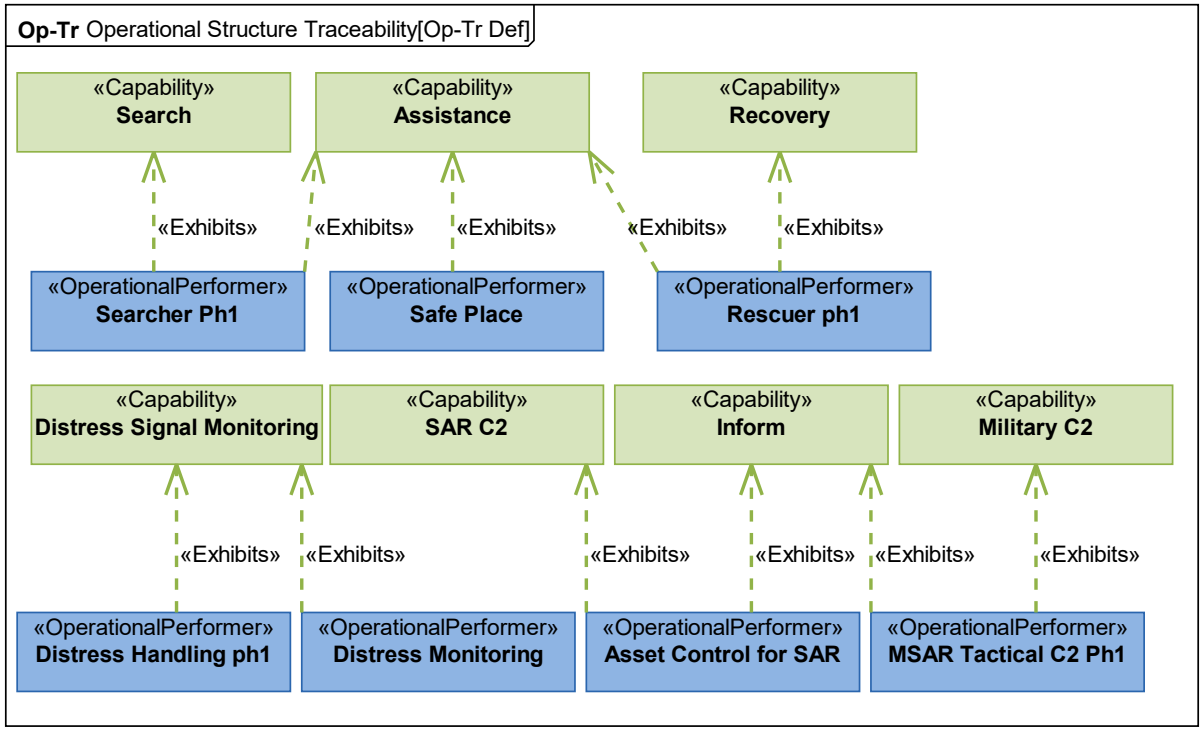

Figure 9:16 - Operational Traceability between the Capabilities and Operational Performers

Table 9-5 shows the traceability between the capabilities and operational performers in tabular form.

Table 9:5 - Operational Traceability between Operational Performers and Capabilities

Operational StructureTraceability [Op-Tr Matrix]

		Exhibiting Element						
		«OperationalPerformer» Asset Control for SAR	«OperationalPerformer» Distress Handling ph1	«OperationalPerformer» Distress Monitoring	«OperationalPerformer» MSAR Tactical C2 Ph1	«OperationalPerformer» Rescuer ph1	«OperationalPerformer» Safe Place	«OperationalPerformer» Searcher Ph1
Exhibited Capability	«Capability» Inform	X			X			
	«Capability» SAR C2	X						
	«Capability» Distress Signal Monitoring		X	X				
	«Capability» Military C2				X			
	«Capability» Assistance					X	X	X
	«Capability» Recovery					X		
	«Capability» Search							X

9.9 View Specifications::Operational::Use Cases

Stakeholders: Business Architect, Systems Engineers, Enterprise Architects
Concerns: captures stakeholder needs and goals.
Definition: describes the use cases that are normally conducted in the course of achieving business goals that support the enterprise..
Recommended Implementation: Use Case Diagram
Note: This is not a standard part of the UAF, but inherited from SysML.

A Mission defines a functional goal that the stakeholders have. This aligns well with the definition of a Use Case. As UAF is built on SysML, it is possible to create Use Case diagrams showing the missions, their relationships, and the stakeholders involved in the mission. Figure 9-17 defines the missions required for search and rescue.

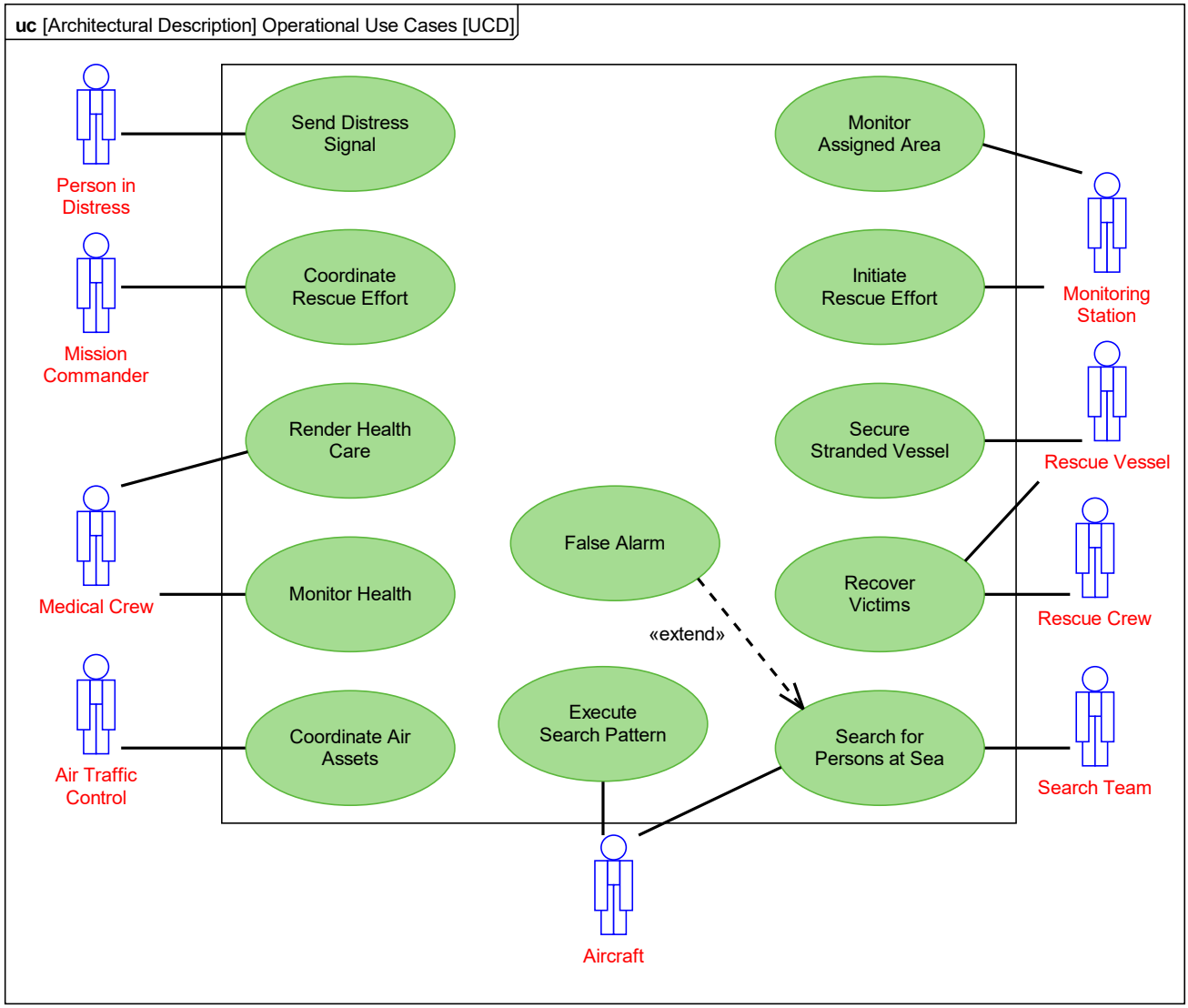

Figure 9:17 – Use Case Diagram for the Operational Enterprise

10. View Specifications::Resources

Stakeholders: Systems Engineers, Resource Owners, Implementers, Solution Providers, IT Architects.
Concerns: definition of solution architectures to implement operational requirements.
Definition: captures a solution architecture consisting of resources, e.g. organizational, software, artifacts, capability configurations, natural resources that implement the operational requirements. Further design of a resource is typically detailed in SysML or UML.

These views describe the resources that realize the SAR capabilities or implement services. They describe resource functions, interactions between resources, and can provide detailed system interface models. System views can describe the "as-is" and/or "to-be" configuration. In addition, several different configurations can be created to perform trade-off analysis. When used in conjunction with SysML, the systems should be developed to the degree that they define the requirements for actual systems that will be implemented. Developing the system views to too much detail will unnecessarily constrain the solution and will involve duplication of work.

System elements can include more than just physical systems. They can include software, organizational resources such as organizations, posts and roles. MODAF defines the concept of a Capability Configuration which is a composition of resources that can deliver a capability. As in the operational views, interactions can consist of more than just information and can include Posts, organizations, capability configurations, energy and software.

10.1 View Specifications::Resources::Taxonomy

Stakeholders: Solution Providers, Systems Engineers, IT Architects, Implementers.
Concerns: resource types.
Definition: shows the taxonomy of types of resources.
Recommended Implementation: SysML Block Definition Diagram.

The Rs-Tx defines the different types of resources that will be used to realize the logical architecture defined in the operational views. Elements include Asset, CapabilityConfiguration, Measurement, NaturalResource, Organization, OrganizationalResource, Person, PhysicalResource, Post, ResourceArtifact, Software, SystemResource, Technology, etc.

Figure 10-1 shows the abstract types of systems and resource artifacts and their subtypes.

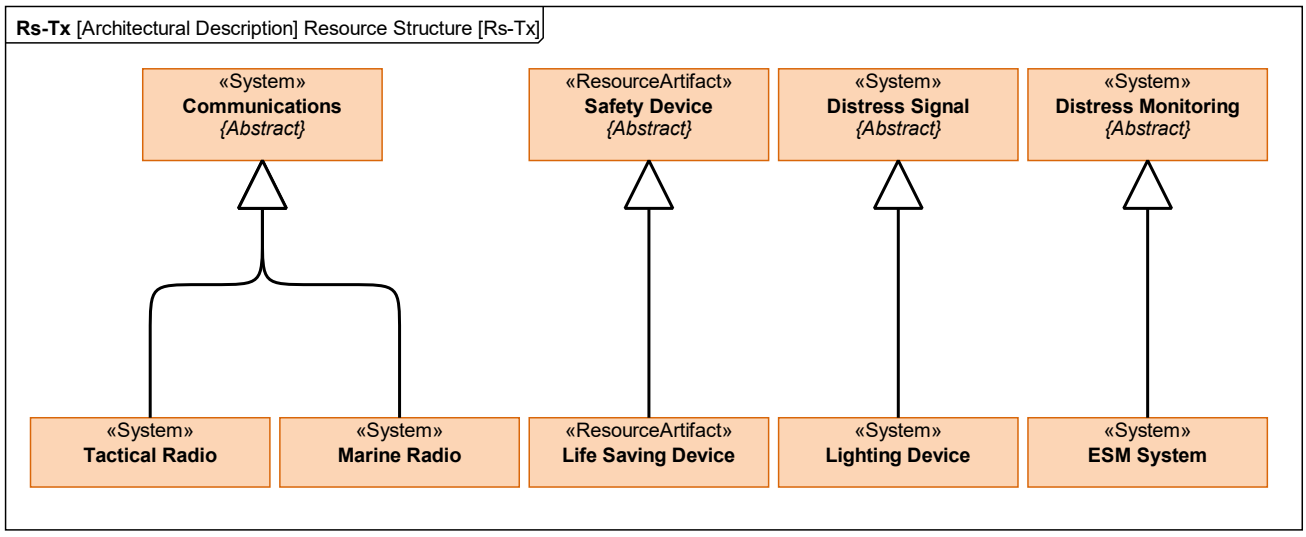

Figure 10:1 - Resources Taxonomy of System Components

Figure 10-2 shows the taxonomy of the Capability Configuration of a Maritime Rescue Architecture V1 and V2, as well as their systems..

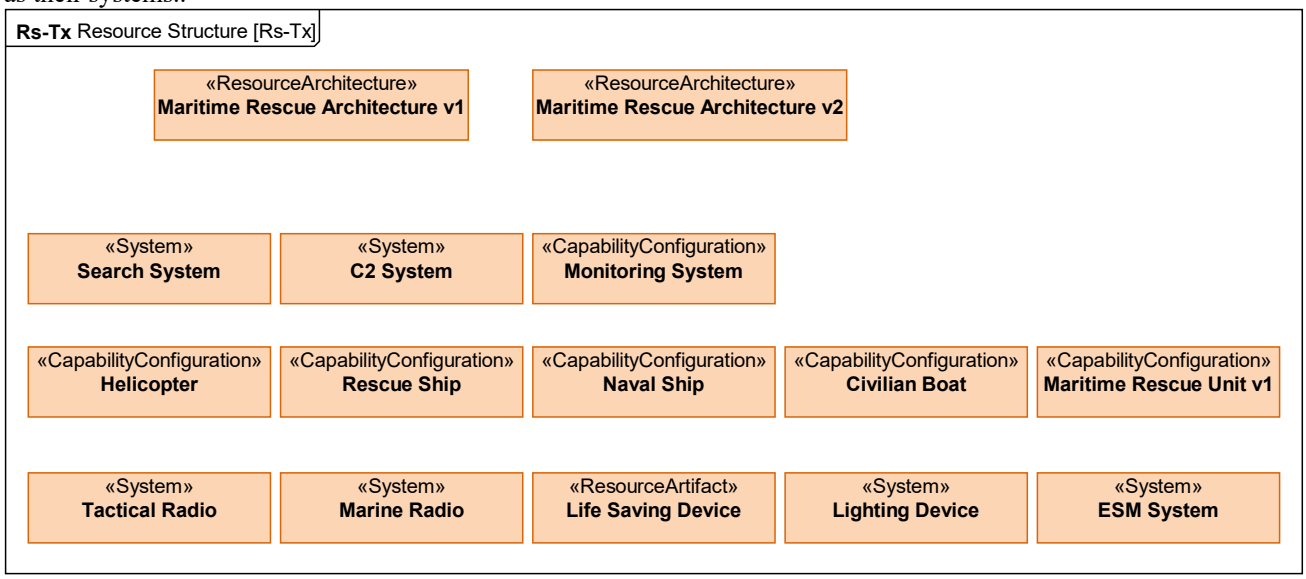

Figure 10:2 - Resources Taxonomy of Maritime Rescue Architectures

10.2 View Specifications::Resources::Structure

Stakeholders: Systems Engineers, Resource Owners, Implementers, Solution Providers.
Concerns: reference the resource structure, connectors and interfaces in a specific context.
Definition: defines the physical resources, e.g. capability configuration(s)/system(s) and interactions necessary to implement a specific set of OperationalPerformer(s). Can be used to represent communications networks and pathways that link communications resources and provides details regarding their configuration.
Recommended Implementation: SysML Internal Block Diagram, SysML Bock Definition Diagram.

The Rs-Sr defines the structure and internal flows of the system architectures to demonstrate how they realize the logical architecture defined in the operational views. The interfaces and interactions are defined at the level of specifying a need for the systems to interact and the way in which they do so.

Figure 10-3 shows the Capability Configuration of a Maritime Rescue Unit. The Maritime Rescue Unit is comprised of the Rescue Ship and the Helicopter as well as the components that enable them to fulfill their role. The posts for the Helicopter and Rescue Ship are also shown.

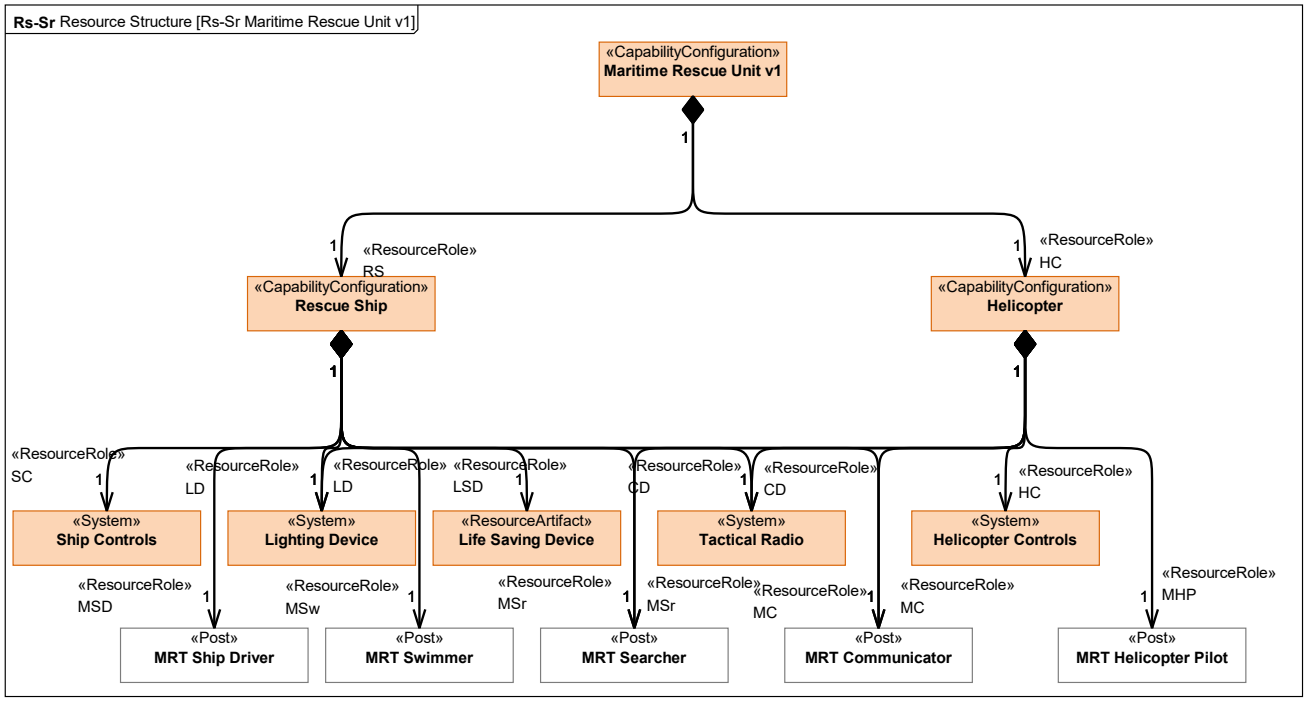

Figure 10:3 - Resources Structure of the Maritime Rescue Unit v1

In Figure 10-4, The Maritime Rescue Unit is shown as a part of the maritime Rescue Architetcture. The other systems such as the C2 System, Naval Ship and Civilian Boat are also shown. These systems can be decomposed to any level required. Security Enclaves are included in this version.

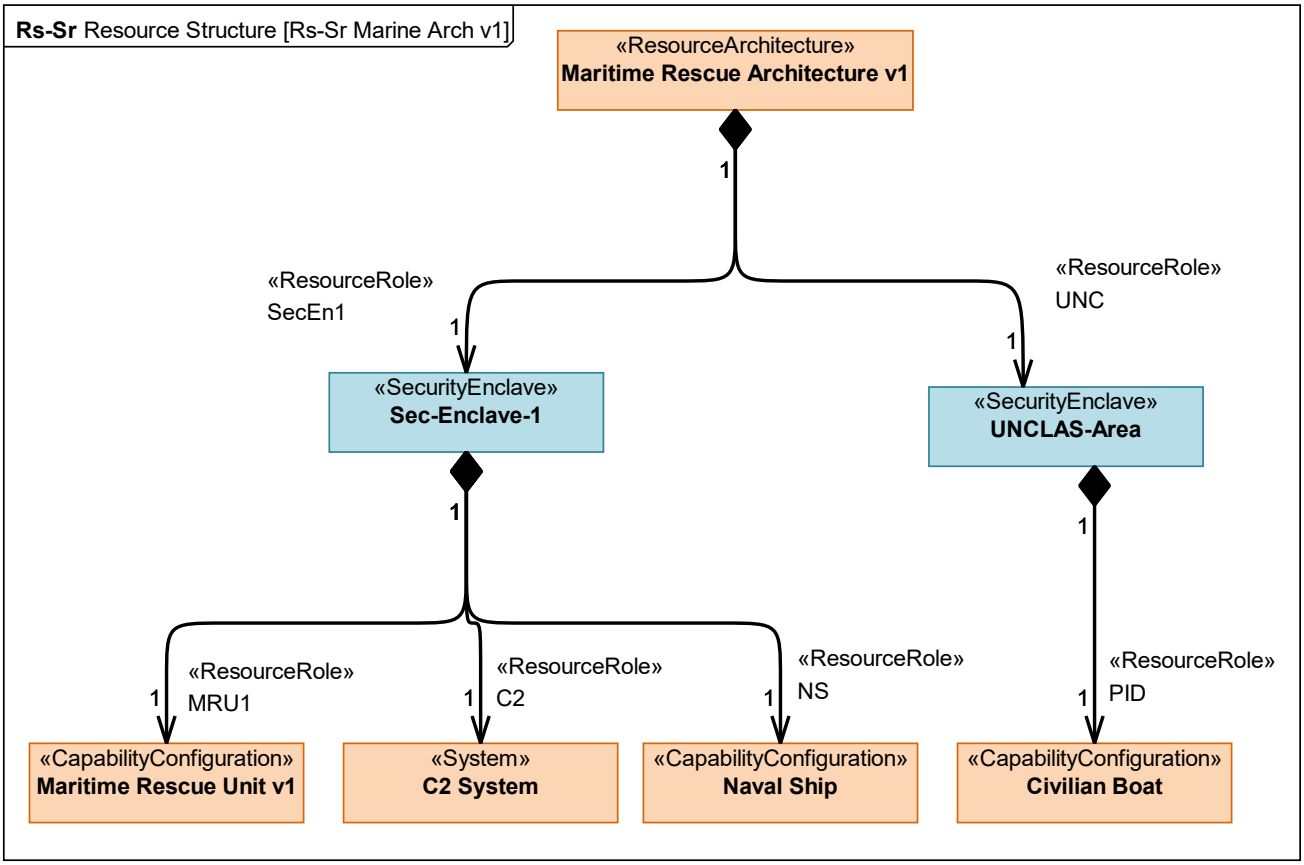

Figure 10:4 - Resources Structure of the Maritime Rescue Architecture

Figure 10-5 defined the Resource Interfaces that the system components use to interact with one another.

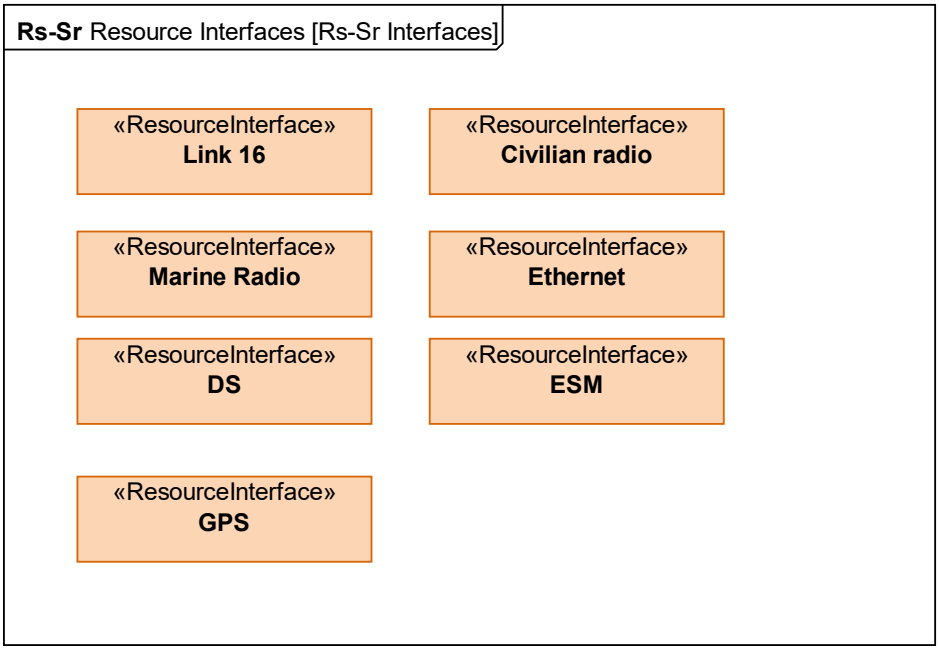

Figure 10:5 - Resources Structure of Resource Interfaces

Figure 10-6 shows the Capability Configuration of a Maritime Rescue Unit. The Maritime Rescue Unit is comprised of the Rescue Ship and the Helicopter as well as their personnel, communications and control equipment.

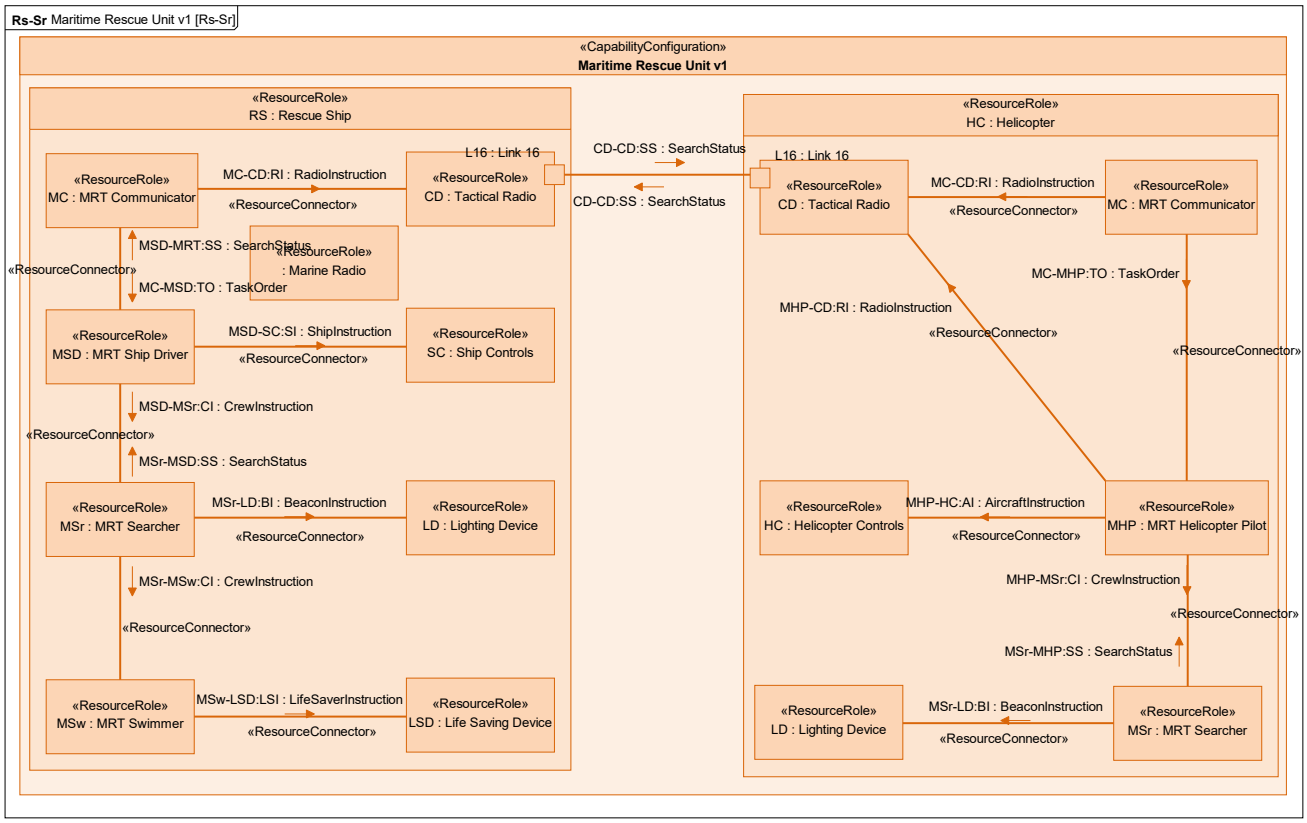

Figure 10:6 - Resources Structure: Internal Structure of the Maritime Rescue Unit v1

The Rs-Sr defines the communications networks and pathways that link the systems as well as providing details about the configuration. The Rs-Sr can also show Port Specification, System to System Port Connectivity, and System Connectivity Clusters. All these details can be shown by using the Internal Block Diagram as has been implemented in UAF. System Protocols and Standards can also be shown.

Figure 10-7 shows systems interconnections for several entities in a maritime search and rescue scenario. The Security Enclaves in the model are shown colored in blue. This structure corresponds to the structure defined in Figure 10-4. Resource connections have been added and the stereotypes have been removed for clarity.

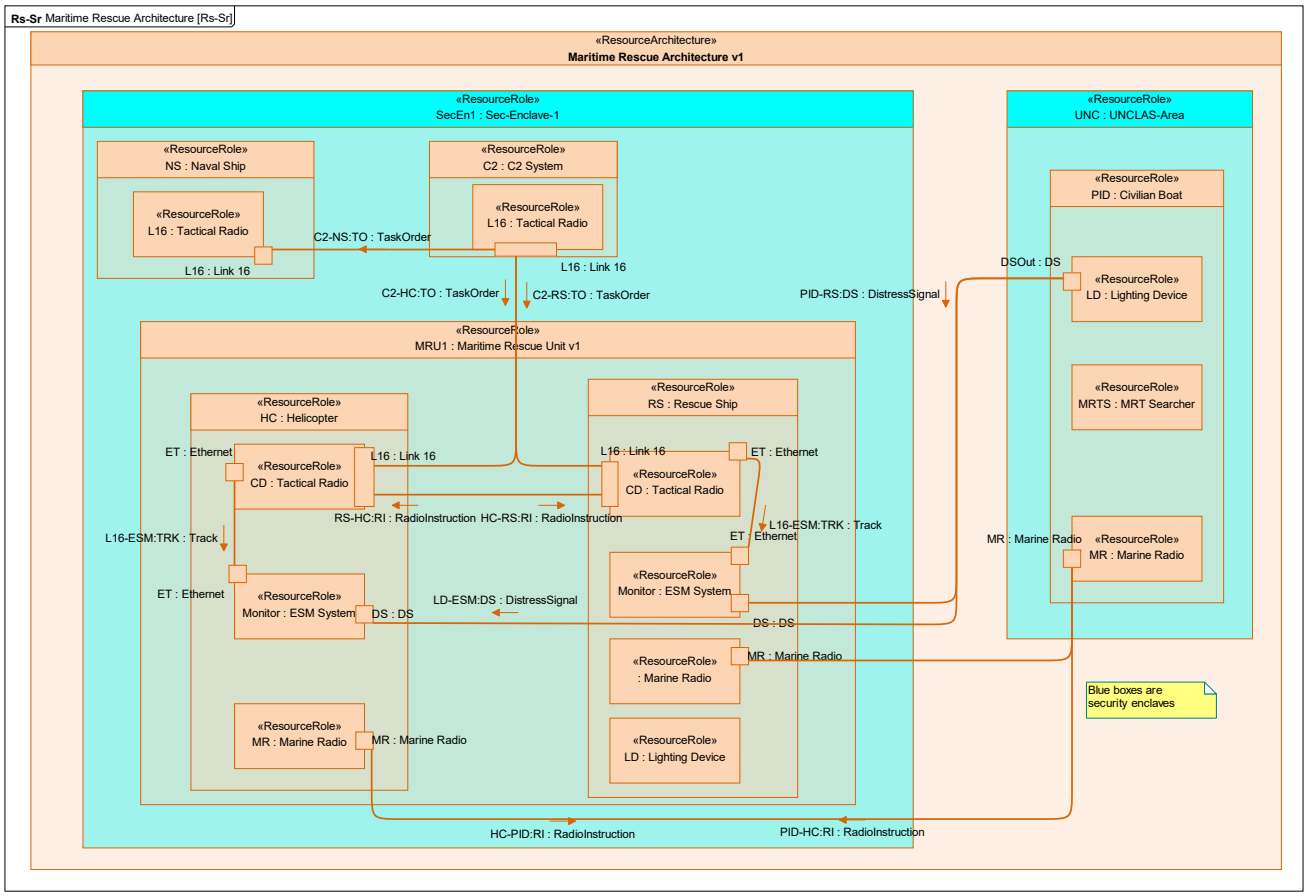

Figure 10:7 - Resources Structure for the Maritime Rescue Architecture

10.3 View Specifications::Resources::Connectivity

Stakeholders: Systems Engineers, IT Architects, Solution Providers, Implementers.
Concerns: capture the interactions between resources.
Definition: summarizes interactions between resources of information, systems, personnel, natural resources etc. and the functions that produce and consume them. Measurements can optionally be included.
Recommended Implementation: SysML Internal Block Diagram, tabular format.

The Rs-Sr report is a summary report of the interactions defined in the Rs-St. It expresses the connections between the system elements. Table 10 1 does this in the form of a matrix. For simplicity and readability, the matrix has been reduced to show only those systems that are connected.

Table 10:1 - Resources Connectivity for the Maritime Rescue Architecture.

[Architectural Description] Resources

Interaction Sent To \ Interaction Received From	«ResourceArtifact» Communication Device	«ResourceArtifact» Lighting Device	«ResourceArtifact» Link 16	«Post» MRT Helicopter Pilot	«Post» MRT Boat Driver	«Post» MRT Communicator	«Post» MRT Swimmer	«Post» MRT Searcher
«ResourceArtifact» Aircraft				X				
«ResourceArtifact» Boat					X			
«ResourceArtifact» Communication Device	X					X		
«ResourceArtifact» ESM System		X	X					
«ResourceArtifact» Life Saving Device							X	
«ResourceArtifact» Lighting Device								X
«ResourceArtifact» Link 16			X					

The Rs-Cn report summarizes the interactions between the resources in the Rs-Sr and Rs-Tx diagram. Table 10-2 shows the interactions between the SAR resources. Additional fields can also be included such as measurements associated with the exchange.

Table 10:2 - Resources Connectivity for the Maritime Rescue Architecture.

Resource Structure [Rs-Cn Table]

Resource Exchange		Producer		Resource Connector		Consumer	
Name	Conveyed	Resource Performer	Function	Name	Protocol	Resource Performer	Function
MHP-CD:RI	«Data Element» RadioInstruction	«Post» MRT Helicopter Pilot		Resource Connector		«System» Tactical Radio	
MC-CD:RI	«Data Element» RadioInstruction	«Post» MRT Communicator		Resource Connector		«System» Tactical Radio	
L16-ESM:TRK	«Data Element» Track	«System» Tactical Radio		Resource Connector		«System» ESM System	
MHP-HC:AI	«Data Element» AircraftInstruction	«Post» MRT Helicopter Pilot		Resource Connector		«System» Helicopter Controls	
MSr-LD:BI	«Data Element» BeaconInstruction	«Post» MRT Searcher		Resource Connector		«System» Lighting Device	
MC-MHP:TO	«Data Element» TaskOrder	«Post» MRT Communicator		Resource Connector		«Post» MRT Helicopter Pilot	
MHP-MSr:CI	«Data Element» CrewInstruction	«Post» MRT Helicopter Pilot		Resource Connector		«Post» MRT Searcher	
MSr-MHP:SS	«Data Element» SearchStatus	«Post» MRT Searcher		Resource Connector		«Post» MRT Helicopter Pilot	
CD-CD:SS	«Data Element» SearchStatus	«System» Tactical Radio		Resource Connector		«System» Tactical Radio	
CD-CD:SS	«Data Element» SearchStatus	«System» Tactical Radio		Resource Connector		«System» Tactical Radio	
HC-RS:RI	«Data Element» RadioInstruction	«System» Tactical Radio		Resource Connector		«System» Tactical Radio	
RS-HC:RI	«Data Element» RadioInstruction	«System» Tactical Radio		Resource Connector		«System» Tactical Radio	
MC-CD:RI	«Data Element» RadioInstruction	«Post» MRT Communicator		Resource Connector		«System» Tactical Radio	
L16-ESM:TRK	«Data Element» Track	«System» Tactical Radio		Resource Connector		«System» ESM System	
MSr-LD:BI	«Data Element» BeaconInstruction	«Post» MRT Searcher		Resource Connector		«System» Lighting Device	
MSw-LSD:LSI	«Data Element» LifeSaverInstruction	«Post» MRT Swimmer		Resource Connector		«Resource Artifact» Life Saving Device	
MC-MSD:TO	«Data Element» TaskOrder	«Post» MRT Communicator		Resource Connector		«Post» MRT Ship Driver	
MSD-MRT:SS	«Data Element» SearchStatus	«Post» MRT Ship Driver		Resource Connector		«Post» MRT Communicator	
MSD-MSr:CI	«Data Element» CrewInstruction	«Post» MRT Ship Driver		Resource Connector		«Post» MRT Searcher	
MSr-MSD:SS	«Data Element» SearchStatus	«Post» MRT Searcher		Resource Connector		«Post» MRT Ship Driver	
MSD-SC:SI	«Data Element» ShipInstruction	«Post» MRT Ship Driver		Resource Connector		«System» Ship Controls	
MSr-MSw:CI	«Data Element» CrewInstruction	«Post» MRT Searcher		Resource Connector		«Post» MRT Swimmer	
C2-RS:TO	«Data Element» TaskOrder	«System» Tactical Radio		Resource Connector		«System» Tactical Radio	
C2-HC:TO	«Data Element» TaskOrder	«System» Tactical Radio		Resource Connector		«System» Tactical Radio	
C2-NS:TO	«Data Element» TaskOrder	«System» Tactical Radio		Resource Connector		«System» Tactical Radio	
LD-ESM:DS	«Data Element» DistressSignal	«System» Lighting Device		Resource Connector		«System» ESM System	
HC-PID:RI	«Data Element» RadioInstruction	«System» Marine Radio		Resource Connector		«System» Marine Radio	
PID-HC:RI	«Data Element» RadioInstruction	«System» Marine Radio		Resource Connector		«System» Marine Radio	
PID-RS:DS	«Data Element» DistressSignal	«System» Lighting Device		Resource Connector		«System» ESM System	

10.4 View Specifications::Resources::Processes

Stakeholders: Solution Providers, Systems Engineers, IT Architects.
Concerns: captures activity-based behavior and flows.
Definition: describes the functions that are normally conducted in the course of implementing operational activity(ies) in support of capability(ies). It describes the functions, their Inputs/Outputs, function actions and flows between them.
Recommended Implementation: SysML Activity Diagram, SysML Block Definition Diagram.

The Rs-Pr defines the functions carried out by the different types of Resources. This includes organizational resources such as posts and organizations. Two forms can be used. Figure 10-8 shows a hierarchical breakdown of the Rescue Victim function. It is also possible to show the resource that is performing the action. This provides a mapping of resource usage to function.

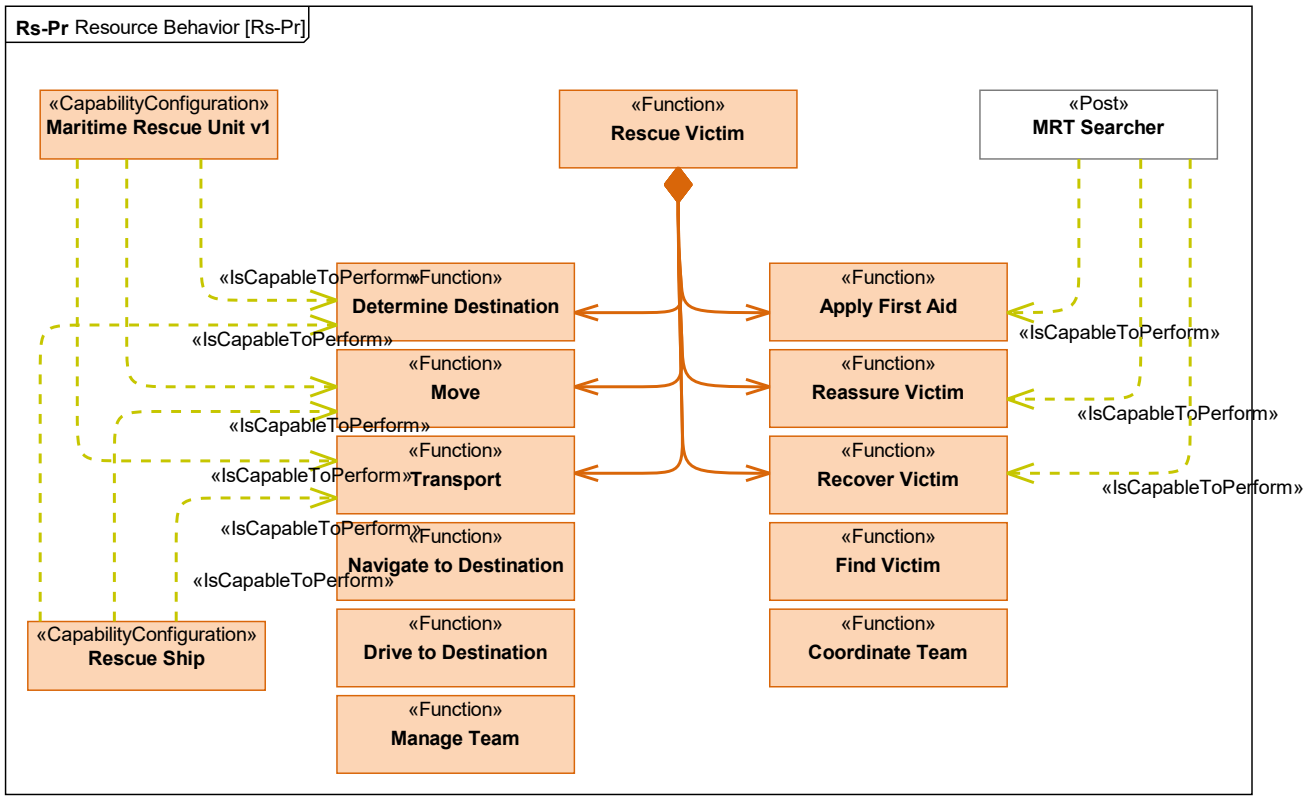

Figure 10:8 - Resources Processes for the Rescue Victim Function

Figure 10-9 shows a set of miscellaneous functions performed by the systems and personnel in the maritime Rescue Architecture.

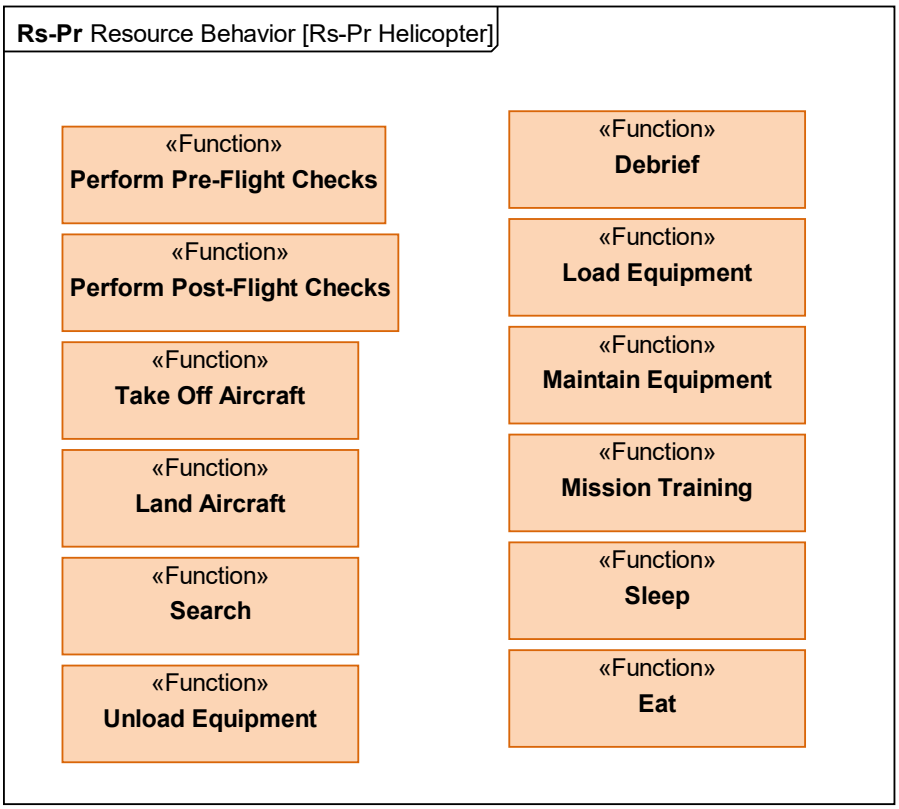

Figure 10:9 - Resources Processes Miscellaneous functions for Systems and Personnel

Figure 10-10 is the other type of Rs-Pr and takes the format of an activity diagram. It shows the Resources using Functions, the operational step-by-step workflows and the overall flow of control The Rescue Ship and the MRT Searcher are represented as the lowest level swim lanes. These are inside the context of the Maritime Rescue Architecture. It shows the functions used by these Resources, the order in which they take place, and the interactions between them to implement the Rescue Victim Activity.

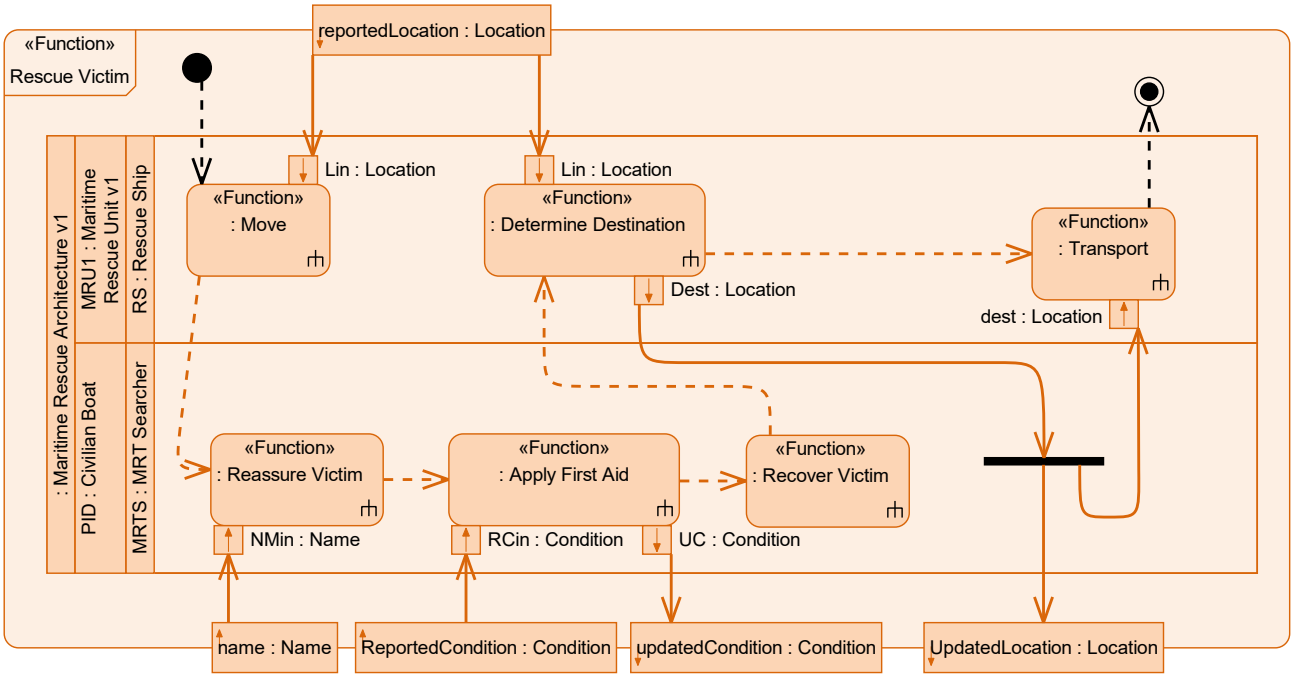

Figure 10:10 - Resources Processes for Rescue Victim

10.5 View Specifications::Resources::States

Stakeholders: Systems Engineers, Software Engineers.
Concerns: capture state-based behavior of a resource.
Definition: it is a graphical representation of states of a resource and how that resource responds to various events and actions.
Recommended Implementation: SysML State Machine Diagram.

The Rs-St uses a state diagram to describe the resource's responses to the various events that it can receive. It can also be to show the operational states of the resource. Figure 10-11 shows the state-based behavior for the Helicopter.

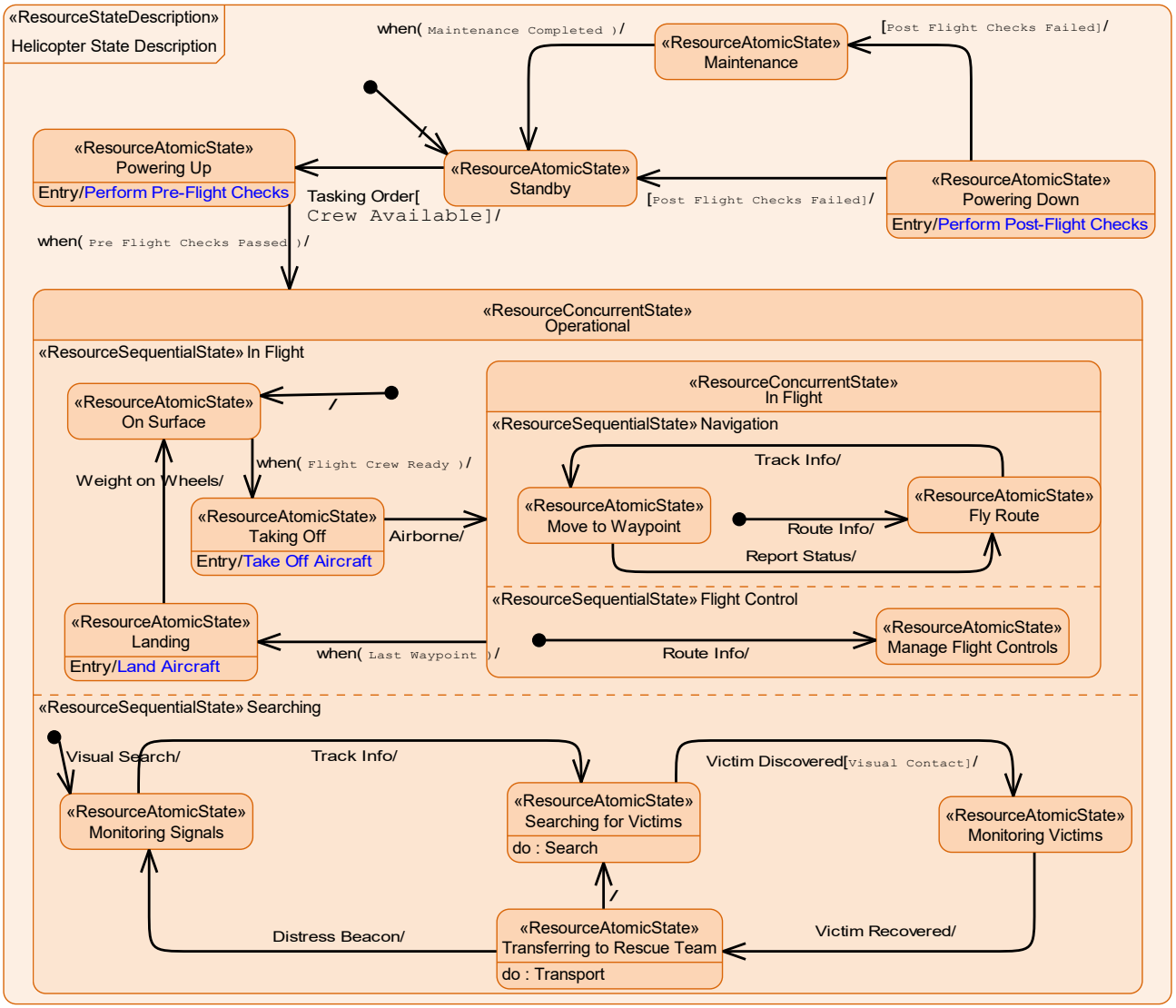

Figure 10:11 - Resources States for the Helicopter

10.6 View Specifications::Resources::Interaction Scenarios

Stakeholders: Software Engineers, Systems Engineers.
Concerns: interactions between resources (roles).
Definition: provides a time-ordered examination of the interactions between resources.
Recommended Implementation: SysML Sequence Diagram.

The Rs-Is defines a sequence of interaction between system resources in time order normally to execute a scenario or to fulfill some other functional requirement. This diagram is normally used once the architecture has been well defined. It is useful as a means of determining if enough interactions and system resources have been defined to allow the architecture to fulfill its functional requirements. Figure 10-12 shows a search and rescue scenario.

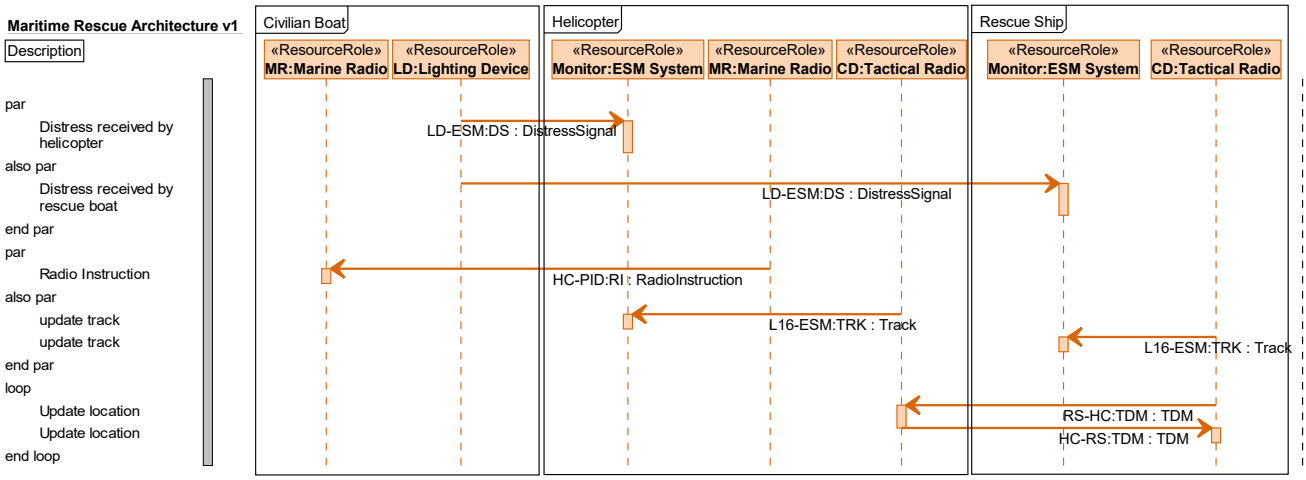

Figure 10:12 - Resources Interaction Scenarios for Initiate Rescue.

10.7 View Specifications::Resources::Constraints

Stakeholders: Systems Engineers, IT Architects, Solution Providers, Implementers.
Concerns: define limitations, constraints and performance parameters for resources, their interactions, performed functions, and data.
Definition: specifies traditional textual rules/non-functional requirements that are constraints on resources, their interactions, performed functions, and data. The addition of SysML parametrics provide a computational means of defining resource constraints within a specific context.
Recommended Implementation: tabular format, SysML Block Definition Diagram, SysML Parametric Diagram, OCL.

The Rs-Ct defines the functional specification of the behavior of the system resources. The Rs-Ct, Rs-St, and Rs-Is augment this by defining the constraints, state behavior, and sequence of interactions of the resources.

Figure 10-13 shows the Resource Constraints for the Maritime Rescue Architecture.

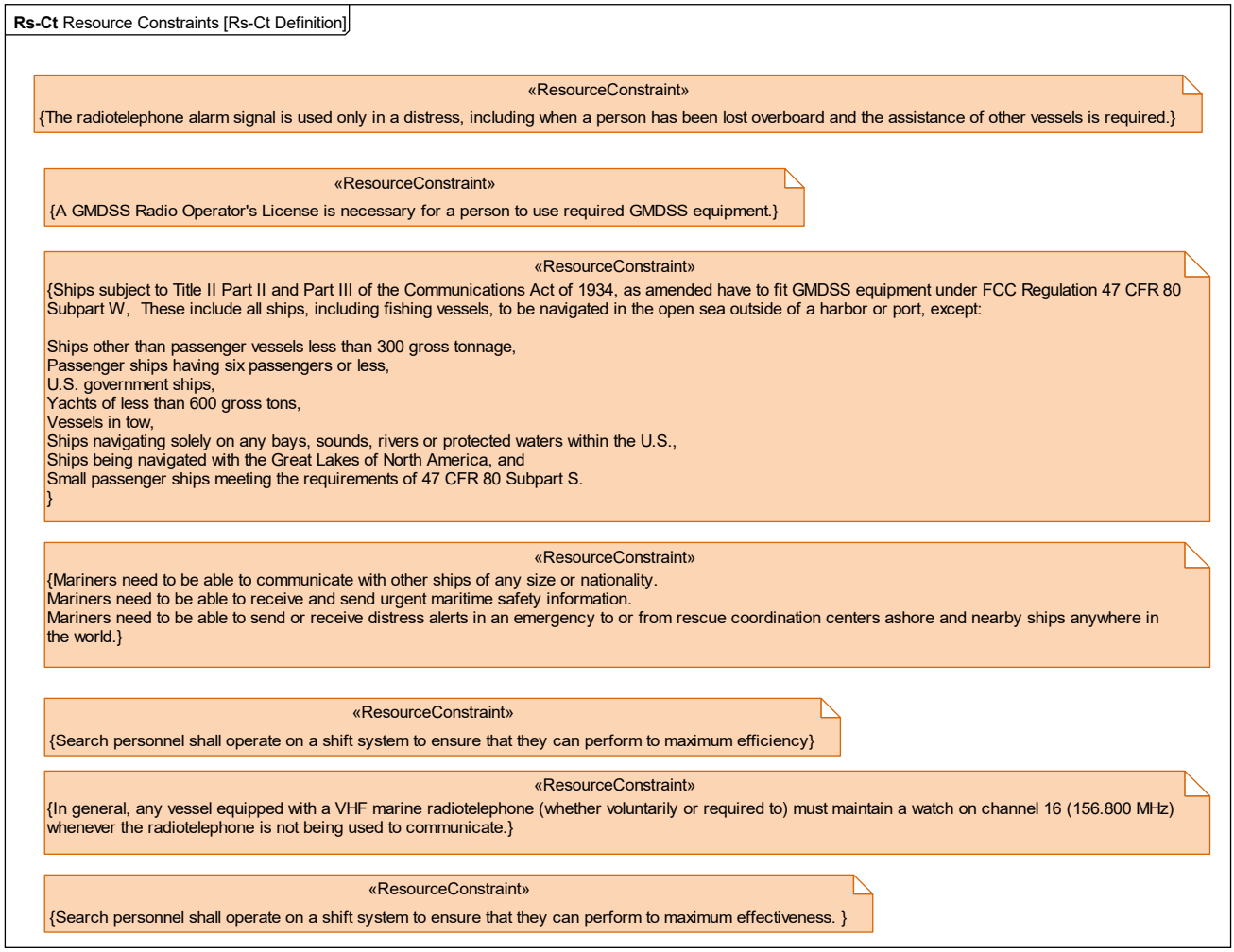

Figure 10:13 - Resources Constraints for Maritime Rescue Architecture

Figure 10-14 shows the Resource Constraints and their links to the Systems, Posts, and Organizations.

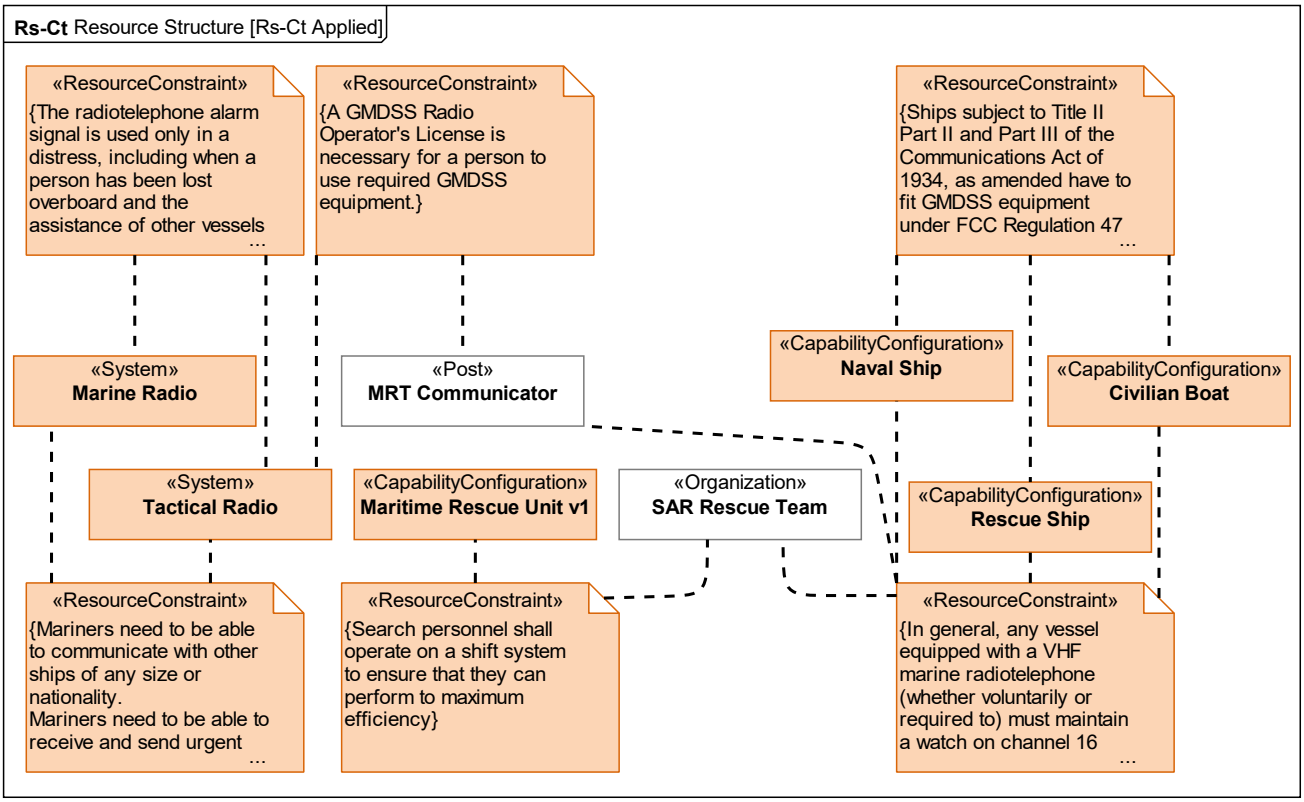

Figure 10:14 - Resources Constraints for the Systems, Posts, and Organizations

Figure 10-15 shows the actual resources and their links to the resource constraints.

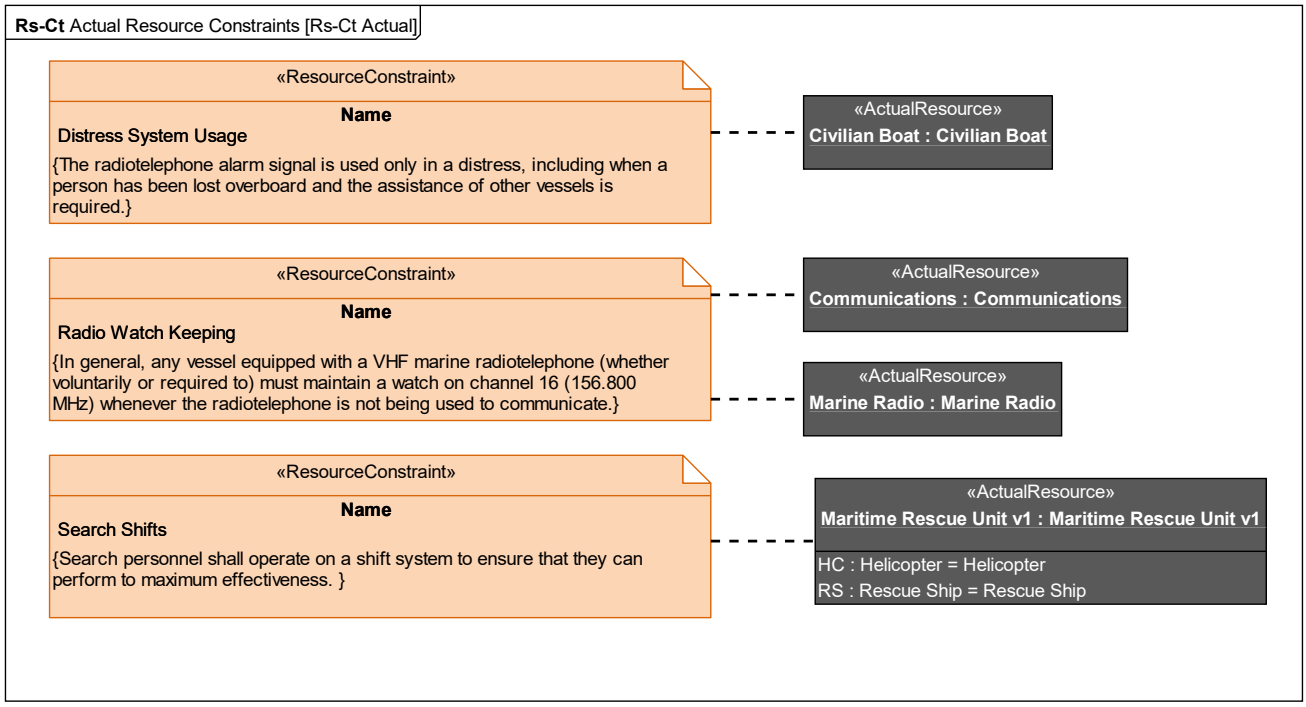

Figure 10:15 - Resources Constraints Linked to Actual Resources

Table 10-3 defines the constraints on a sample of system resources and the elements to which they are linked.

Table 10:3 - Resources Constraints Table and Links
[Architectural Description] Resource Structure [Rs-Ct Matrix]

Resource Constrained Element		Resource Constraint	
Type	**Name**	**Name**	**Text**
«CapabilityConfiguration»	Civilian Boat	GMDSS Vessel Requirements	Ships subject to Title II Part II and Part III of the Communications Act of 1934, as amended have to fit GMDSS equipment under FCC Regulation 47 CFR 80 Subpart W, These include all ships, including fishing vessels, to be navigated in the open sea outside of a harbor or port, except: Ships other than passenger vessels less than 300 gross tonnage, Passenger ships having six passengers or less, U.S. government ships, Yachts of less than 600 gross tons, Vessels in tow, Ships navigating solely on any bays, sounds, rivers or protected waters within the U.S., Ships being navigated with the Great Lakes of North America, and Small passenger ships meeting the requirements of 47 CFR 80 Subpart S.
		Radio Watch Keeping	In general, any vessel equipped with a VHF marine radiotelephone (whether voluntarily or required to) must maintain a watch on channel 16 (156.800 MHz) whenever the radiotelephone is not being used to communicate.
«CapabilityConfiguration»	Maritime Rescue Unit v1	Personnel Safety	Search personnel shall operate on a shift system to ensure that they can perform to maximum efficiency
«CapabilityConfiguration»	Monitoring System	[none]	[none]
«CapabilityConfiguration»	Naval Ship	GMDSS Vessel Requirements	Ships subject to Title II Part II and Part III of the Communications Act of 1934, as amended have to fit GMDSS equipment under FCC Regulation 47 CFR 80 Subpart W, These include all ships, including fishing vessels, to be navigated in the open sea outside of a harbor or port, except: Ships other than passenger vessels less than 300 gross tonnage, Passenger ships having six passengers or less, U.S. government ships, Yachts of less than 600 gross tons, Vessels in tow, Ships navigating solely on any bays, sounds, rivers or protected waters within the U.S., Ships being navigated with the Great Lakes of North America, and Small passenger ships meeting the requirements of 47 CFR 80 Subpart S.
		Radio Watch Keeping	In general, any vessel equipped with a VHF marine radiotelephone (whether voluntarily or required to) must maintain a watch on channel 16 (156.800 MHz) whenever the radiotelephone is not being used to communicate.
«CapabilityConfiguration»	Rescue Ship	GMDSS Vessel Requirements	Ships subject to Title II Part II and Part III of the Communications Act of 1934, as amended have to fit GMDSS equipment under FCC Regulation 47 CFR 80 Subpart W, These include all ships, including fishing vessels, to be navigated in the open sea outside of a harbor or port, except: Ships other than passenger vessels less than 300 gross tonnage, Passenger ships having six passengers or less, U.S. government ships, Yachts of less than 600 gross tons, Vessels in tow, Ships navigating solely on any bays, sounds, rivers or protected waters within the U.S., Ships being navigated with the Great Lakes of North America, and Small passenger ships meeting the requirements of 47 CFR 80 Subpart S.
		Radio Watch Keeping	In general, any vessel equipped with a VHF marine radiotelephone (whether voluntarily or required to) must maintain a watch on channel 16 (156.800 MHz) whenever the radiotelephone is not being used to communicate.
«System»	Marine Radio	Distress System Usage	The radiotelephone alarm signal is used only in a distress, including when a person has been lost overboard and the assistance of other vessels is required.
		Marine Vessel Communications	Mariners need to be able to communicate with other ships of any size or nationality. Mariners need to be able to receive and send urgent maritime safety information. Mariners need to be able to send or receive distress alerts in an emergency to or from rescue coordination centers ashore and nearby ships anywhere in the world.
«System»	Ship Controls	[none]	[none]
«System»	Tactical Radio	Distress System Usage	The radiotelephone alarm signal is used only in a distress, including when a person has been lost overboard and the assistance of other vessels is required.
		GMDSS Equipment Operation	A GMDSS Radio Operator's License is necessary for a person to use required GMDSS equipment.
		Marine Vessel Communications	Mariners need to be able to communicate with other ships of any size or nationality. Mariners need to be able to receive and send urgent maritime safety information. Mariners need to be able to send or receive distress alerts in an emergency to or from rescue coordination centers ashore and nearby ships anywhere in the world.
«ResourceRole»	L16	[none]	[none]

10.8 View Specifications::Resources::Roadmap

Stakeholders: Systems Engineers, IT Architects, Solution Providers, Implementers.
Concerns: resource structure changes over time.
Definition: provides an overview of how a resource structure changes over time. It shows the structure of several resources mapped against a timeline.
Recommended Implementation: timeline, SysML Block Definition Diagram, SysML Internal Block Diagram.

The Rs-Rm view is used to show the whole lifecycle of a resource showing how its configuration changes over time. It shows the capabilities, the resources that implement those capabilities, and any constituent components. Table 10-4 shows the lifecycles for the architecture capabilities. Note that some capabilities do not have any implementing resources. This is also useful information as it demonstrates that all capabilities have not been linked to systems.

Table 10:4 - Resources Roadmap: Evolution

[Architectural Description] System View (Evolution Matrix)

Capability	Exhibiting Element		Milestone Dates						
Name	Name	Components	2014-01-01	2015-12-15	2015-12-16	2018-12-31	2019-02-01	2022-12-30	2022-12-31
Assistance	«Resource Architecture» Maritime SAR resource architecture phase 1	«Capability Configuration» Rescue boat phase 1 «Capability Configuration» MSAR control centre phase 1 «Capability Configuration» Search Helicopter phase 1 «Capability Configuration» Life raft «Capability Configuration» Medical facility «Capability Configuration» Military resource command and control «Capability Configuration» Distress monitoring	Increment	Out Of Service					
	«Resource Architecture» Maritime SAR resource architecture phase 2	«Capability Configuration» Rescue boat phase 2 «Capability Configuration» MSAR control centre phase 2 «Capability Configuration» Search Helicopter phase 2 «Capability Configuration» Life raft «Capability Configuration» Location snc prov «Capability Configuration» Medical facility «Capability Configuration» Military resource command and control «Capability Configuration» Distress monitoring «Capability Configuration» Weather and sea state snc prov			Increment	Out Of Service			
	«Resource Architecture» Maritime SAR resource architecture phase 3	«Capability Configuration» MSAR control centre phase 3 «Capability Configuration» Collaboration snc prov «Capability Configuration» Rescue hovercraft phase 3 «Capability Configuration» Life raft «Capability Configuration» Medical facility «Capability Configuration» Military resource command and control «Capability Configuration» Distress monitoring «Capability Configuration» Search VTOL phase 3					Increment	Out Of Service	
	«Organization» SAR Organization Context Phase 1	«Organization» Maritime Rescue Team Phase 1 «Post» MSAR C2 Operator	Increment	Out Of Service					
	«Organization» SAR Organization Context Phase 2	«Post» SAR C2 manager «Organization» Maritime Rescue Team Phase 2 «Post» MSAR C2 Operator			Increment	Out Of Service			
	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Post» Distressed Party «Organization» Maritime Rescue Team Phase 3					Increment		Out Of Service
	«Enterprise Phase» SARPhase 1								
	«Enterprise Phase» SARPhase 2								
	«Enterprise Phase» SARPhase 3								
Common operational picture access	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Post» Distressed Party «Organization» Maritime Rescue Team Phase 3					Increment		Out Of Service
Distress Signal Monitoring	«Organization» SAR Organization Context Phase 1	«Organization» Maritime Rescue Team Phase 1 «Post» MSAR C2 Operator	Increment	Out Of Service					
	«Organization» SAR Organization Context Phase 2	«Post» SAR C2 manager «Organization» Maritime Rescue Team Phase 2 «Post» MSAR C2 Operator			Increment	Out Of Service			
	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Post» Distressed Party «Organization» Maritime Rescue Team Phase 3					Increment		Out Of Service
Land SAR									
Maritime SAR									
Maritime SAR phase 1	«Resource Architecture» Maritime SAR resource architecture phase 1	«Capability Configuration» Rescue boat phase 1 «Capability Configuration» MSAR control centre phase 1 «Capability Configuration» Search Helicopter phase 1 «Capability Configuration» Life raft «Capability Configuration» Medical facility «Capability Configuration» Military resource command and control «Capability Configuration» Distress monitoring	Increment	Out Of Service					
	«Organization» SAR Organization Context Phase 1	«Organization» Maritime Rescue Team Phase 1 «Post» MSAR C2 Operator	Increment	Out Of Service					
Maritime SAR phase 2	«Resource Architecture» Maritime SAR resource architecture phase 2	«Capability Configuration» Rescue boat phase 2 «Capability Configuration» MSAR control centre phase 2 «Capability Configuration» Search Helicopter phase 2 «Capability Configuration» Life raft «Capability Configuration» Location snc prov «Capability Configuration» Medical facility «Capability Configuration» Military resource command and control «Capability Configuration» Distress monitoring «Capability Configuration» Weather and sea state snc prov			Increment	Out Of Service			
	«Organization» SAR Organization Context Phase 2	«Post» SAR C2 manager «Organization» Maritime Rescue Team Phase 2 «Post» MSAR C2 Operator			Increment	Out Of Service			
Maritime SAR phase 3	«Resource Architecture» Maritime SAR resource architecture phase 3	«Capability Configuration» MSAR control centre phase 3 «Capability Configuration» Collaboration snc prov «Capability Configuration» Rescue hovercraft phase 3 «Capability Configuration» Life raft «Capability Configuration» Medical facility «Capability Configuration» Military resource command and control «Capability Configuration» Distress monitoring «Capability Configuration» Search VTOL phase 3					Increment	Out Of Service	
	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Post» Distressed Party «Organization» Maritime Rescue Team Phase 3					Increment		Out Of Service
Military C2									

Stakeholders: Solution Providers, Systems Engineers, IT Architects.
Concerns: technology forecast.
Definition: defines the underlying current and expected supporting technologies. Expected supporting technologies are those that can be reasonably forecast given the current state of technology and expected improvements / trends.
Recommended Implementation: timeline, tabular format, SysML Block Definition Diagram.

The Rs-Rm provides a summary of the current and emerging technologies and skills that impact on the Resources that constitute the architecture. The examples shown in Figure 10-17 and Table 10-5 show the technology forecasts for the resource artifacts used in the systems views. Reports can also be created for competencies (Skill in DoDAF), posts (PersonType in DoDAF), organizations (OrganizationType in DoDAF), etc.

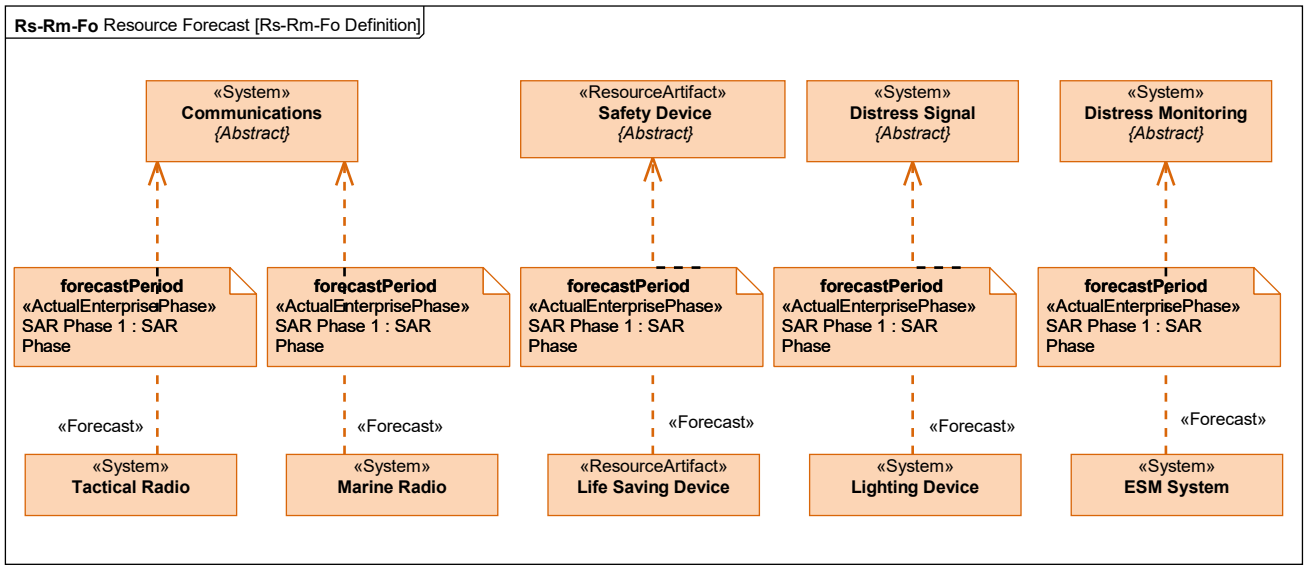

Figure 10:17 - Resources Roadmap: Forecast

Table 10:5 - Resources Roadmap: Forecast

Resource Structure [Rs-Rm-Fo]

Type: Resources Roadmap - Forecast [Timeline] (Rs-Rm-Fo)
Description:

		2019											
Resource Performer	**Enterprise Phase**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Life Saving Device	SAR Phase 1	**Safety Device** **Start:** 2019-01-01 **End:** 2019-12-31											
ESM System	SAR Phase 1	**Distress Monitoring** **Start:** 2019-01-01 **End:** 2019-12-31											
Lighting Device	SAR Phase 1	**Distress Signal** **Start:** 2019-01-01 **End:** 2019-12-31											
Marine Radio	SAR Phase 1	**Communications** **Start:** 2019-01-01 **End:** 2019-12-31											
Tactical Radio	SAR Phase 1	**Communications** **Start:** 2019-01-01 **End:** 2019-12-31											

10.9 View Specifications::Resources::Traceability

Stakeholders: Systems Engineers, Enterprise Architects, Solution Providers, Business Architects.
Concerns: traceability between operational activities and functions that implements them.
Definition: depicts the mapping of functions to operational activities and thus identifies the transformation of an operational need into a purposeful function performed by a resource or solution.
Recommended Implementation: Matrix format, SysML Block Definition Diagram.

The Rs-Tr view is used to show how System Functions support Operational Activities and Service Functions. UAF also provides a graphical view to define these relationships. Figure 10-18 shows the SAR Activities and those System Functions that implement them. This provides an essential requirements traceability capability as well as a means of validating the overall architecture. Functions that do not implement operational activities may be superfluous, and operational activities that are not implemented by functions have not been fully analyzed.

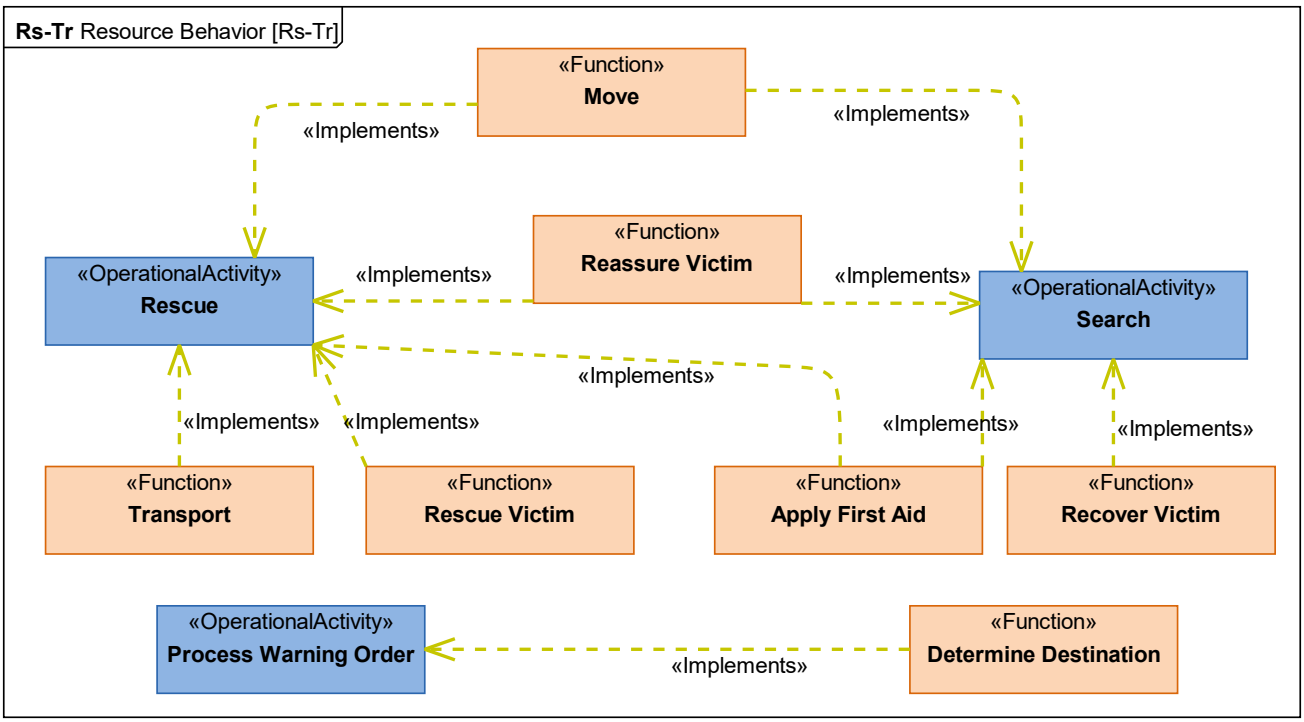

Figure 10:18 - Resources Traceability between Resource Functions and Operational Activities

Table 10-6 summarizes the traceability between the system functions and operational activities in matrix form. It has been simplified for readability.

Table 10:6 - Resources Traceability

Resource Structure [Rs-Tr Behavior Matrix]

		Implemented Operational Activities			
		«OperationalActivity» Process Warning Order	«OperationalActivity» Track Victim	«OperationalActivity» Rescue	«OperationalActivity» Search
Resource Performed Functions	«Function» Determine Destination	X	X		
	«Function» Move			X	X
	«Function» Transport			X	

11. View Specifications::Actual Resources

View Specifications::Actual Resources::Structure

Stakeholders: Solution Providers, Systems Engineers, Business Architects.
Concerns: the analysis, e.g. evaluation of different alternatives, what-if, trade-offs, V&V on the actual resource configurations as it provides a means to capture different solution architectures. The detailed analysis (trade-off, what-if etc.) is carried out using the Resource Constraints view.
Definition: illustrates the expected or achieved actual resource configurations required to meet an operational need.
Recommended Implementation: SysML Block Definition Diagram.
The analysis, e.g., evaluation of different alternatives, what-if, trade-offs, V&V on the actual resource configurations.
Illustrates the expected or achieved actual resource configurations.

Figure 11-1 shows a set of actual resources. All the resource elements have been instantiated as an example of what is possible. Actual projects would use actual systems with specific names and deployed elements.

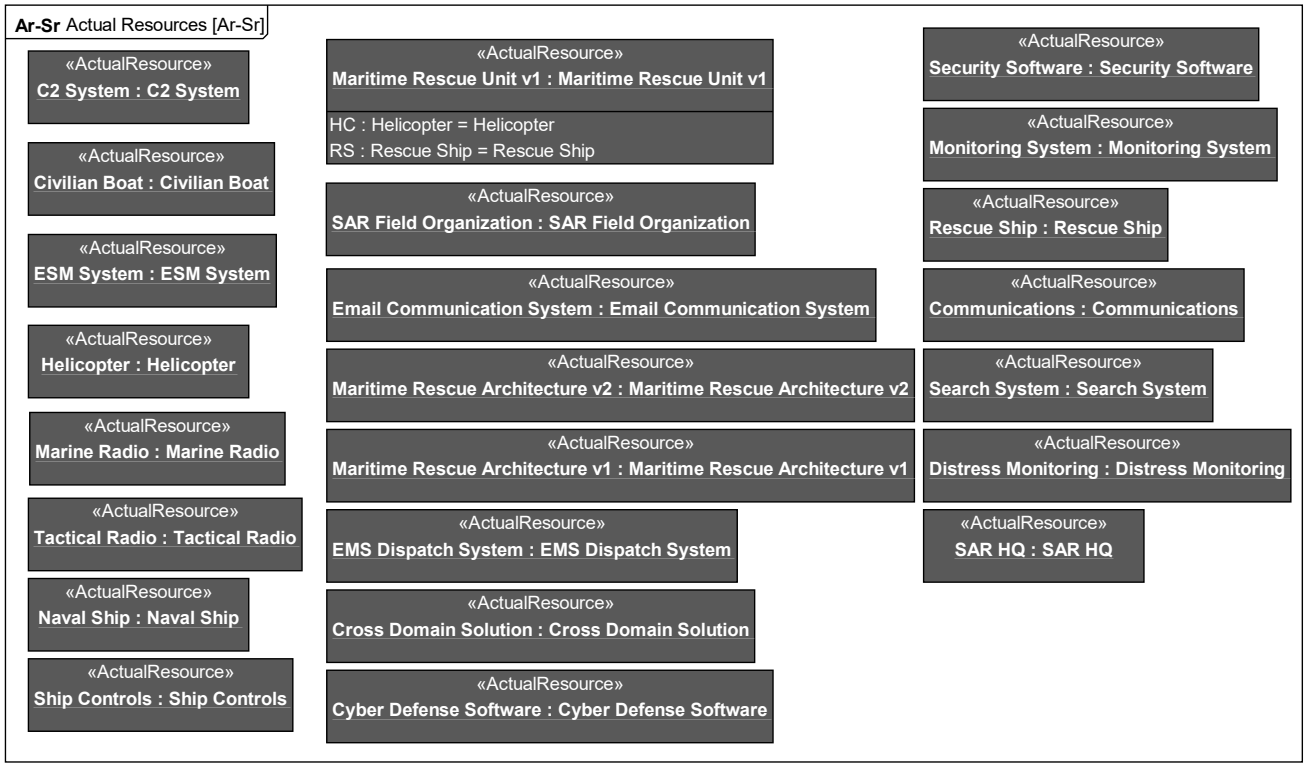

Figure 11:1 – Collection of Actual Resources

Figure 11-2 shows an example architecture as well a availability forecasts.

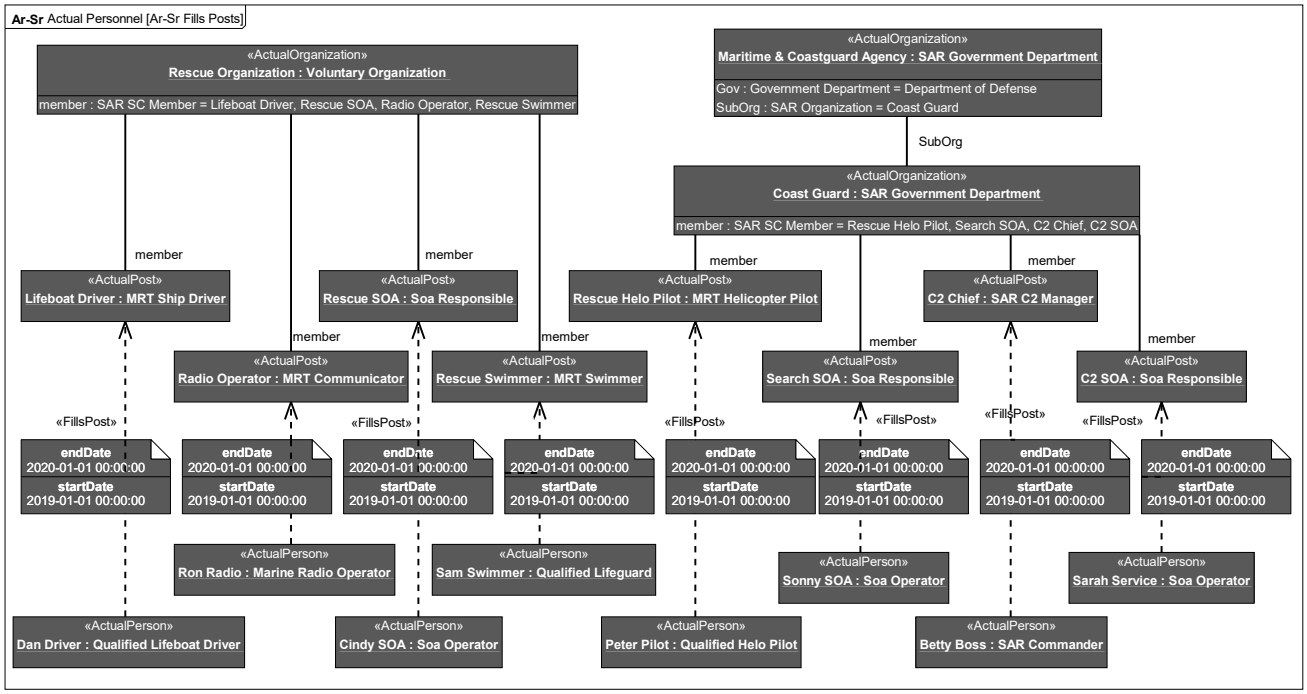

Figure 11:2 - Actual Resources Structure and Forecast

11.1 View Specifications::Actual Resources::Connectivity

Stakeholders: Solution Providers, Systems Engineers, Business Architects.
Concerns: the communication of actual resource.
Definition: illustrates the actual resource configurations and actual relationships between them.
Recommended Implementation: tabular format, SysML Block Definition Diagram, SysML Internal Block Diagram, SysML Sequence Diagram.

Figure 11-3 shows a nominal architecture to demonstrate example system interactions.

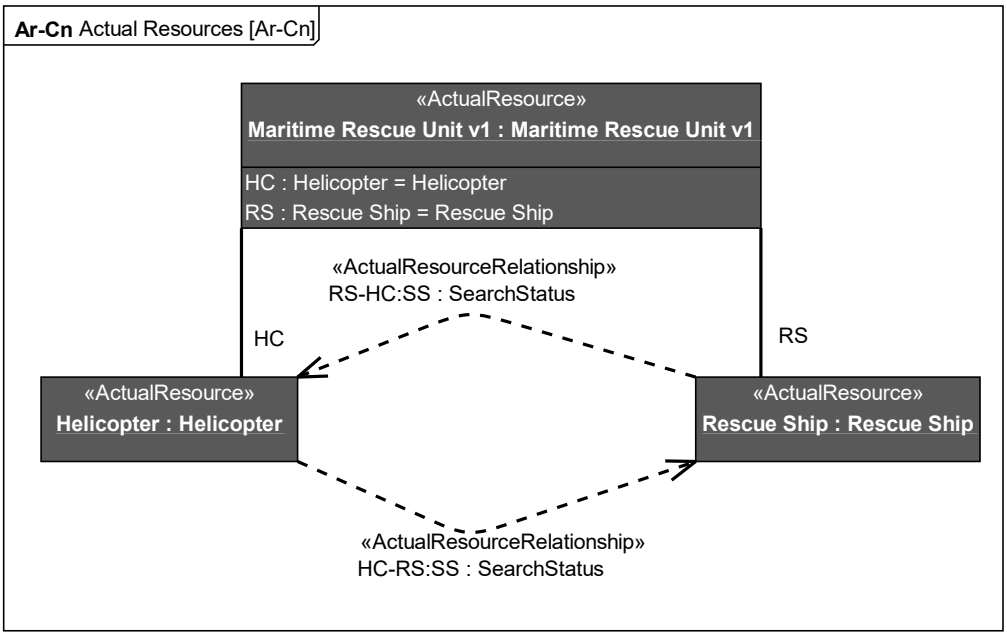

Figure 11:3 - Actual Resources Connectivity between Systems

11.2 View Specifications::Actual Resources::Traceability

Stakeholders: Systems Engineers, Enterprise Architects, Solution Providers, Business Architects.
Concerns: traceability between operational activities and functions that implements them.
Definition: depicts the mapping of functions to operational activities and thus identifies the transformation of an operational need into a purposeful function performed by a resource or solution.
Recommended Implementation: Matrix format, SysML Block Definition Diagram.

Table 11-1 shows the connections defined in Figure 11-3 in matrix form.

Table 11:1 - Actual Resources Traceability Matrix

Actual Resources [Ar-Cn Matrix]

Actual Relationship Target \ Actual Relationship Sourc	«ActualResource» Helicopter	«ActualResource» Rescue Ship
«ActualResource» Helicopter		SearchStatus
«ActualResource» Rescue Ship	SearchStatus	

12. View Specifications::Information

View Specifications::Information::Information Model

Stakeholders: Data Modelers, Software Engineers, Systems Engineers
Concerns: address the information perspective on operational, service, and resource architectures.
Definition: allows analysis of an architecture's information and data definition aspect, without consideration of implementation specific issues.
Recommended Implementation: SysML Block Definition Diagram.

The Information Views are used to define the concepts, information and data used in the UAF model. This can be done at various levels of abstraction or none at all.

The If view shown in Figure 12-1 describes the taxonomy of information elements and entities used in the operational context.

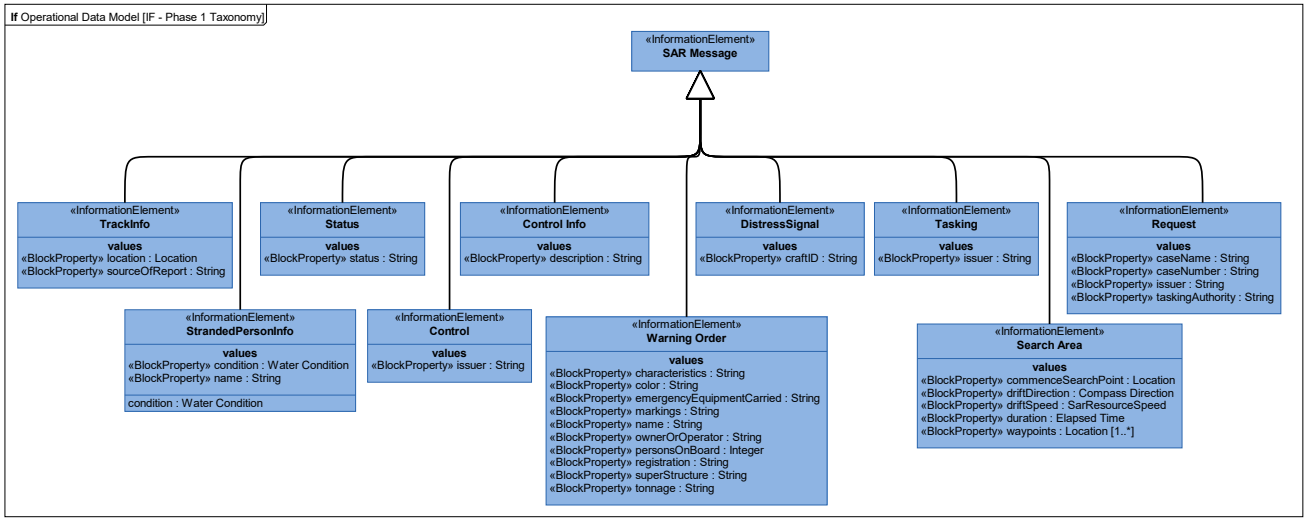

Figure 12:1 - Information Model Taxonomy for the Operational Views

The If view shown in Figure 12-1 describes the information elements and entities used in the operational context. The boxes show the information items and the lines represent their inter-relationships. Attributes can be used to show the characteristics of the information items. These are used on the Op-Sr and other diagrams.

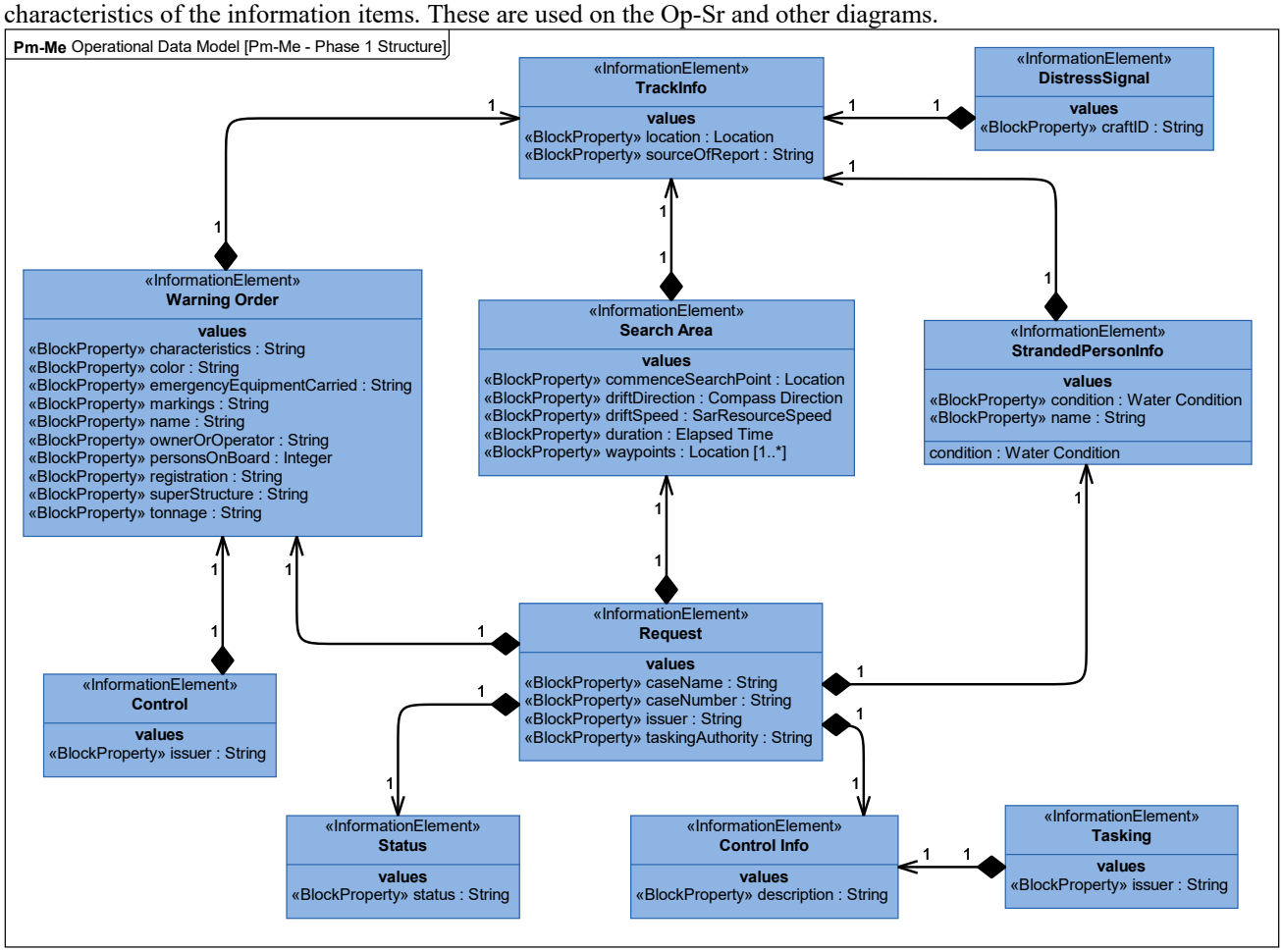

Figure 12:2 - Information Model for Operation Views with Structure and Attributes

The If also defines the structure of various kinds of system data that are utilized by the system resources. These are the data elements used by the structure, process and interaction diagrams. Data elements are defined that are defined by entities. These entities can have complex structures. Figure 12-3 shows the initial stages of the definition of the SAR data model.

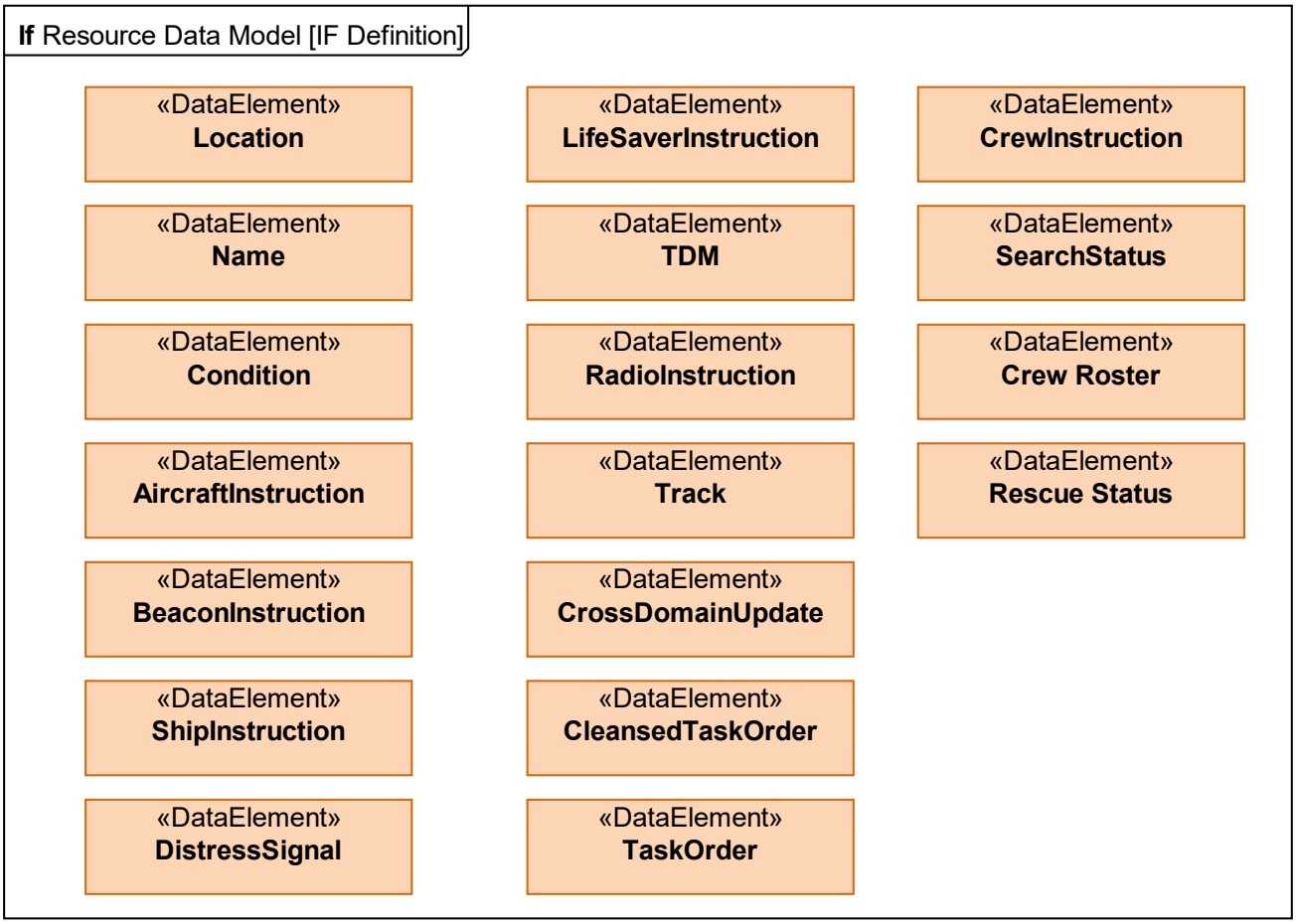

Figure 12:3 - Information Model Data Elements for Resources Views

Figure 12-4 shows the traceability between the information elements and the data elements. Its purpose is to make sure that the data defined in the operation view is reflected in the resource views.

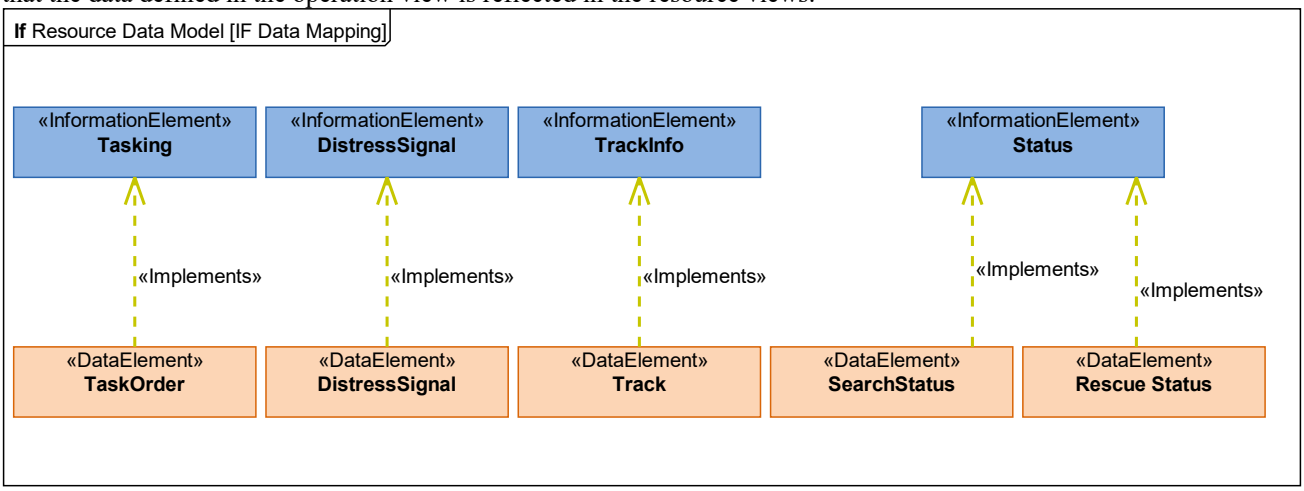

Figure 12:4 - Information Model with Operational to Resource Traceability

13. View Specifications::Personnel

Stakeholders: Human resources, Solution Providers, PMs.
Concerns: human factors.
Definition: aims to clarify the role of Human Factors (HF) when creating architectures in order to facilitate both Human Factors Integration (HFI) and systems engineering (SE).

The Human Factors/Personnel views aim to clarify the role of Human Factors (HF) when creating architectures to facilitate both Human Factors Integration (HFI) and systems engineering (SE).

- Stakeholders: Human resources, Solution Providers, PMs.
- Concerns: human factors.
- Definition: aims to clarify the role of Human Factors (HF) when creating architectures to facilitate both Human Factors Integration (HFI) and systems engineering (SE).

13.1 View Specifications::Personnel::Taxonomy

Stakeholders: Human resources, Solution Providers, PMs.
Concerns: organizational resource types.
Definition: shows the taxonomy of types of organizational resources.
Recommended Implementation: SysML Block Definition Diagram.

Figure 13-1 Shows the Personnel Taxonomy for the government departments

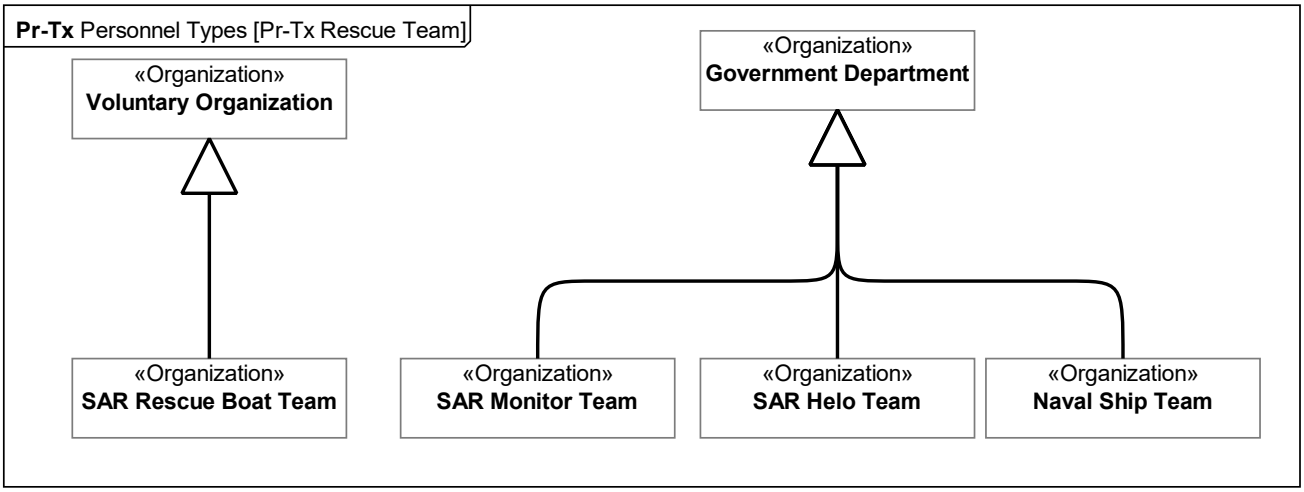

Figure 13:1 - Personnel Taxonomy for Government Departments

Figure 13-2 Shows the Personnel Taxonomy for the Search and Rescue organization.

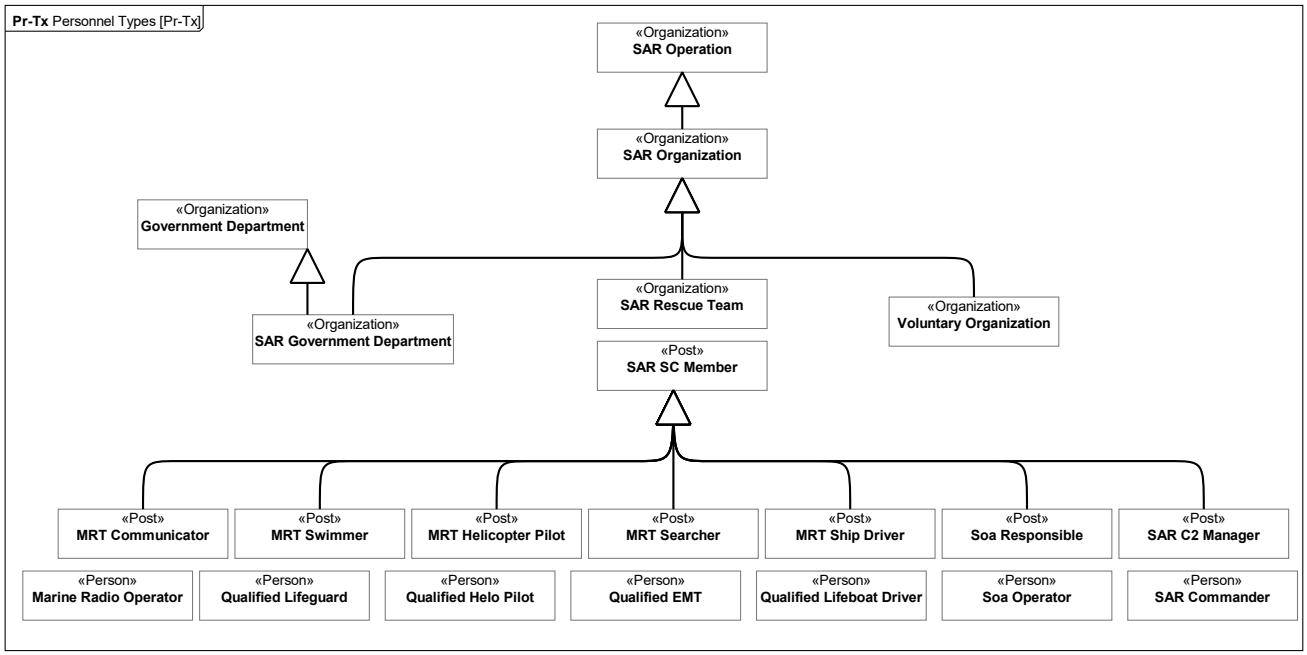

Figure 13:2 - Personnel Taxonomy for SAR Organizations and Posts

13.2 View Specifications::Personnel::Structure

Stakeholders: Human resources, Solution Providers, PMs.
Concerns: typical organizational structure used to support a capability(ies).
Definition: shows organizational structures and possible interactions between organizational resources.
Recommended Implementation: SysML Block Definition Diagram, SysML Internal Block Diagram.

The aggregation or whole-part relationships are also shown in Figure 13-3. Command and Control interactions can also be shown on the diagram.

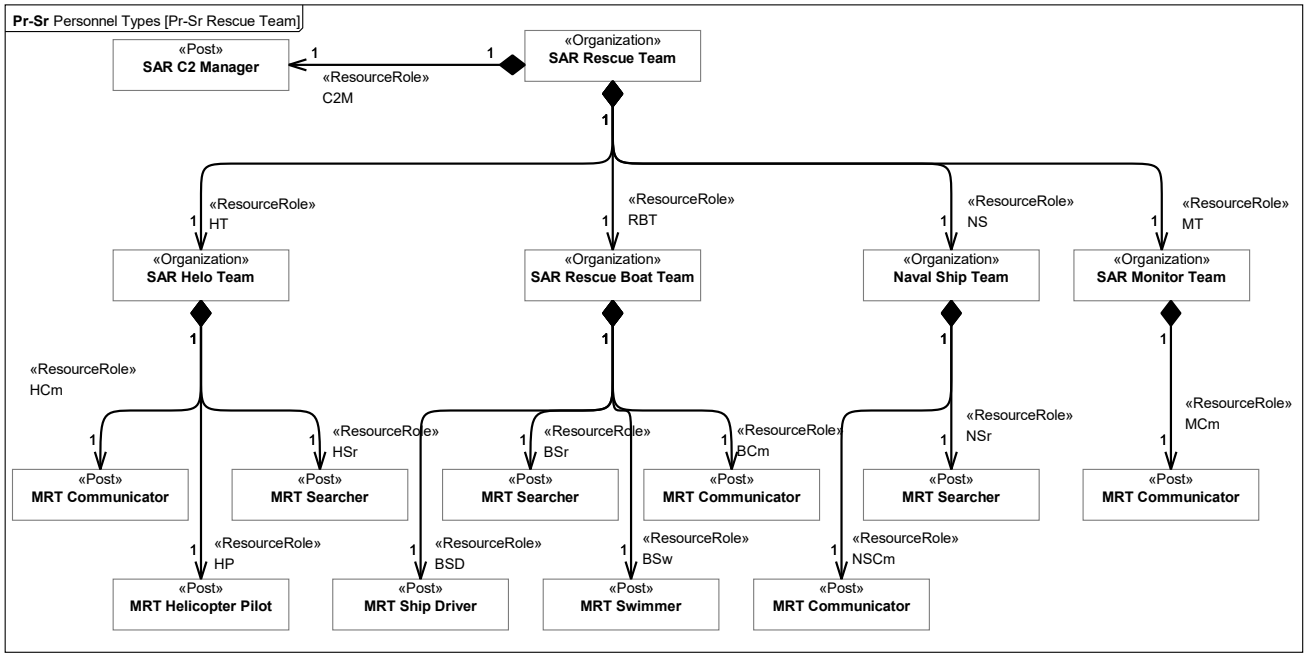

Figure 13:3 - Personnel Structure for SAR Rescue Team

Figure 13-4 defines the responsibilities for the various posts in the SAR operation.

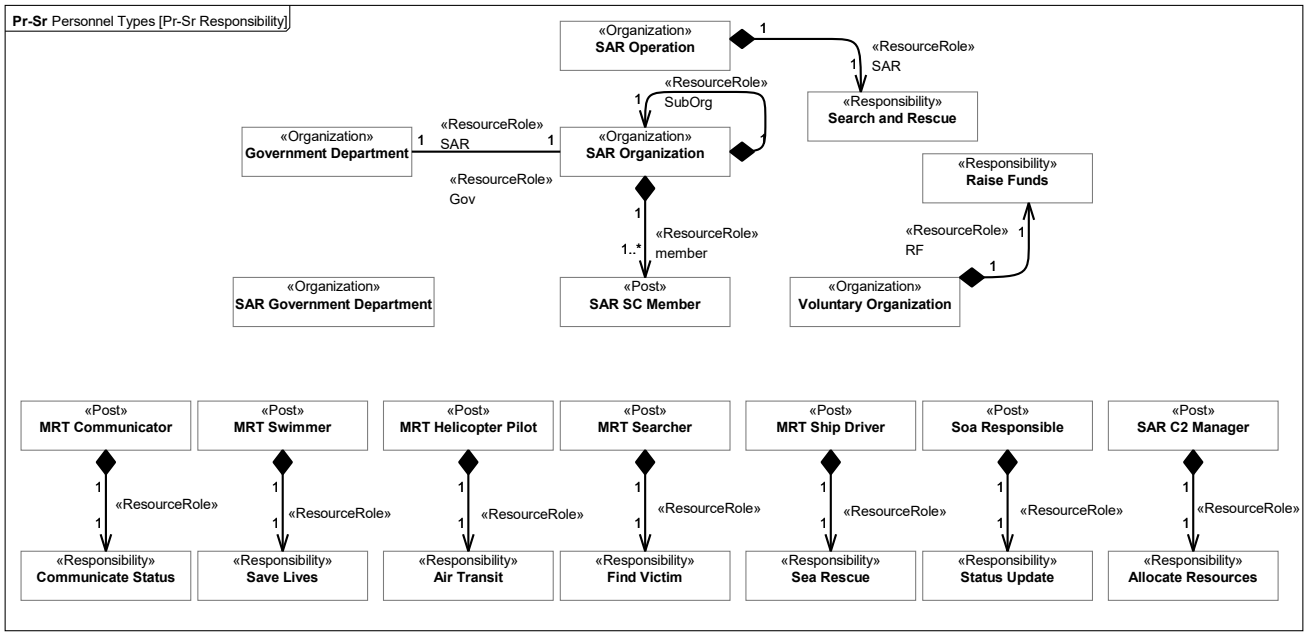

Figure 13:4 - Personnel Structure and Responsibilities for the SAR Operation

Figure 13-5 shows the interaction between the personnel in the Marine Rescue Team. This can be used to help define the required HCI and Human factors characteristics.

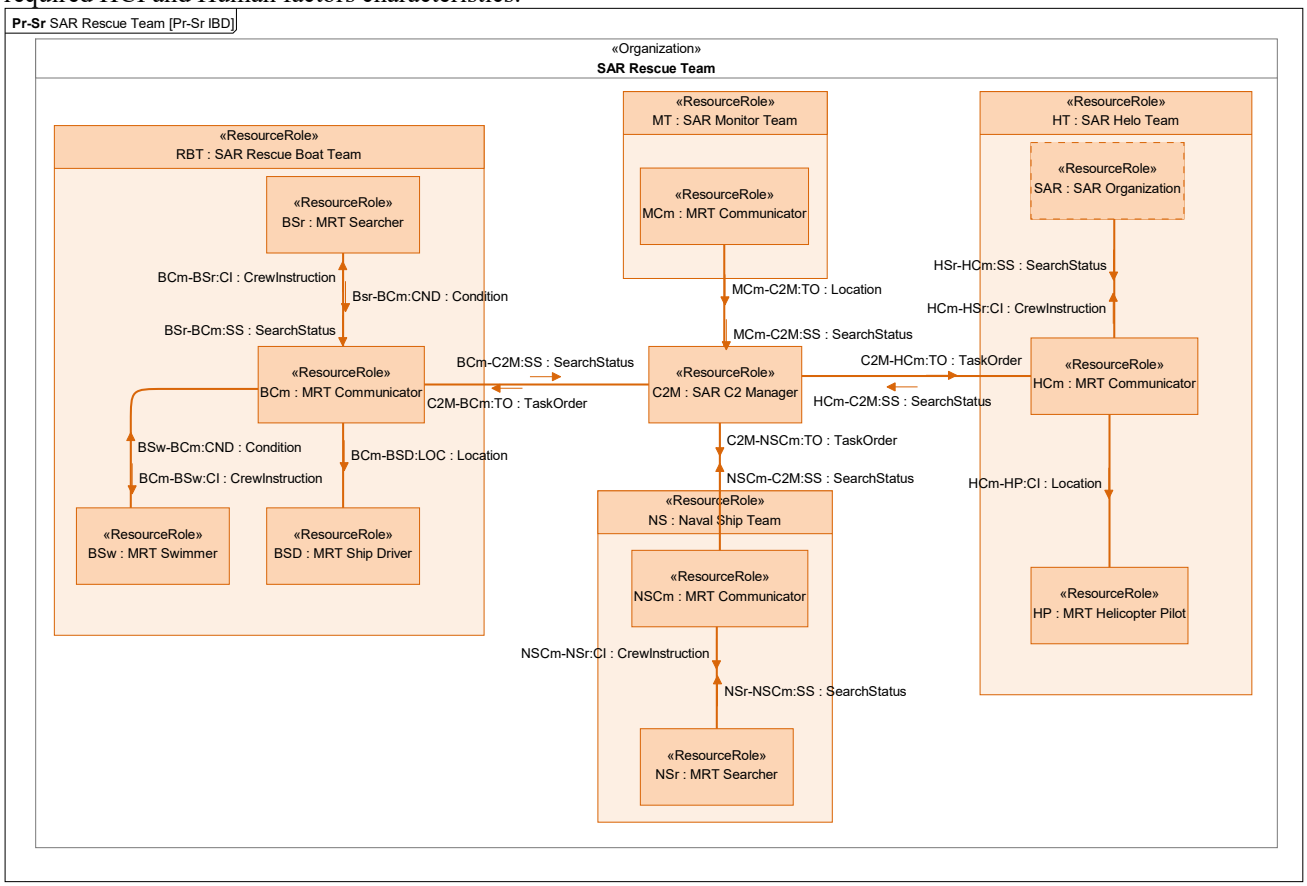

Figure 13:5 – Internal Personnel Structure for the SAR Rescue Team

Figure 13-6 sows the Internal Personnel Structure for the Actual SAR Organization. This structure corresponds to the class view defined in Figure 13-3.

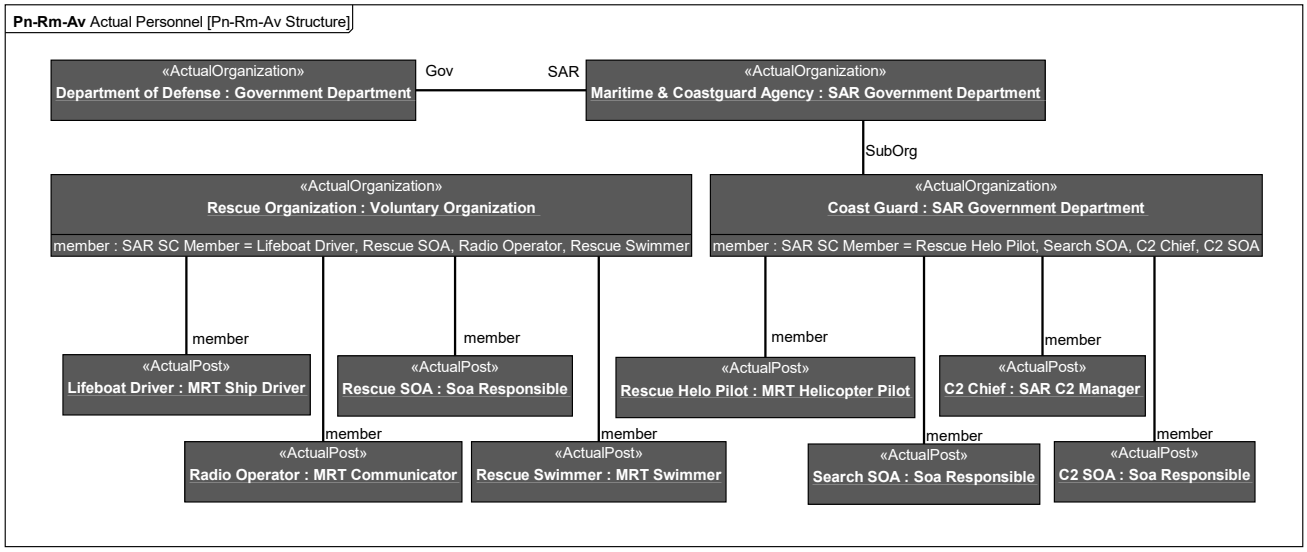

Figure 13:6 – Internal Personnel Structure for the Actual SAR Organization

13.3 View Specifications::Personnel::Connectivity

Stakeholders: Solution providers.
Concerns: interaction of organizational resources.
Definition: captures the possible interactions between organizational resources, including command and control relationships. Interactions typically illustrate the fundamental roles and management responsibilities.
Recommended Implementation: tabular format.
Table 13-1 Summarizes the interactions between the system and human elements in Figure 13-5.

Table 13:1 - Personnel Connectivity of the SAR Rescue Team

SAR Rescue Team [Pr-Cn Table]

Resource Exchange		Producer		Resource Connector		Consumer	
Name	Conveyed	Resource Performer	Function	Name	Protocol	Resource Performer	Function
BCm-C2M:SS	«Data Element» SearchStatus	«Post» MRT Communicator		Resource Connector		«Post» SAR C2 Manager	
C2M-BCm:TO	«Data Element» TaskOrder	«Post» SAR C2 Manager		Resource Connector		«Post» MRT Communicator	
C2M-HCm:TO	«Data Element» TaskOrder	«Post» SAR C2 Manager		Resource Connector		«Post» MRT Communicator	
HCm-C2M:SS	«Data Element» SearchStatus	«Post» MRT Communicator		Resource Connector		«Post» SAR C2 Manager	
MCm-C2M:SS	«Data Element» SearchStatus	«Post» MRT Communicator		Resource Connector		«Post» SAR C2 Manager	
MCm-C2M:TO	«Data Element» Location	«Post» MRT Communicator		Resource Connector		«Post» SAR C2 Manager	
C2M-NSCm:TO	«Data Element» TaskOrder	«Post» SAR C2 Manager		Resource Connector		«Post» MRT Communicator	
NSCm-C2M:SS	«Data Element» SearchStatus	«Post» MRT Communicator		Resource Connector		«Post» SAR C2 Manager	
HCm-HP:CI	«Data Element» Location	«Post» MRT Communicator		Resource Connector		«Post» MRT Helicopter Pilot	
HCm-HSr:CI	«Data Element» CrewInstruction	«Post» MRT Communicator		Resource Connector		«Post» MRT Searcher	
HSr-HCm:SS	«Data Element» SearchStatus	«Post» MRT Searcher		Resource Connector		«Post» MRT Communicator	
NSCm-NSr:CI	«Data Element» CrewInstruction	«Post» MRT Communicator		Resource Connector		«Post» MRT Searcher	
NSr-NSCm:SS	«Data Element» SearchStatus	«Post» MRT Searcher		Resource Connector		«Post» MRT Communicator	
BCm-BSw:CI	«Data Element» CrewInstruction	«Post» MRT Communicator		Resource Connector		«Post» MRT Swimmer	
BSw-BCm:CND	«Data Element» Condition	«Post» MRT Swimmer		Resource Connector		«Post» MRT Communicator	
BCm-BSr:CI	«Data Element» CrewInstruction	«Post» MRT Communicator		Resource Connector		«Post» MRT Searcher	
Bsr-BCm:CND	«Data Element» Condition	«Post» MRT Searcher		Resource Connector		«Post» MRT Communicator	
BSr-BCm:SS	«Data Element» SearchStatus	«Post» MRT Searcher		Resource Connector		«Post» MRT Communicator	
BCm-BSD:LOC	«Data Element» Location	«Post» MRT Communicator		Resource Connector		«Post» MRT Ship Driver	

13.4 View Specifications::Personnel::Processes

Stakeholders: Systems engineers, Solution providers.
Concerns: functions that must be carried out by organizational resources.
Definition: specifies organizational resource functions in relation to resource definitions.
Recommended Implementation: SysML Activity Diagram, SysML Block Definition Diagram, BPMN Process Diagram.

Figure 13-7 shows the system functions for rescuing a victim.

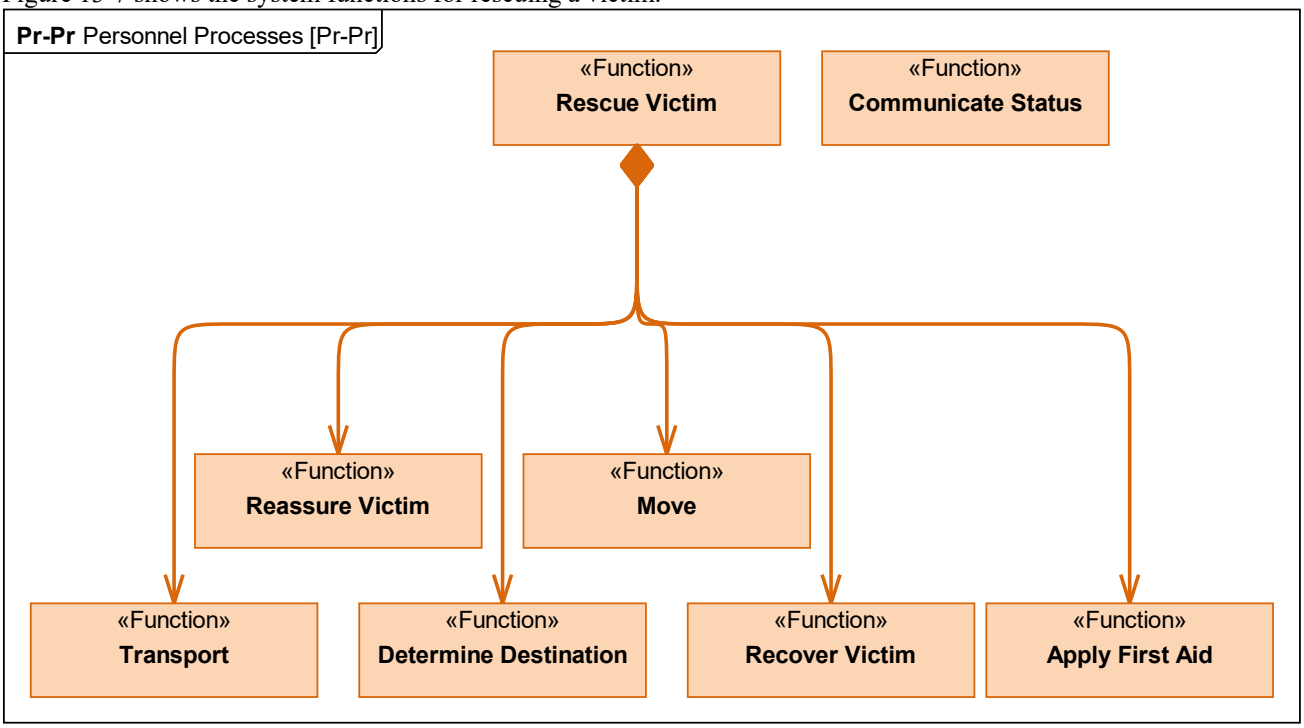

Figure 13:7 - Personnel Processes for the Rescue Operation

Figure 13-8 shows the sequence of activities or system functions for rescuing a victim. Timing and other constraints and metrics can be added to help clarify behavioral constraints.

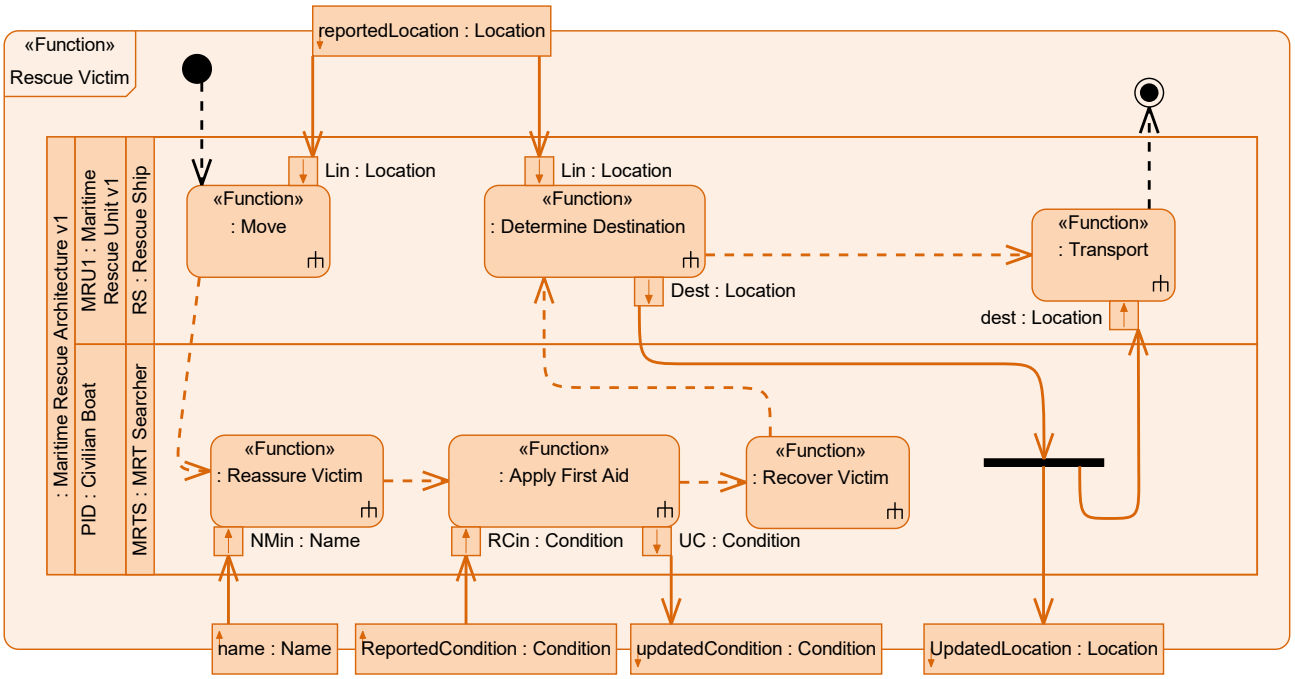

Figure 13:8 - Personnel Processes Activity Diagram for Rescue Victim.

13.5 View Specifications::Personnel::States

Stakeholders: Systems Engineers, Software Engineers.
Concerns: capture state-based behavior of an organizational resource.
Definition: it is a graphical representation of states of an organizational resource and how that organizational resource responds to various events and actions.
Recommended Implementation: SysML State Machine Diagram.

Figure 13-9 details the state-based behavior for the SAR Rescue Team. It shows the activities that they perform while in the various states and the sequences which they undertake. It can also be used to show career development and other human state-based aspects.

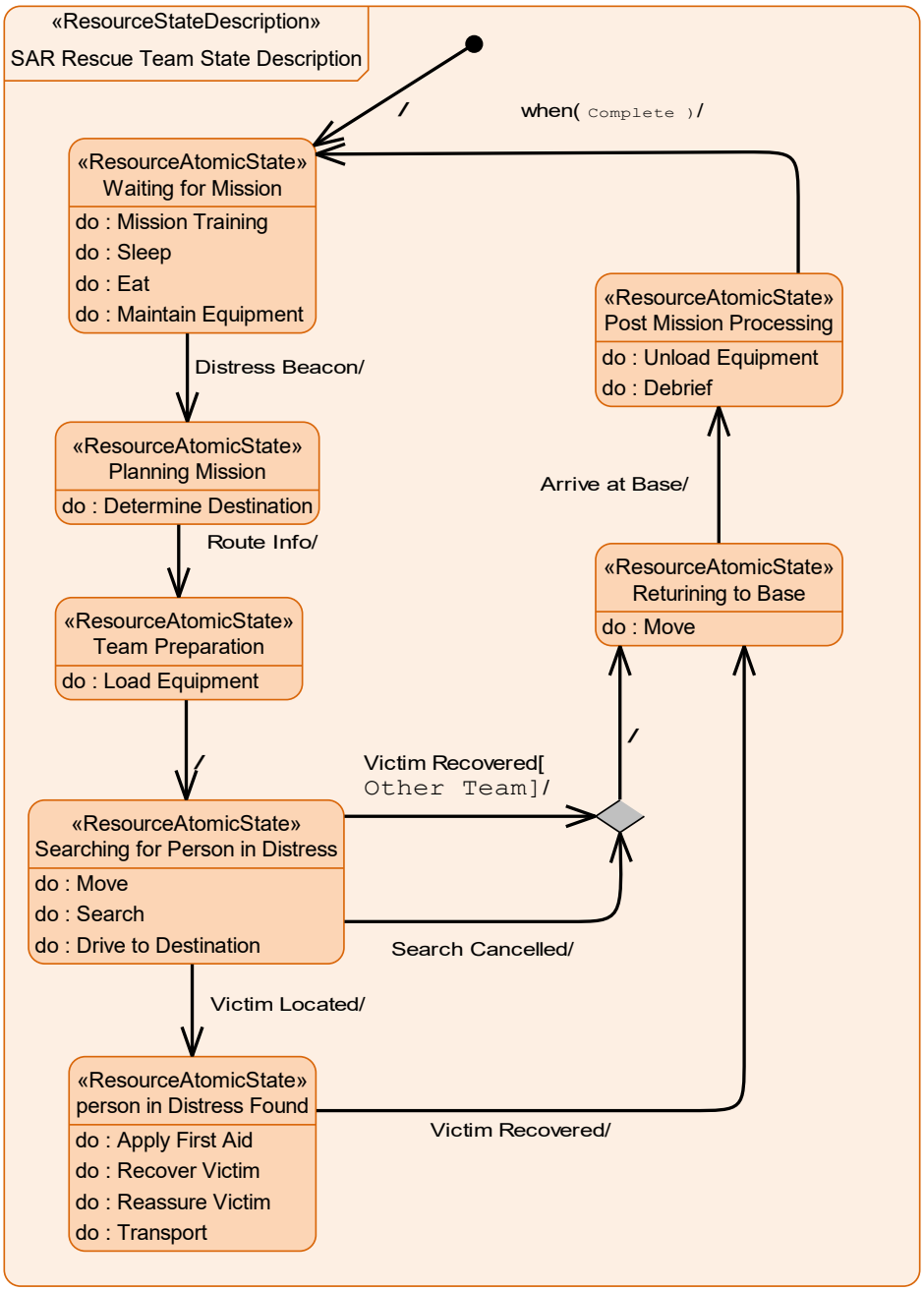

Figure 13:9 - Personnel States for SAR Rescue Team.

13.6 View Specifications::Personnel::Interaction Scenarios

Stakeholders: Software Engineers, Systems Engineers.
Concerns: interactions between organizational resources (roles).
Definition: provides a time-ordered examination of the interactions between organizational resources.
Recommended Implementation: SysML Sequence Diagram, BPMN Collaboration Diagram.

Figure 13-10 shows the sequence of interactions between the personnel in the SAR organization as part of the initiation of a SAR operation.

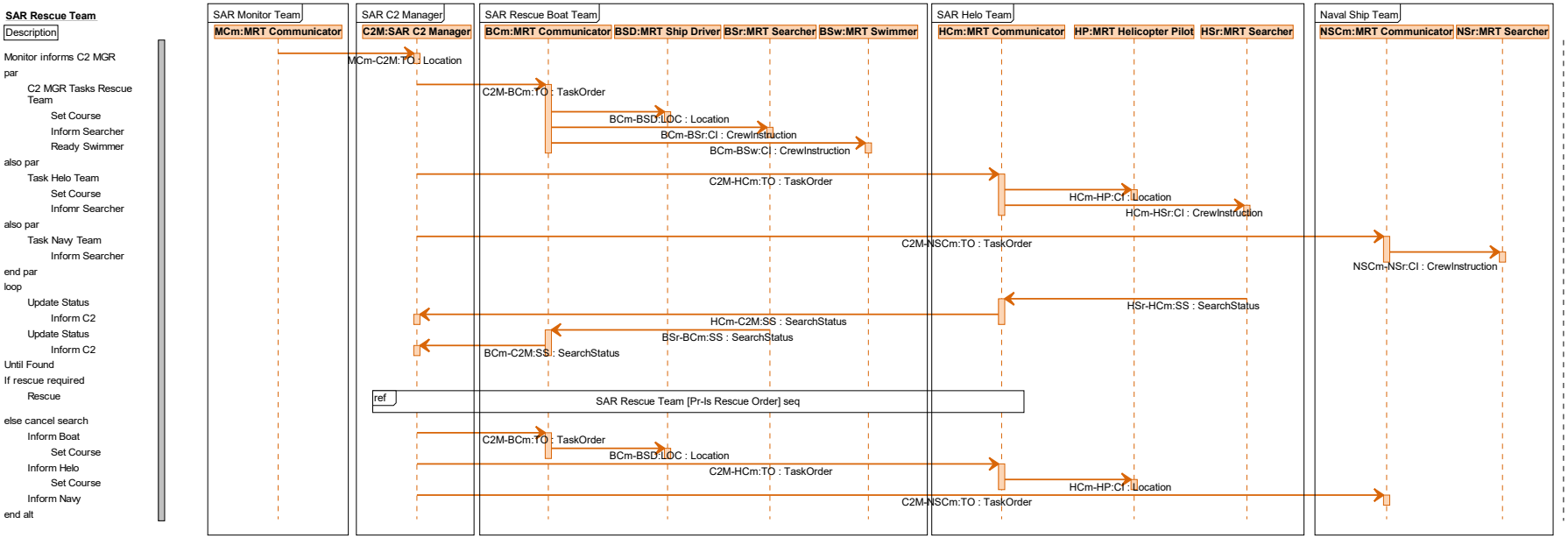

Figure 13:10 - Personnel Interaction Scenario for Initiate SAR Rescue Operation.

Figure 13-11 shows the rescue sequence for the SAR Rescue Team.

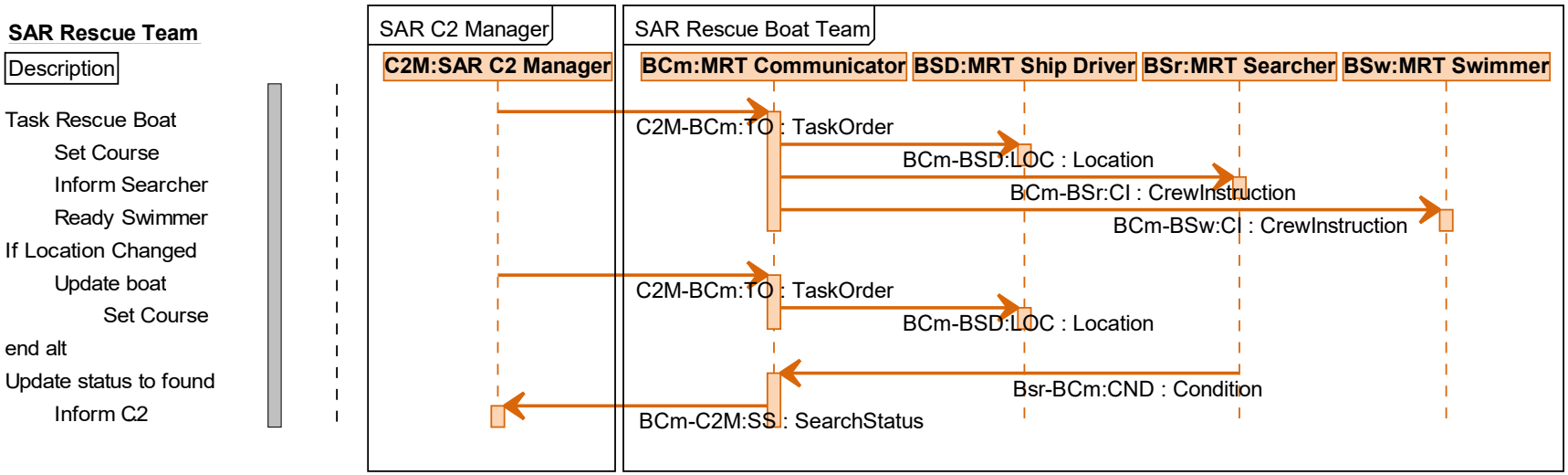

Figure 13:11 - Personnel Interaction Scenarios for Rescue

13.7 View Specifications::Personnel::Constraints

Stakeholders: Systems engineers, Solution providers.
Concerns: allocation of competencies to actual posts.
Definition: specifies requirements for actual organizational resources – by linking competencies and actual posts.
Recommended Implementation: SysML Block Definition Diagram.

Figure 13-12 defines the Posts and their required Competencies and Functions.

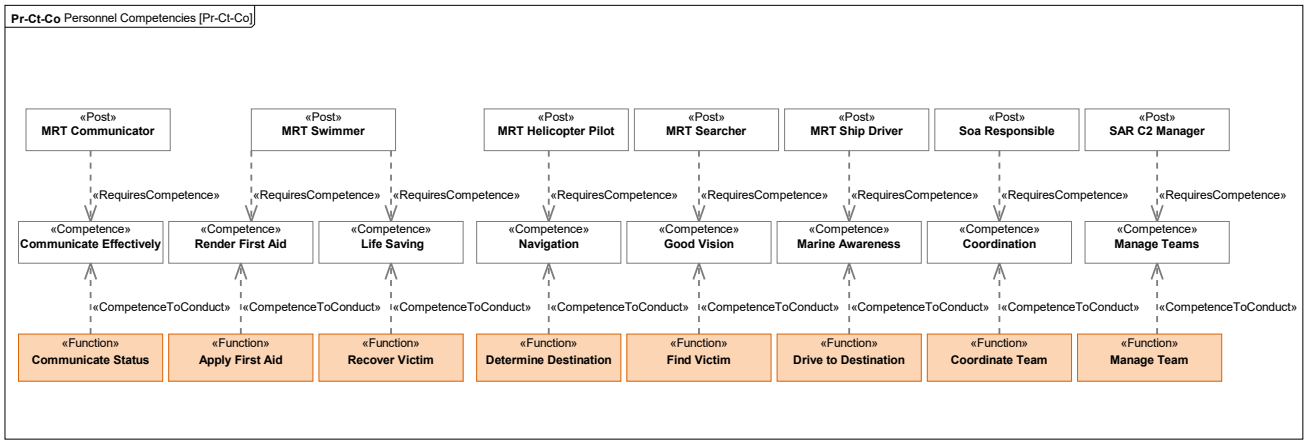

Figure 13:12 - Personnel Constraints: Competence for Posts and Functions

Figure 13-13defines the actual posts that provide the competencies and the roles that require these competencies. This can be used to match people and posts to the required competencies as well as identify competency gaps and the need for training.

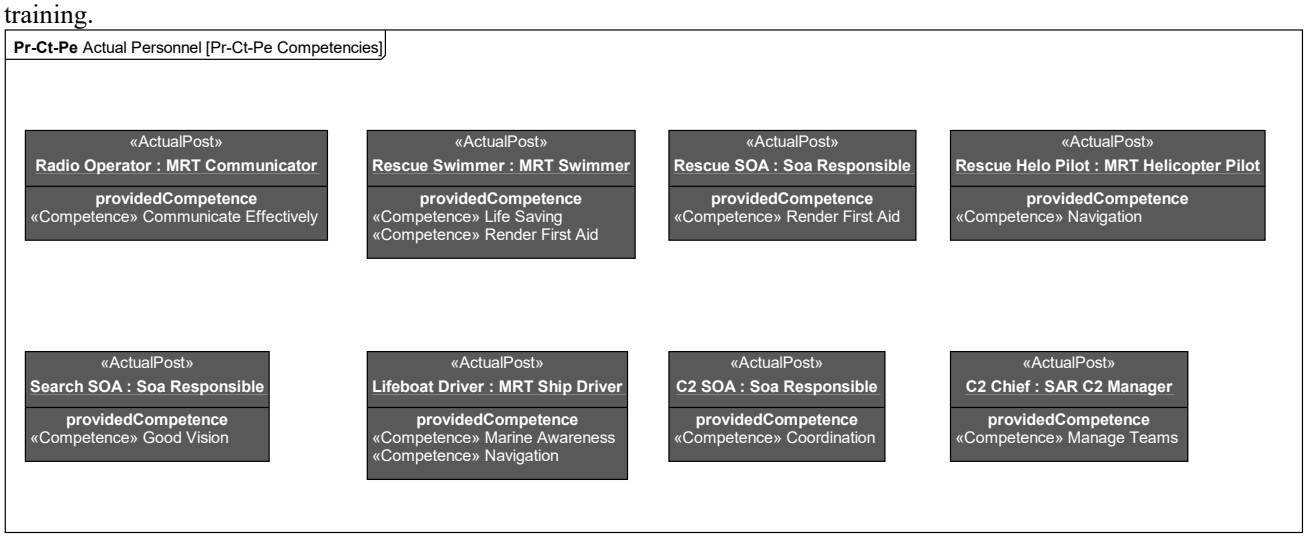

Figure 13:13 - Personnel Constraints: Competences for Actual Posts

Stakeholders: Systems engineers, Solution providers, Human resources.
Concerns: optimization of organizational resource behavior.
Definition: captures the factors that affect, constrain and characterize organizational resource behavior as the basis for performance predictions at the level of actual persons and actual organizations. It creates a bridge between static architectural definitions and behavior predictions through executable models.
Recommended Implementation: tabular format, SysML Parametric Diagram, SysML Block Definition Diagram.

Figure 13-14 describes the Posts and the functions performed by the MRT Searcher. The environmental and other constraints are also shown. This helps to define the circumstances under which tasks will be performed.

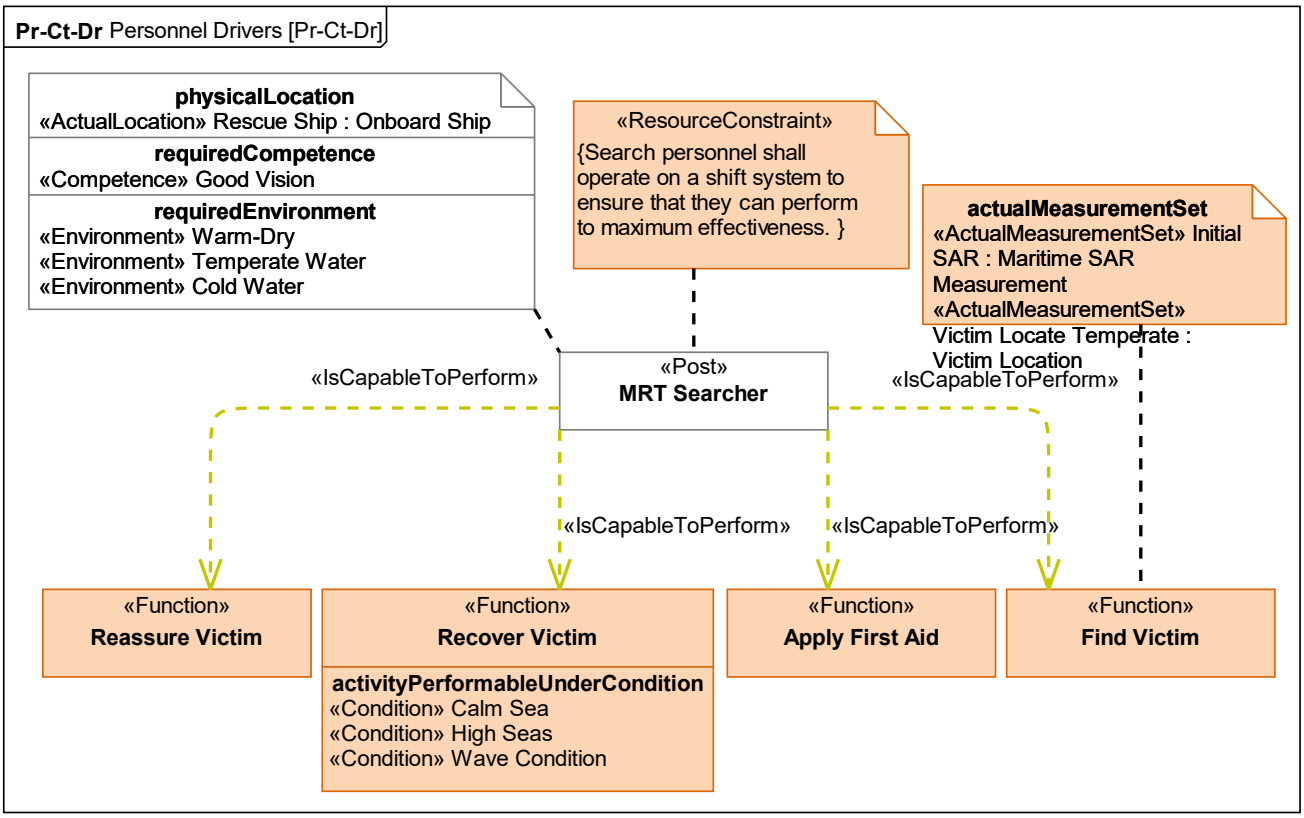

Figure 13:14 - Personnel Constraints: Drivers for MRT Searcher

Table 13-2 summarizes the Posts, Personnel, and Organizations and their constraints.

Table 13:2 - Personnel Constraints: Drivers Summary Table
[Architectural Description] Personnel Types [Pr-Ct-Dr Table]

Resource Constrained Element		Resource Constraint	
Type	**Name**	**Name**	**Text**
«Organization»	Government Department	[none]	[none]
«Organization»	SAR Rescue Boat Team	[none]	[none]
«Organization»	SAR Rescue Team	Personnel Safety	Search personnel shall operate on a shift system to ensure that they can perform to maximum efficiency
		Radio Watch Keeping	In general, any vessel equipped with a VHF marine radiotelephone (whether voluntarily or required to) must maintain a watch on channel 16 (156.800 MHz) whenever the radiotelephone is not being used to communicate.
«Organization»	Voluntary Organization	[none]	[none]
«Person»	Soa Operator	[none]	[none]
«Post»	MRT Communicator	GMDSS Equipment Operation	A GMDSS Radio Operator's License is necessary for a person to use required GMDSS equipment.
		Radio Watch Keeping	In general, any vessel equipped with a VHF marine radiotelephone (whether voluntarily or required to) must maintain a watch on channel 16 (156.800 MHz) whenever the radiotelephone is not being used to communicate.
«Post»	MRT Helicopter Pilot	[none]	[none]
«Post»	MRT Searcher	Search Shifts	Search personnel shall operate on a shift system to ensure that they can perform to maximum effectiveness.
«Post»	MRT Ship Driver	[none]	[none]
«Responsibility»	Status Update	[none]	[none]

Stakeholders: Human resources, solution providers.
Concerns: how well an actual organizational resource matches the needs of the actual organization.
Definition: provides a repository for human-related measures (i.e. quality objectives and performance criteria (HFI values)), targets and competences.
Recommended Implementation: SysML Block Definition Diagram.

Figure 13-15 defines the functions and metrics for the MRT Searcher for Recover Victim and Find Victim.

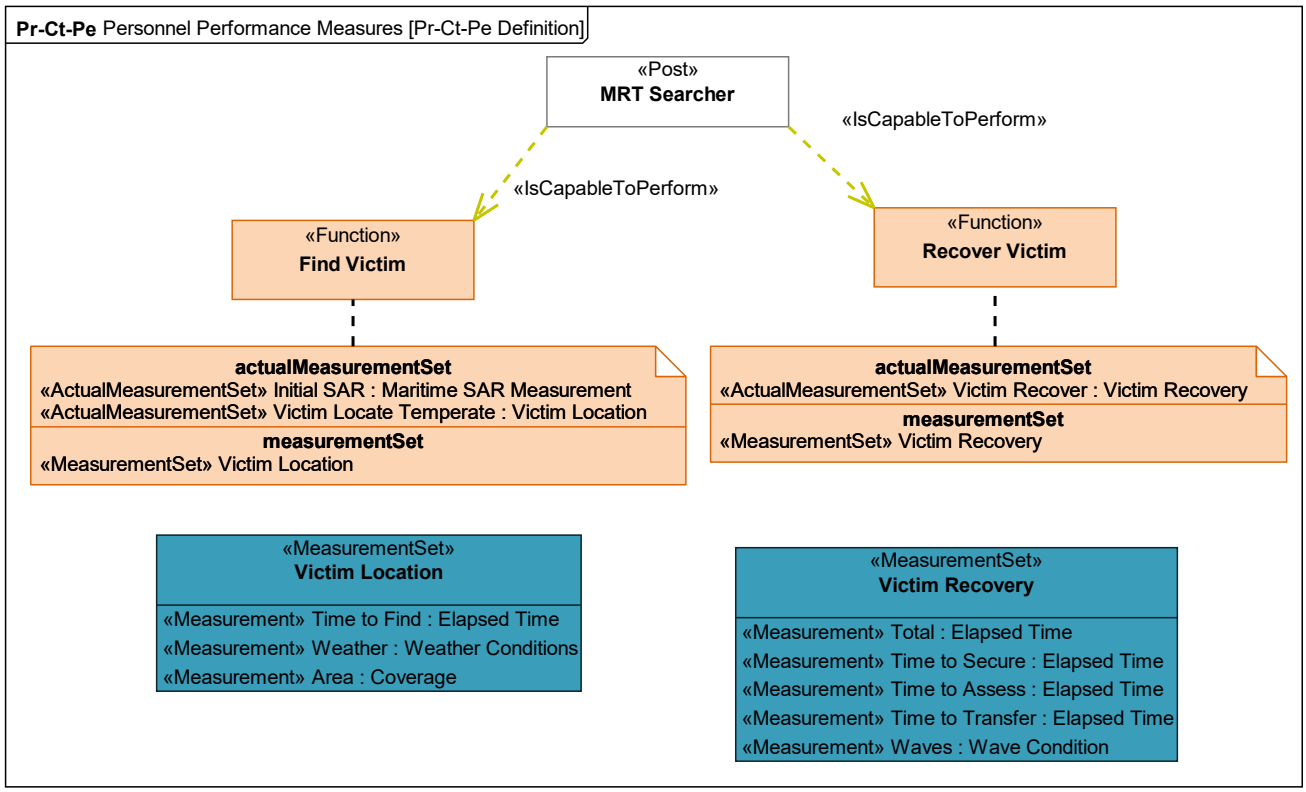

Figure 13:15 - Personnel Constraints: Performance Metrics and Functions for MRT Searcher

Figure 13-16 defines the Functions and conditions for the MRT Searcher.

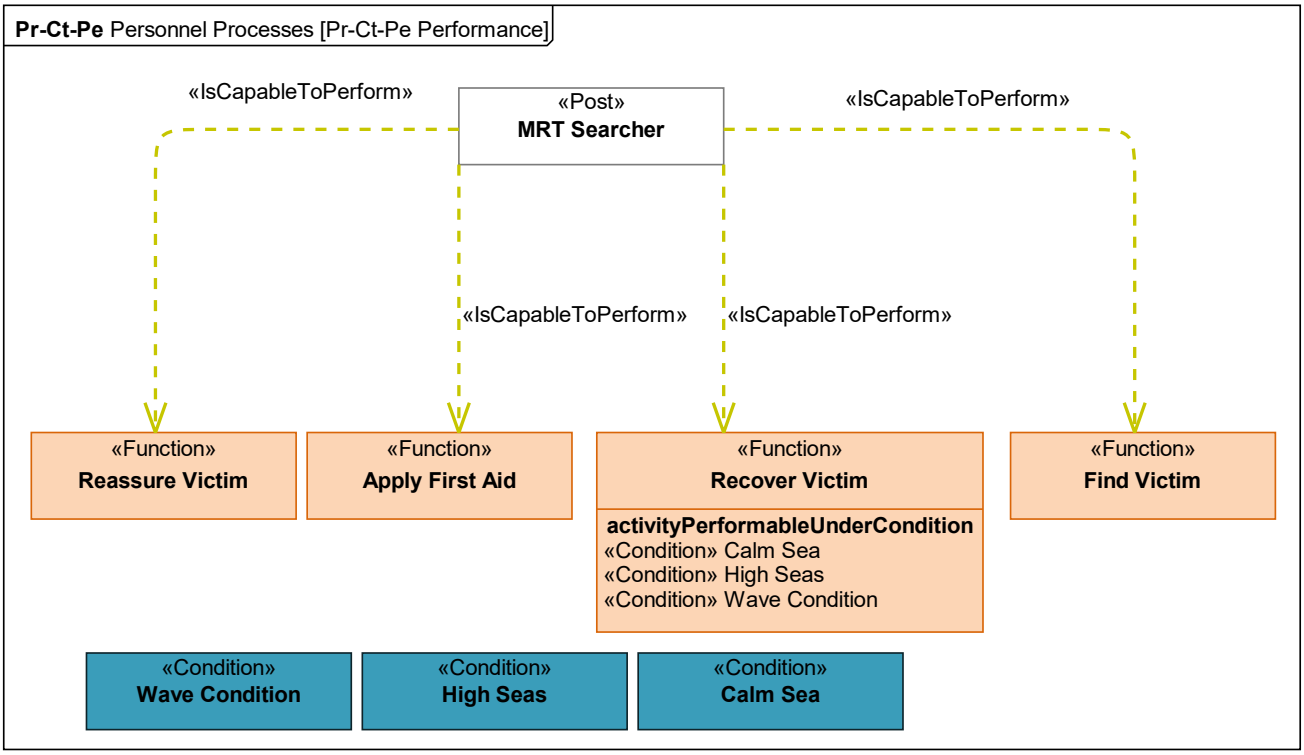

Figure 13:16 - Personnel Constraints: Performance Functions and Conditions for MRT Searcher

Figure 13-17 defines the performance constraints for the Rescue Swimmer, an instantiation of the MRT Swimmer.

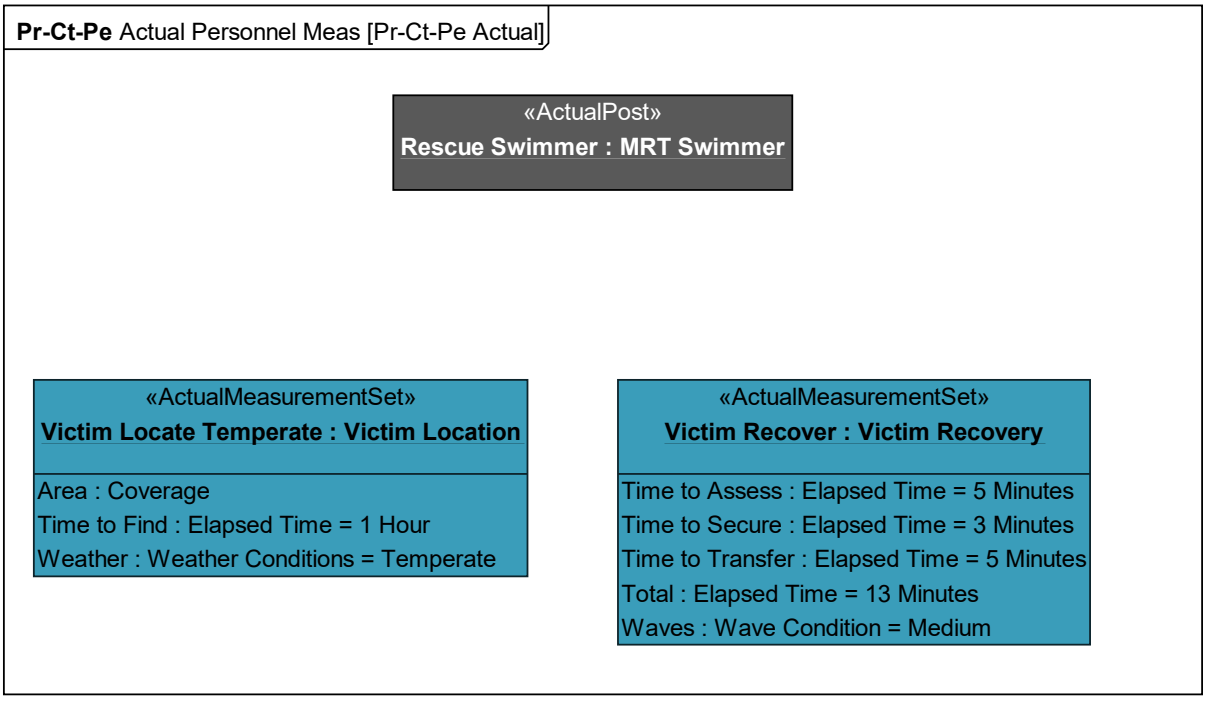

Figure 13:17 - Personnel Constraints: Performance Metrics for Actual MRT Swimmer

13.8 View Specifications::Personnel::Roadmap

Stakeholders: Human Resources, Training, Logisticians, Solution Providers.
Concerns: the staffing and training of resources.
Definition: defines the requirements and functions to ensure that actual persons with the right competencies, and in the right numbers, are available to fulfill actual posts.
Recommended Implementation: Timeline, SysML Block Definition Diagram.

Figure 13-18 defines the actual persons and the dates for which they will be filling actual posts. This defines personnel availability.

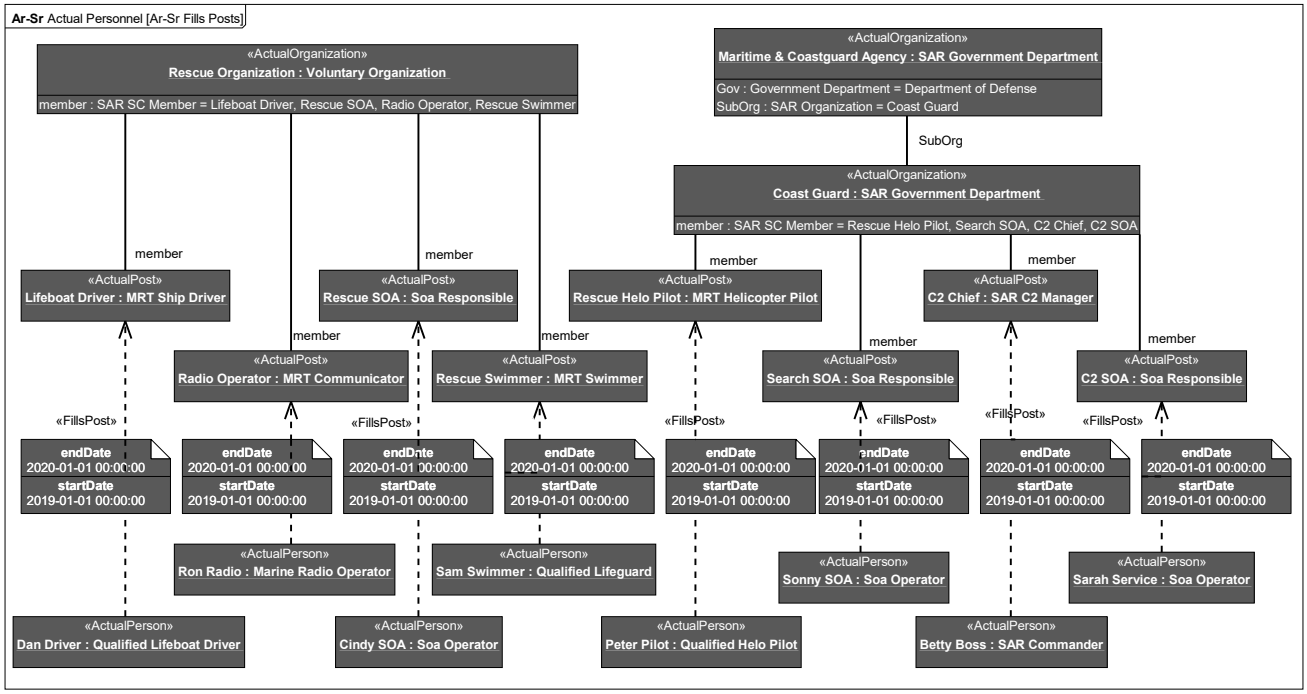

Figure 13:18 - Personnel Roadmap: Availability for SAR Organization People and Posts

Table 13-3 defines the deployment of actual persons in actual posts in the SAR organization.

Table 13-3 Actual Personnel availability schedule.

Actual Personnel [Pr-Rm-Av]

Type: Personnel Roadmap - Availability [Timeline] (Pr-Rm-Av)

Description:

		2019												2020											
Actual Organization	**Actual Post**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Department of Defense																									
Maritime & Coastguard Agency																									
Rescue Organization	Lifeboat Driver	**Dan Driver** **Start:** 2019-01-01 **End:** 2020-01-01																							
	Radio Operator	**Ron Radio** **Start:** 2019-01-01 **End:** 2020-01-01																							
	Rescue SOA	**Cindy SOA** **Start:** 2019-01-01 **End:** 2020-01-01																							
	Rescue Swimmer	**Sam Swimmer** **Start:** 2019-01-01 **End:** 2020-01-01																							
Coast Guard	C2 Chief	**Betty Boss** **Start:** 2019-01-01 **End:** 2020-01-01																							
	C2 SOA	**Sarah Service** **Start:** 2019-01-01 **End:** 2020-01-01																							
	Rescue Helo Pilot	**Peter Pilot** **Start:** 2019-01-01 **End:** 2020-01-01																							
	Search SOA	**Sonny SOA** **Start:** 2019-01-01 **End:** 2020-01-01																							

Stakeholders: Human resources, Solution Providers.
Concerns: organizational structure changes over time.
Definition: provides an overview of how an organizational structure changes over time. It shows the structure of several organizational structures mapped against a timeline.
Recommended Implementation: timeline, SysML Block Definition Diagram, SysML Internal Block Diagram.

The Personnel Roadmap is used to show the whole lifecycle of a personnel resource showing how its configuration changes over time. It shows the capabilities, the personnel resources that implement those capabilities, and any constituent organizations and posts. Table 10-4 shows the lifecycles for the architecture capabilities. Note that some capabilities do not have any implementing personnel resources. This is also useful information as it demonstrates that all capabilities have not been linked.

Table 13:4 - Personnel Roadmap: Evolution

[Architectural Description] Personnel Forecast [Phases]

Capability	Exhibiting Element							
Name	Name	Components	2014-01-01	2015-12-15	2015-12-16	2018-12-31	2019-01-01	2022-12-31
	«Organization» SAR Organization Context Phase 1	«Organization» Maritime Rescue Team Phase 1 «Post» MSAR C2 Operator	Increment	Out Of Service				
	«Organization» SAR Organization Context Phase 2	«Post» SAR C2 manager «Organization» Maritime Rescue Team Phase 2 «Post» MSAR C2 Operator			Increment	Out Of Service		
	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Organization» Maritime Rescue Team Phase 3					Increment	Out Of Service
Common operational picture access	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Organization» Maritime Rescue Team Phase 3					Increment	Out Of Service
Distress Signal Monitoring	«Organization» SAR Organization Context Phase 1	«Organization» Maritime Rescue Team Phase 1 «Post» MSAR C2 Operator	Increment	Out Of Service				
	«Organization» SAR Organization Context Phase 2	«Post» SAR C2 manager «Organization» Maritime Rescue Team Phase 2 «Post» MSAR C2 Operator			Increment	Out Of Service		
	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Organization» Maritime Rescue Team Phase 3					Increment	Out Of Service
	«Organization» SAR Organization Context Phase 1	«Organization» Maritime Rescue Team Phase 1 «Post» MSAR C2 Operator	Increment	Out Of Service				
	«Organization» SAR Organization Context Phase 2	«Post» SAR C2 manager «Organization» Maritime Rescue Team Phase 2 «Post» MSAR C2 Operator			Increment	Out Of Service		
	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Organization» Maritime Rescue Team Phase 3					Increment	Out Of Service
Military C2								
MSAR C2 phase 1	«Organization» SAR Organization Context Phase 1	«Organization» Maritime Rescue Team Phase 1 «Post» MSAR C2 Operator	Increment	Out Of Service				
MSAR C2 phase 2	«Organization» SAR Organization Context Phase 2	«Post» SAR C2 manager «Organization» Maritime Rescue Team Phase 2 «Post» MSAR C2 Operator			Increment	Out Of Service		
MSAR C2 phase 3	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Organization» Maritime Rescue Team Phase 3					Increment	Out Of Service
Position location of persons in distress	«Organization» SAR Organization Context Phase 2	«Post» SAR C2 manager «Organization» Maritime Rescue Team Phase 2 «Post» MSAR C2 Operator			Increment	Out Of Service		
	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Organization» Maritime Rescue Team Phase 3					Increment	Out Of Service
Recovery phase 1	«Organization» SAR Organization Context Phase 1	«Organization» Maritime Rescue Team Phase 1 «Post» MSAR C2 Operator	Increment	Out Of Service				
Recovery phase 2	«Organization» SAR Organization Context Phase 2	«Post» SAR C2 manager «Organization» Maritime Rescue Team Phase 2 «Post» MSAR C2 Operator			Increment	Out Of Service		
Recovery phase 3	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Organization» Maritime Rescue Team Phase 3					Increment	Out Of Service
SAR C2	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Organization» Maritime Rescue Team Phase 3					Increment	Out Of Service
Search phase 1	«Organization» SAR Organization Context Phase 1	«Organization» Maritime Rescue Team Phase 1 «Post» MSAR C2 Operator	Increment	Out Of Service				
Search phase 2	«Organization» SAR Organization Context Phase 2	«Post» SAR C2 manager «Organization» Maritime Rescue Team Phase 2 «Post» MSAR C2 Operator			Increment	Out Of Service		
Search phase 3	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Organization» Maritime Rescue Team Phase 3					Increment	Out Of Service
Weather and sea state determination	«Organization» SAR Organization Context Phase 3	«Organization» C2 Organization «Organization» Maritime Rescue Team Phase 3					Increment	Out Of Service
	«Enterprise Phase» SARPhase 3							

Stakeholders: Human resources, Logisticians, Solution Providers.
Concerns: competencies and skills forecast.
Definition: defines the underlying current and expected supporting competencies and skills of organizational resources.
Recommended Implementation: timeline, tabular format, SysML Block Definition Diagram.

Figure 13-19 shows the forecast of the SAR Rescue Team over the course of the architectural phases.

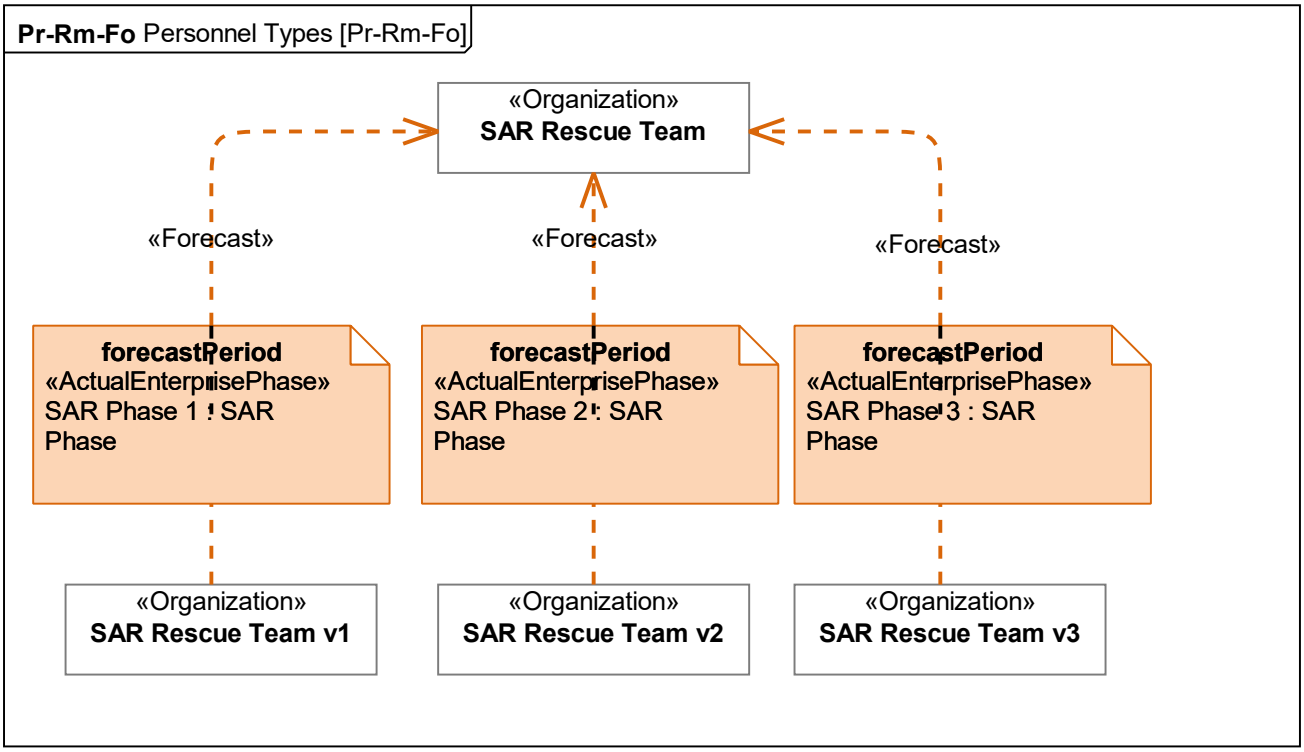

Figure 13:19 - Personnel Roadmap: Forecast

Table 13-5 is an automatically generated table showing the forecast for the SAR Rescue Team.

Table 13-5: Personnel Types Roadmap for SAR Rescue Team

Personnel Types [Pr-Rm-Fo Table]

Type: Personnel Roadmap - Forecast [Timeline] (Pr-Rm-Fo)
Description:

Organizational Resource	Enterprise Phase	2019	2020	2021	2022	2023	2024	2025
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
SAR Rescue Team v1	SAR Phase 1	SAR Rescue Team Start: 2019-01-01 End: 2019-12-31						
SAR Rescue Team v2	SAR Phase 2		SAR Rescue Team Start: 2020-01-01 End: 2022-12-31					
SAR Rescue Team v3	SAR Phase 3					SAR Rescue Team Start: 2023-01-01 End: 2025-12-31		

13.9 View Specifications::Personnel::Traceability

Stakeholders: Systems Engineers, Enterprise Architects, Solution Providers, Business Architects.
Concerns: traceability between operational activities and functions that implements them.
Definition: depicts the mapping of functions (performed by organizational resources) to operational activities and thus identifies the transformation of an operational need into a purposeful function performed by an organizational resource or solution.
Recommended Implementation: Matrix format, SysML Block Definition Diagram.

Figure 13-20 shows how the functions performed by posts and organizations support operational activities.

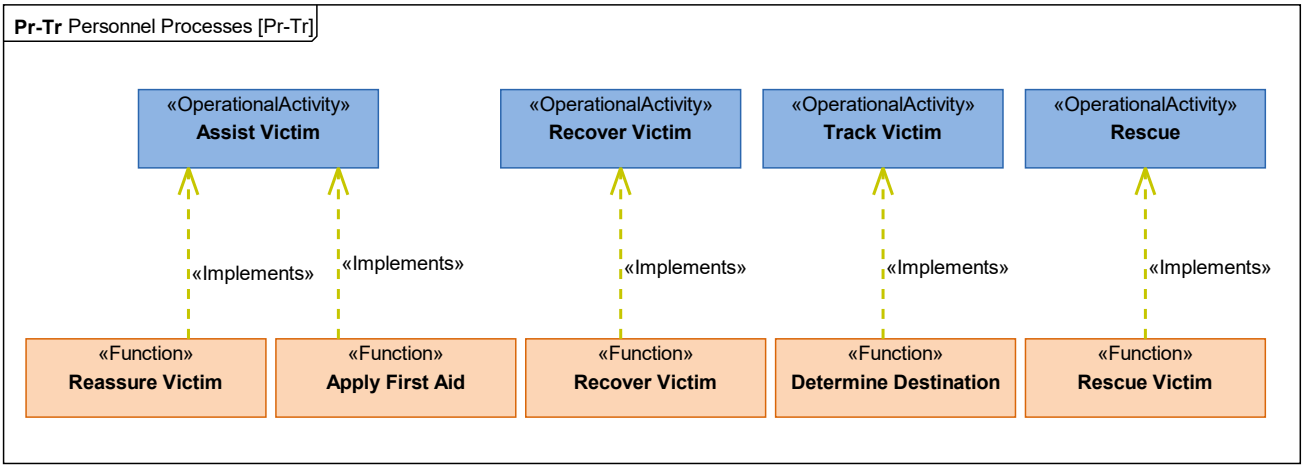

Figure 13:20 - Personnel Traceability of Personnel Functions to Operational Activities.

14. View Specifications::Security

Stakeholders: Security Architects, Security Engineers. Systems Engineers, Operational Architects.
Concerns: addresses the security constraints and information assurance attributes that exist on exchanges between resources and OperationalPerformers
Definition: illustrates the security assets, security constraints, security controls, families, and measures required to address specific security concerns.

The security domain (Sc) describes security assets and security enclaves. Sc views define the hierarchy of security assets and asset owners, security constraints (policy, laws, and guidance) and detail where they are located (security enclaves).

The Security View (SecV) in the Department of National Defence and the Canadian Forces Architecture Framework (DNDAF) are defined for the development of architectures across the Department of National Defence and the Canadian Forces (DND/CF). DNDAF provides visibility on those attributes of the DND/CF architecture that deal with the protection of assets. Consequently, it deals with the security and information assurance architecture of the DND/CF.

UAF includes a set of security views that support DNDAF security views SecV-1 to 3 as defined in DNDAF V 1.8.1. In addition, the UAF includes support to define a security structure view as well as a security taxonomy of security asserts or security controls, as needed by the cyber security engineers.

Examples of the security enclaves are shown in the resources views.

14.1 View Specifications::Security::Taxonomy

Stakeholders: Security Architects, Security Engineers.
Concerns: Security assets and security enclaves.
Definition: Defines the hierarchy of security assets and asset owners that are available to implement security, security constraints (policy, guidance, laws and regulations) and details where they are located (security enclaves).
Recommended Implementation: tabular format, SysML Block Definition Diagram.

Figure 14-1 shows the Taxonomy for the security Elements.

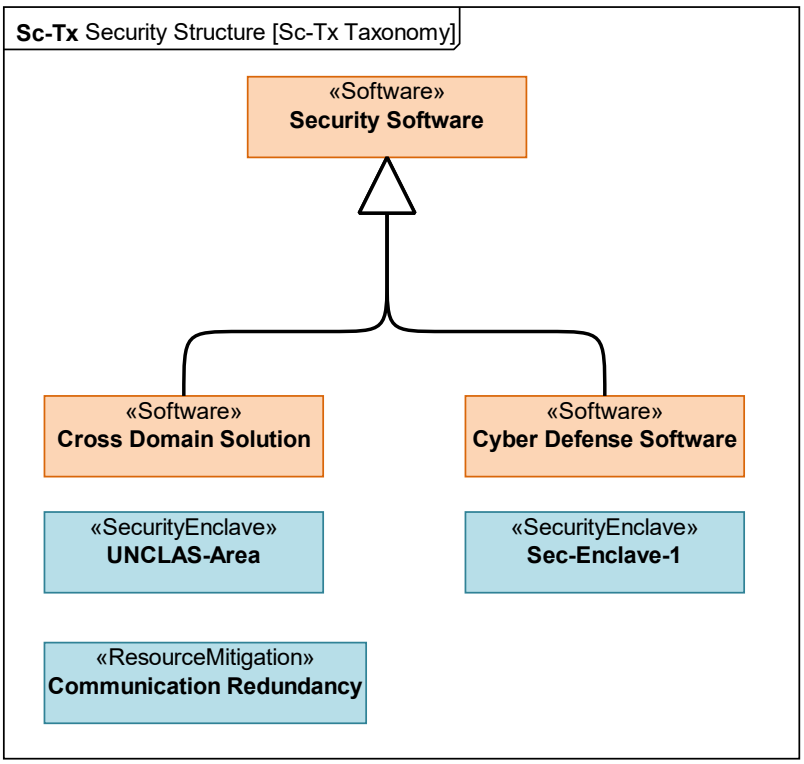

Figure 14:1 - Security Taxonomy for Software and Enclaves

14.2 View Specifications::Security::Structure

Stakeholders: Security Architects, Security Engineers.
Concerns: The structure of security information and where it is used at the operational and resource level.
Definition: Captures the allocation of assets (operational and resource, information and data) across the security enclaves, shows applicable security controls necessary to protect organizations, systems and information during processing, while in storage (bdd), and during transmission (flows on an ibd). This view also captures Asset Aggregation and allocates the usage of the aggregated information at a location using the SecurityProperty.
Recommended Implementation: SysML Internal Block Diagram, SysML Block Definition Diagram.

Figure 14-2 shows the structure for the Communication Redundancy Resource Mitigation. This shows the structural breakdown of the systems.

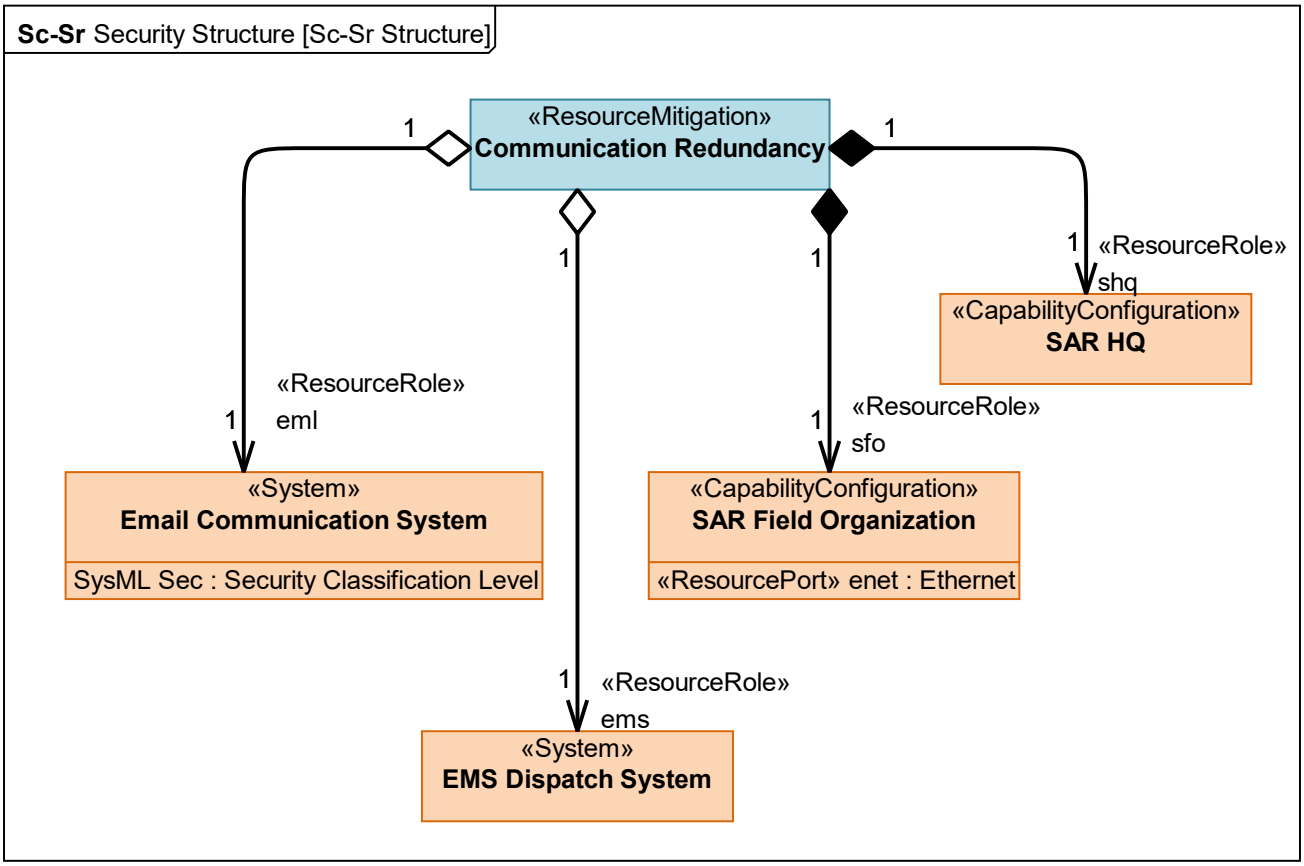

Figure 14:2 - Security Structure for Communication Redundancy

The following diagram shows the communication redundancy and the mitigating systems.

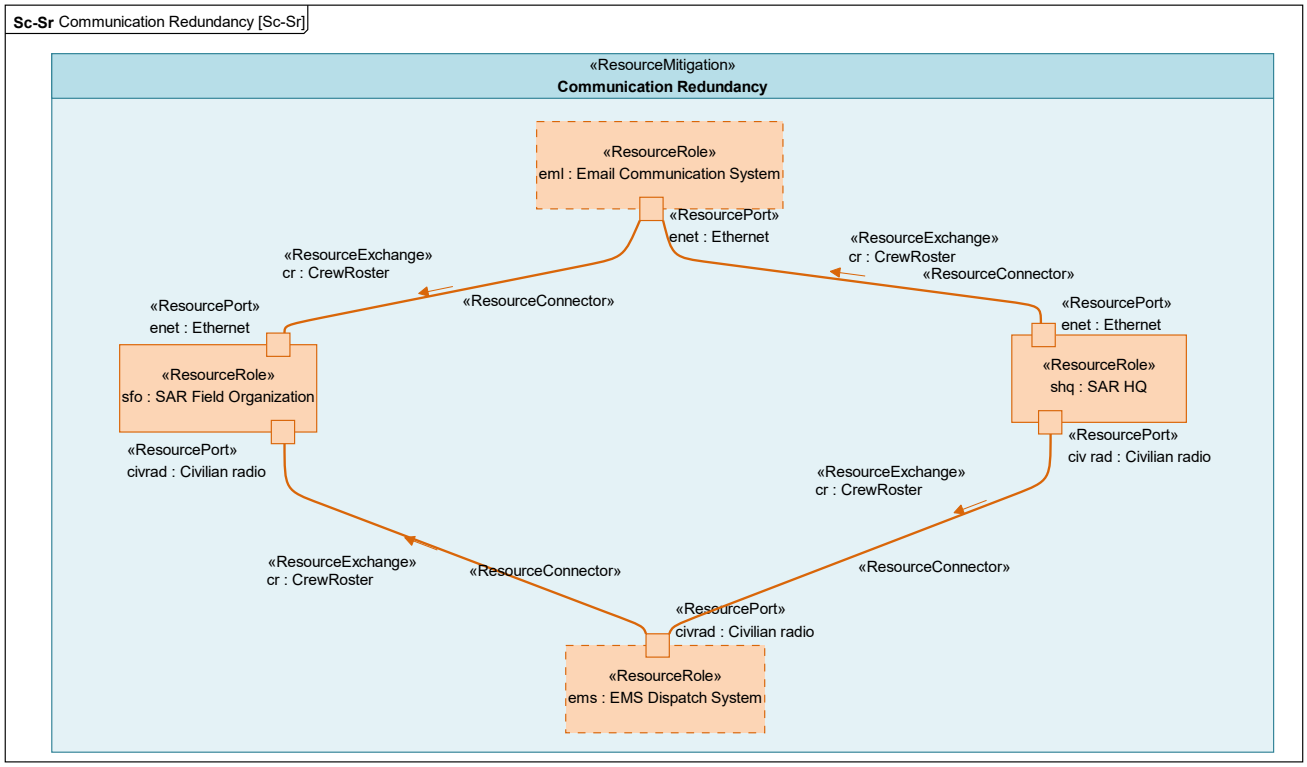

Figure 14:3 - Security Structure

14.3 View Specifications::Security::Connectivity

Stakeholders: Security Architects, Security Engineers.
Concerns: Addresses the security constraints and information assurance attributes that exist on exchanges across resources and across performers.
Definition: Lists security exchanges across security assets; the applicable security controls; and the security enclaves that house the producers and consumers of the exchanges. Measurements can optionally be included.
Recommended Implementation: SysML Internal Block Diagram, tabular format.

Table 14-1 is an automatically generated table showing the interactions from Figure 14-3.

Table 14:1 - Security Connectivity

Communication Redundancy [Sc-Cn Table]

Resource		Producer		Resource Connector		Consumer	
Name	Conveyed	Resource Performer	Function	Name	Protocol	Resource Performer	Function
cr	«Resource Signal» CrewRoster	«Capability Configuration» SAR HQ		Resource Connector		«System» Email Communication System	
cr	«Resource Signal» CrewRoster	«System» Email Communication System		Resource Connector		«Capability Configuration» SAR Field Organization	
cr	«Resource Signal» CrewRoster	«Capability Configuration» SAR HQ		Resource Connector		«System» EMS Dispatch System	
cr	«Resource Signal» CrewRoster	«System» EMS Dispatch System		Resource Connector		«Capability Configuration» SAR Field Organization	

14.4 View Specifications::Security::Processes

Stakeholders: Security Architects, Security Engineers.
Concerns: The specification of the Security Control families, security controls, and measures required to address a specific security baseline.
Definition: Provides a set of Security Controls and any possible enhancements as applicable to assets. The activity diagram describes operational or resource level processes that apply (operational level) or implement (resource level) security controls/enhancements to assets located in enclaves and across enclaves. This Security Process view can be instantiated either as a variant of an activity/flow diagram or as a hierarchical work breakdown structure.
Recommended Implementation: SysML Activity Diagram, SysML Block Definition Diagram.

Figure 14-4 shows the functional decomposition of the Access SAR System Function and the security processes that implement it.

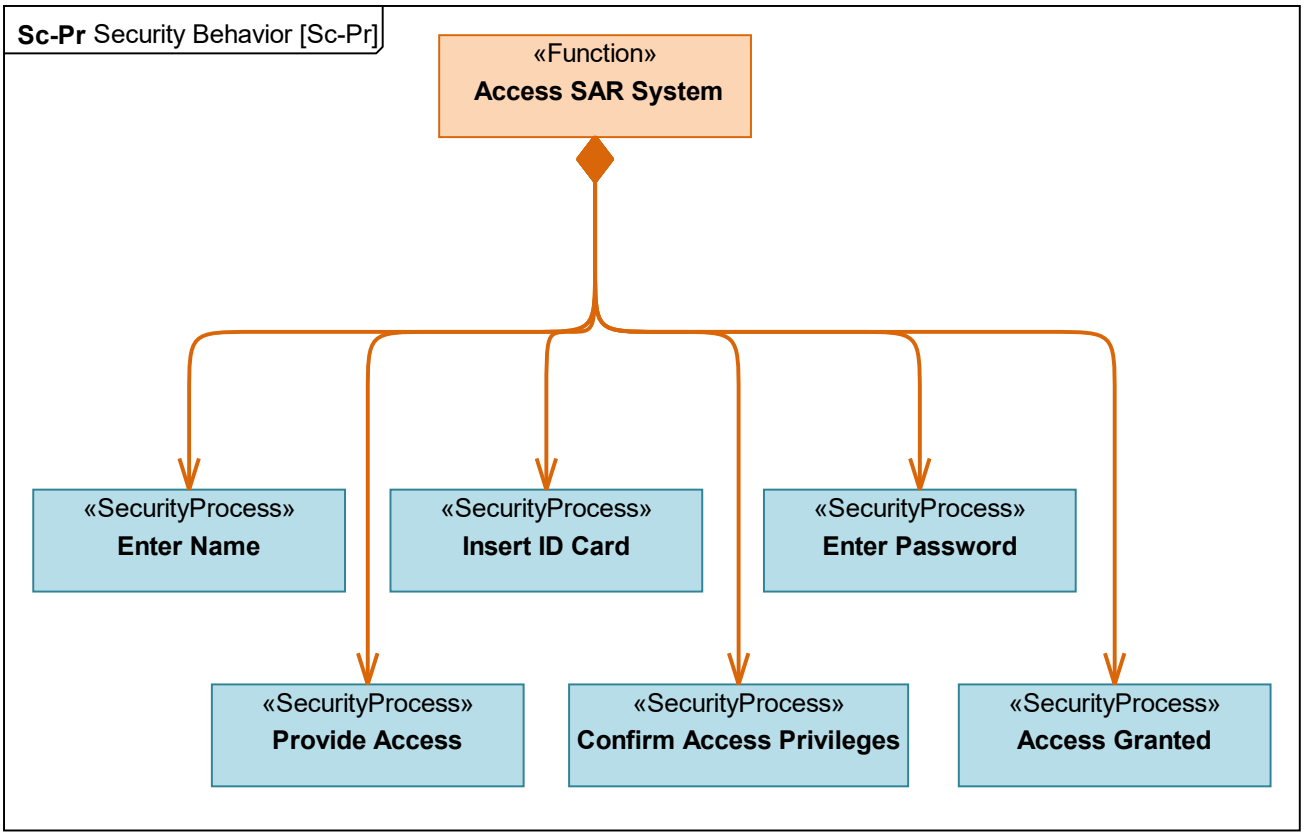

Figure 14:4 - Security Processes for Access SAR System

Figure 14-5 shows the activity diagram for the Access SAR function.

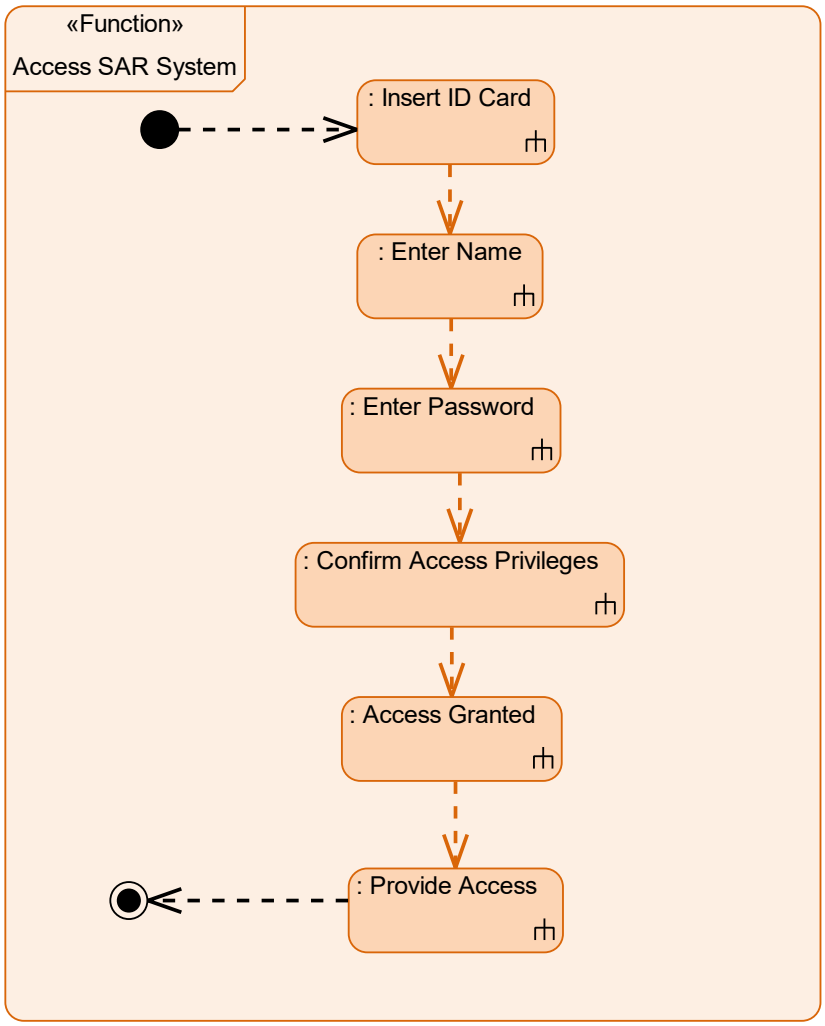

Figure 14:5 - Security Processes

14.5 View Specifications::Security::Constraints

Stakeholders: Security Architects, Security Engineers, Risk Analysts.
Concerns: (i) Security-related policy, guidance, laws and regulations as applicable to assets, (ii) threats, vulnerabilities, and risk assessments as applicable to assets.
Definition: (i) Specifies textual rules/non-functional requirements that are security constraints on resources, information and data (e.g. security-related in the form of rules (e.g. access control policy). A common way of representing access control policy is through the use of XACML (eXtensible Access Control Markup Language), it is expected that implementations of UAF allow users to link security constraints to external files represented in XACML. (ii) Identifies risks, specifies risk likelihood, impact, asset criticality, other measurements and enables risk assessment.
Recommended Implementation: tabular or Matrix format, SysML Block Definition Diagram, SysML Parametric Diagram, or OCL.

The diagram below shows how risk and risk mitigation may be associated with systems and information/data.

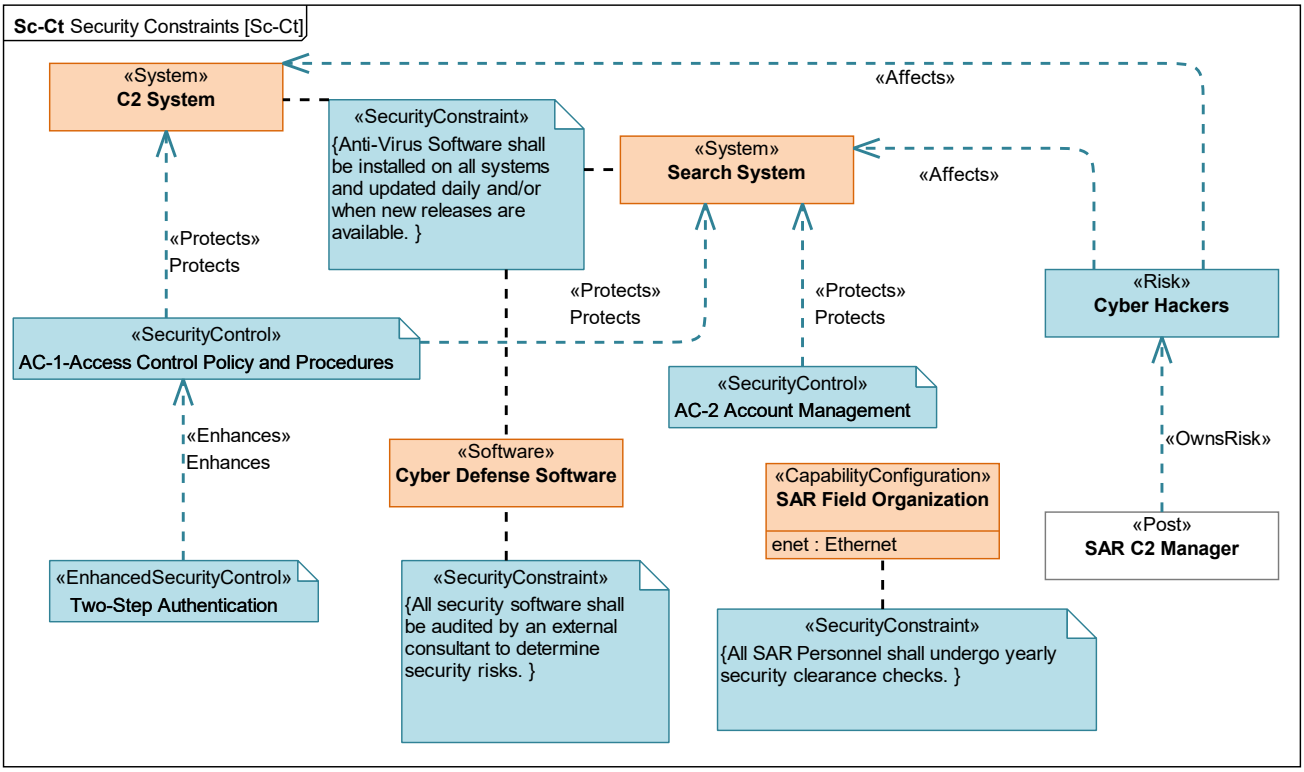

Figure 14:6 - Security Constraints for the SAR Architecture

Table 14-2 is an automatically generated table showing the security constraints for the systems.

Table 14:2 - Security Constraints
[Architectural Description] Service Specifications [Sv-Ct]

Policy Constrained Specification	Service Policy	
Name	**Name**	**Text**
Maritime SAR C2	Security Clearance	All SAR C2 personnel must have appropriate security clearances.
Maritime Search and Rescue version 1	MSAR Availability	MSAR Services shall be coordinated and interoperable.
Maritime Search and Rescue version 2	[none]	[none]
Maritime Search and Rescue version 3	[none]	[none]
Medical Assistance	Personnel Qualifications	Medical personnel must be certified in emergency medicine.
Monitoring version 1	Monitor Teams	Teams shall consist of at least two people to ensure rest periods and breaks can be taken.
	Monitoring Availability	Monitoring service must be available 24/7.
Patient Transportation	Transport Time.	Transport services must reach victims within 30 minutes.
Rescuing	Craft Qualifications	Rescue craft must be comply with local regulations.
Safe Place Handling	Safe Place Planning	Sufficient safe place sites must be secured prior to start of contract award.
	Safe Place Setup	Safe places must be assembled within 30 minutes of a request being made.
Safe place handling other version	[none]	[none]
Searching	Lifeguard Certified	Search personnel must be qualified lifeguards.

Figure 14-7 shows the security risks for the SAR Architecture.

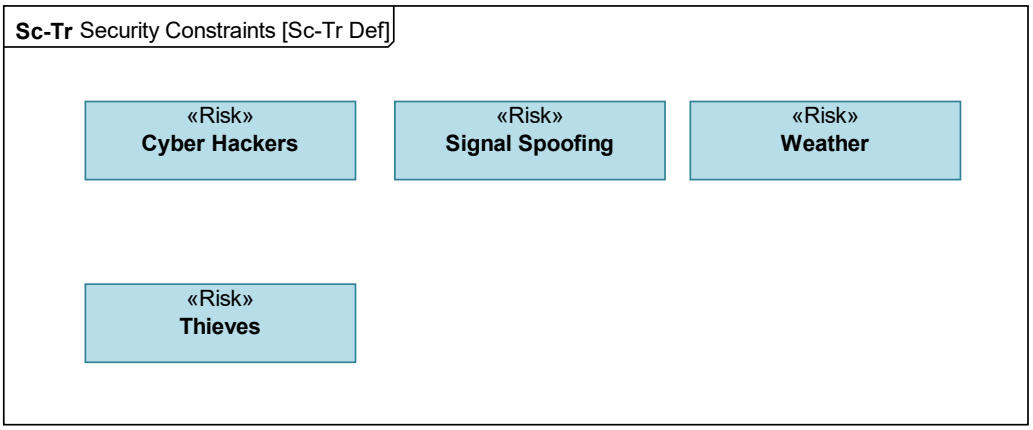

Figure 14:7 - Security Constraints

14.6 View Specifications::Security::Traceability

Stakeholders: Security Architects, Security Engineers, Risk Analysts.
Concerns: traceability between risk and risk owner, risk mitigations, and affected asset roles.
Definition: depicts the mapping of a risk to each of the following: risk owner, risk mitigations, and affected asset roles.
Recommended Implementation: Matrix format, SysML Block Definition Diagram.

Table 14-3 shows the traceability between the risks and the systems that they affect.

Table 14:3 - Security Constraints

Security Constraints [Sc-Tr Risk]

Affected Asset	Affecting Ris «Risk» Cyber Hackers
«System» C2 System	X
«System» Search System	X

14.7 View Specifications::Security Measurements

Stakeholders: Capability owners, Systems Engineers, Solution Providers.
Concerns: identifies measurable properties that can be used to support analysis such as KPIs, MOs, TPIs etc.
Definition: Shows the measurable properties of something in the physical world, expressed in amounts of a unit of measure that can be associated with any element in the architecture.
Recommended Implementation: SysML Block Definition Diagram.
Note: Security Measurements is not a UAF View, but the use of Measurements within the Security View.

Figure 14-8 shows the definition of the security classifications levels.

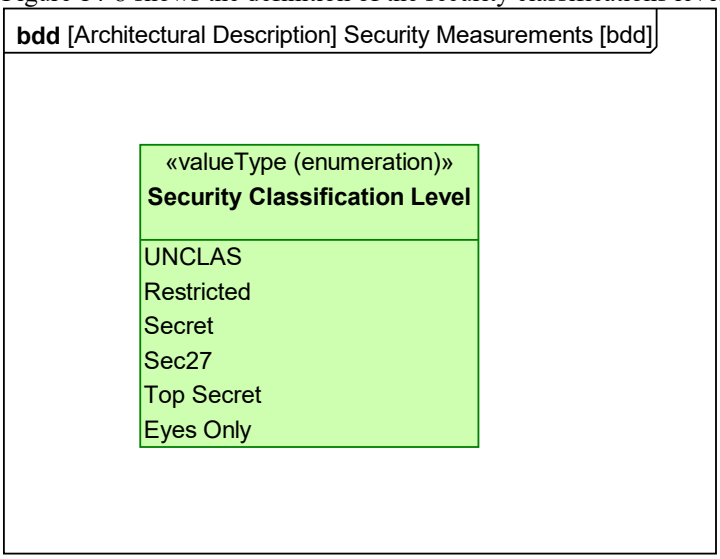

Figure 14:8 - Security Measurements for Security Classification Levels

Figure 14-9 shows the Security Category measurement set making use of the Security Classification Level.

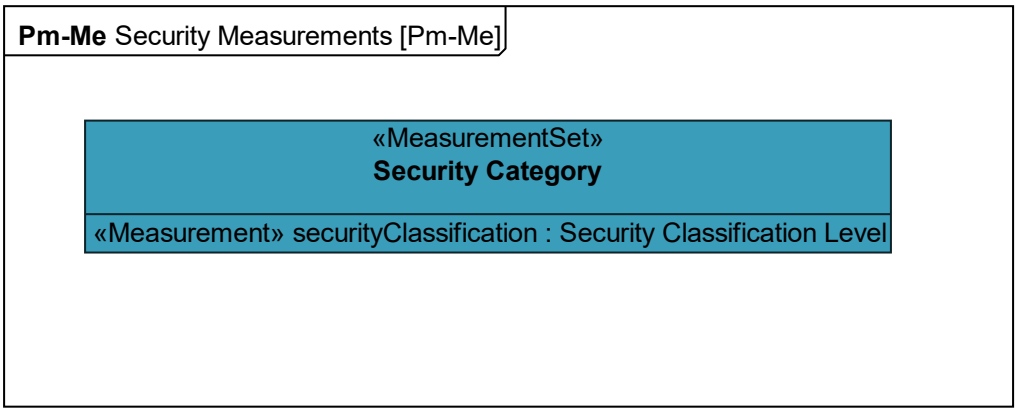

Figure 14:9 - Security Measurements for Security Category

The following diagram shows the actual security classifications that will be used in the model.

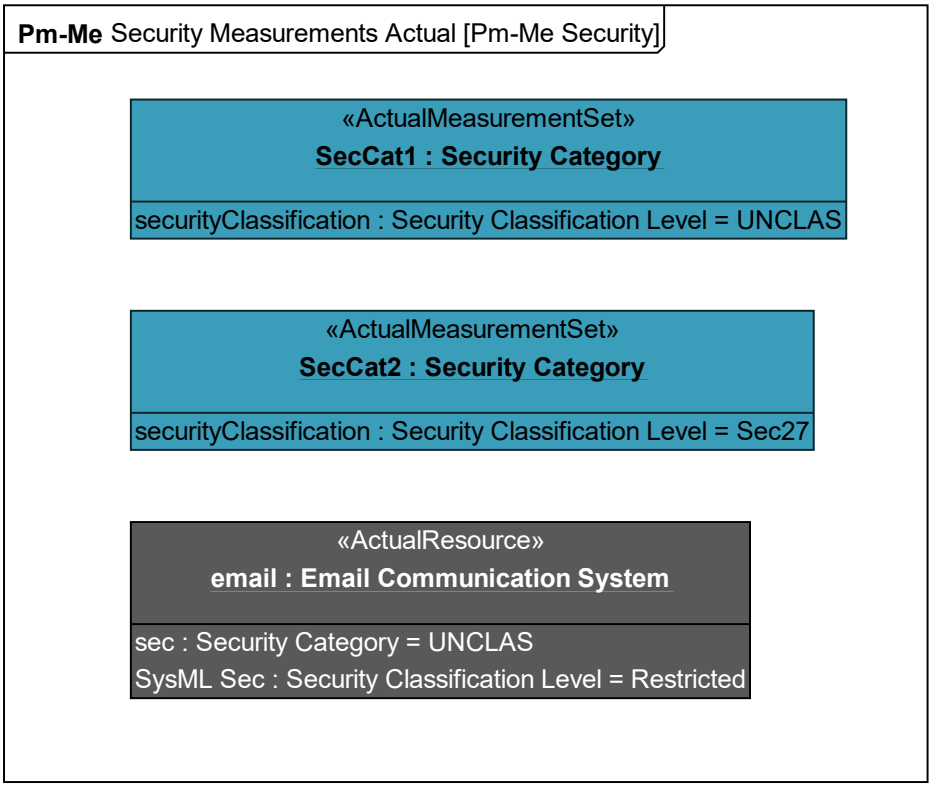

Figure 14:10 - Security Measurements Actual Classification Levels.

15. View Specifications::Projects

Stakeholders: PMs, Project Portfolio Managers, Enterprise Architects.
Concerns: project portfolio, projects and project milestones.
Definition: describes projects and project milestones, how those projects deliver capabilities, the organizations contributing to the projects and dependencies between projects.

The Project views identify top-level tasks in the acquisition process. They help you understand how resources, assets and capabilities are acquired during the life of the project. It gives you the ability to perform analysis to determine if the resources can be obtained, if they are available in the time they are needed, and the overall effect on the schedule. They can also show whether complete coverage of the Defence Lines of Development (DLOD) (known as DOTMLPF in the DoD are fully covered.

15.1 View Specifications::Projects::Taxonomy

Stakeholders: PMs, Project Portfolio Managers, Enterprise Architects.
Concerns: types of projects and project milestones.
Definition: shows the taxonomy of types of projects and project milestones.
Recommended Implementation: SysML Block Definition Diagram.

The Pj-Tx defines the projects and milestones that will be used in the model.

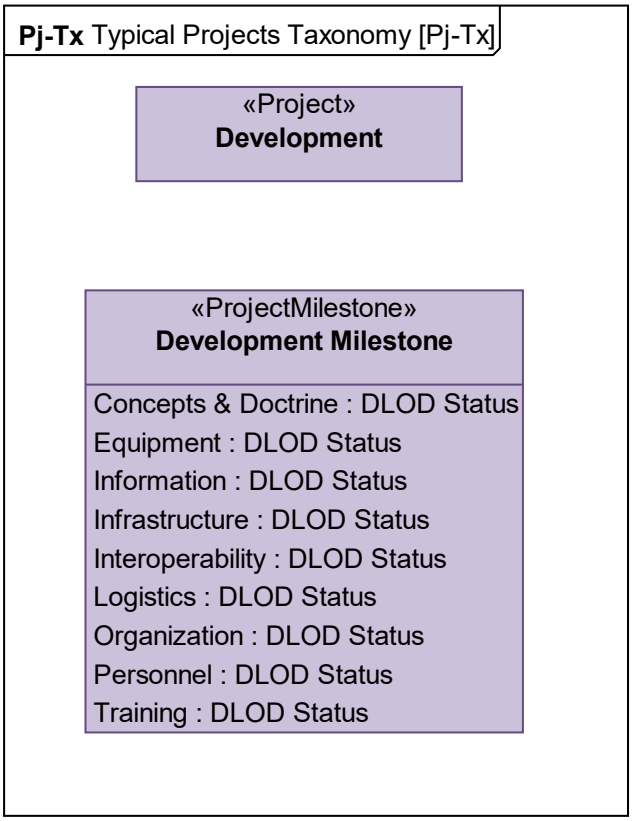

Figure 15:1 - Project Taxonomy for Projects and Milestones.

15.2 View Specifications::Projects::Structure

Stakeholders: PMs.
Concerns: relationships between types of projects and project milestones.
Definition: provides a template for an actual project(s) road map(s) to be implemented.
Recommended Implementation: SysML Block Definition Diagram.

The Pj-Sr class diagram provides a means of defining projects and project types. In Figure 15-2, the development projects contain milestones containing project themes corresponding to DLOD (DoD DOTMLPF) themes.

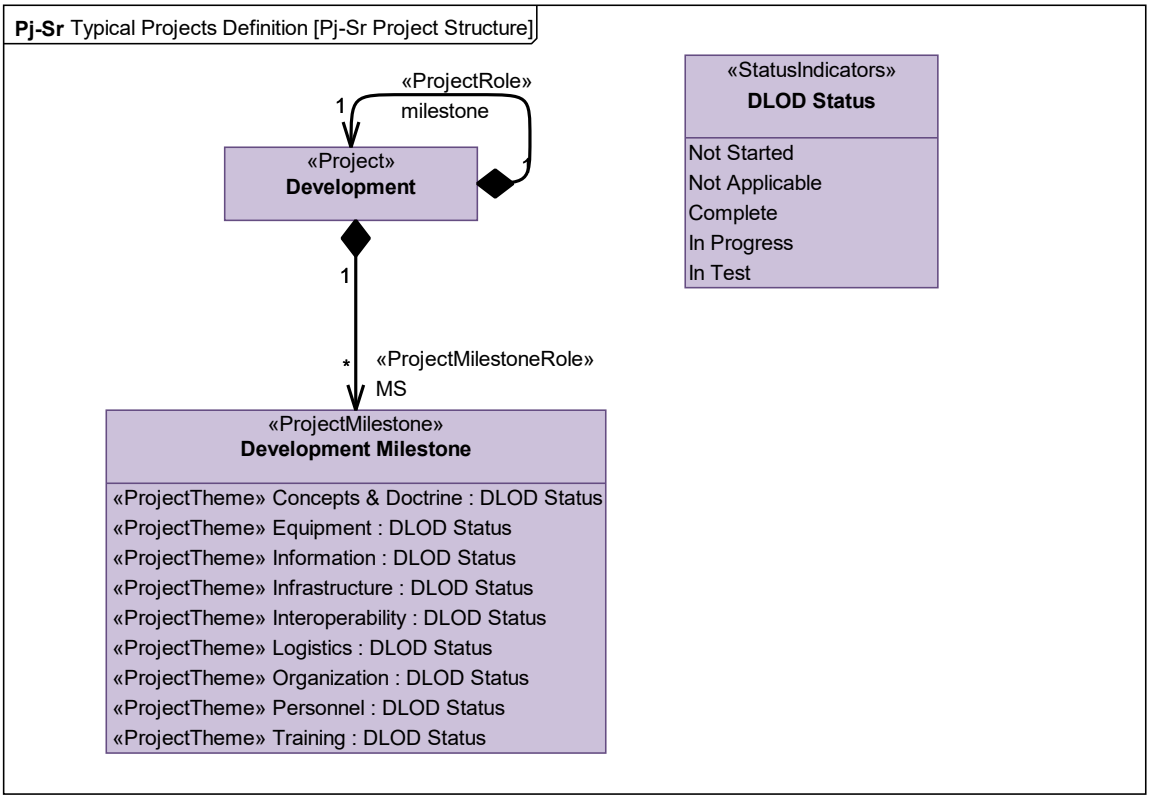

Figure 15:2 - Project Structure

15.3 View Specifications::Projects::Connectivity

Stakeholders: PMs.
Concerns: relationships between projects and project milestones.
Definition: shows how projects and project milestones are related in sequence.
Recommended Implementation: SysML Block Definition Diagram.

The Pj-Cn provides a means of defining actual projects and actual project milestones. In Figure 15-3 two SAR projects and their project milestones are shown.. The project also contains in service and out of service milestones that provide a means of showing when resources are deployed and rendered out of service as well as capability increments.

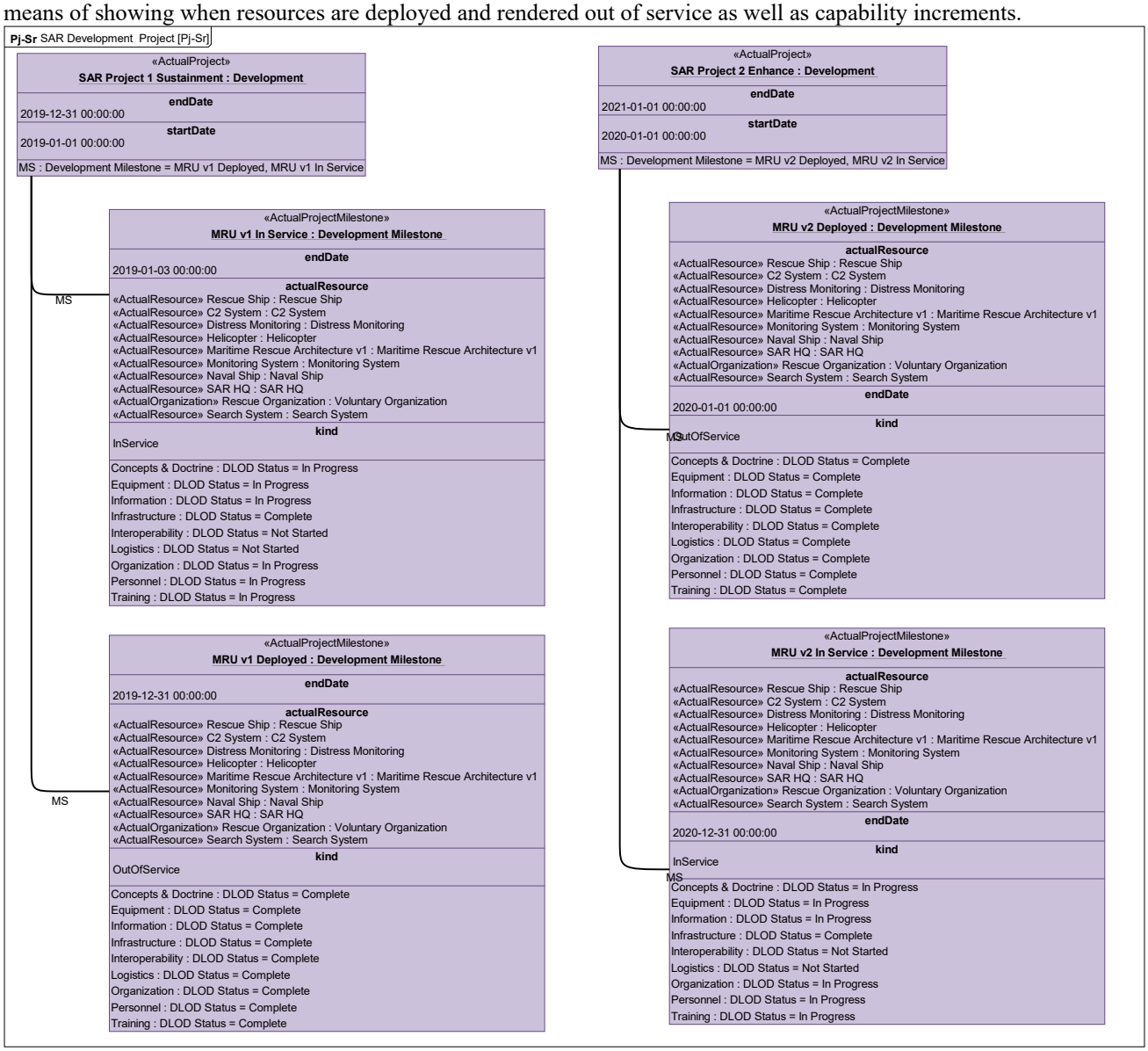

Figure 15:3 - Project Connectivity for SAR Actual Projects.

15.4 View Specifications::Projects::Processes

Stakeholders: PMs.
Concerns: captures project tasks (ProjectActivities) and flows between them.
Definition: describes the ProjectActivities that are normally conducted during projects to support capability(ies) and implement resources. It describes the ProjectActivities, their Inputs/Outputs, ProjectActivityActions and flows between them.
Recommended Implementation: SysML Activity Diagram, SysML Block Definition Diagram.

The Pj-Pr class diagram provides a means of defining projects activities. In Figure 15-4, the hierarchy of activities is shown. It consists of the activities for the 3 phases of the SAR project.

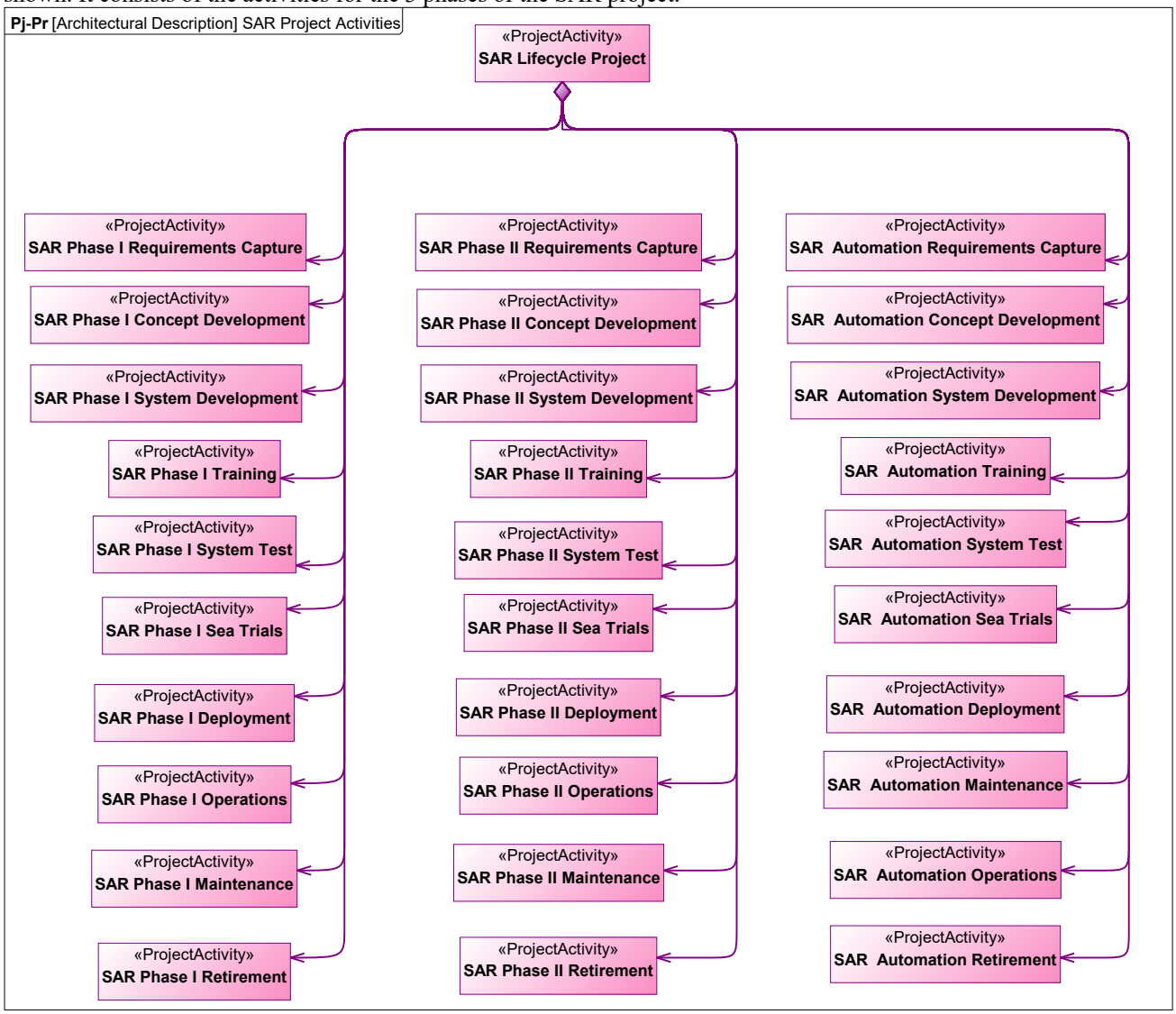

Figure 15:4 - Project Processes Definition

The Pj-Pr activity diagram provides a means of defining projects activities. In Figure 15-5, the sequence of activities is shown within each project. Each project contains its activities and the interaction between the activities is also shown. For example, SAR Phase I Requirements Capture creates requirements. These are then passed to the SAR Phase I Concept Development activity.

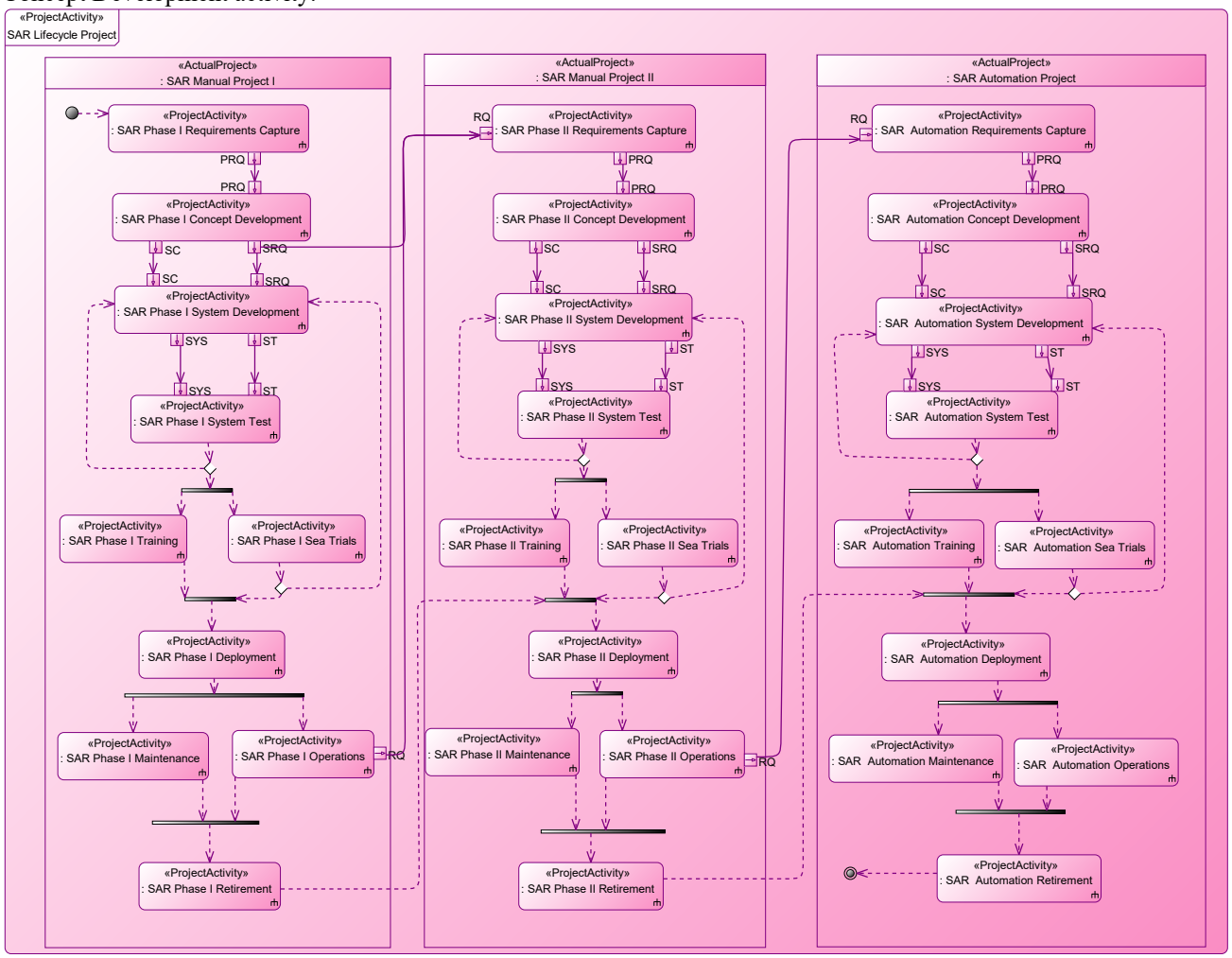

Figure 15:5 - Project Processes Activity Diagram

15.5 View Specifications::Projects::Roadmap

Stakeholders: PMs, Capability Owners, Solution Providers, Enterprise Architects.
Concerns: the product portfolio management; a planning of capability delivery.
Definition: provides a timeline perspective on programs or projects
Recommended Implementation: timeline, tabular format, SysML Block Definition Diagram.

The Pj-Rm Program Timeline diagram allows management the ability to view a summary of project status across the complete program timeline. It also provides a means of viewing the DLOD status for each of the defined milestones for the project. This and the Pj-Cn diagram provide much of the information for the St-Rm (DoDAF CV-3) view.

Figure 15-6 shows the 2 projects and their associated milestones. They are spaced according to time order. The pie charts represent the DLODs and their meaning is defined on the key to the right.

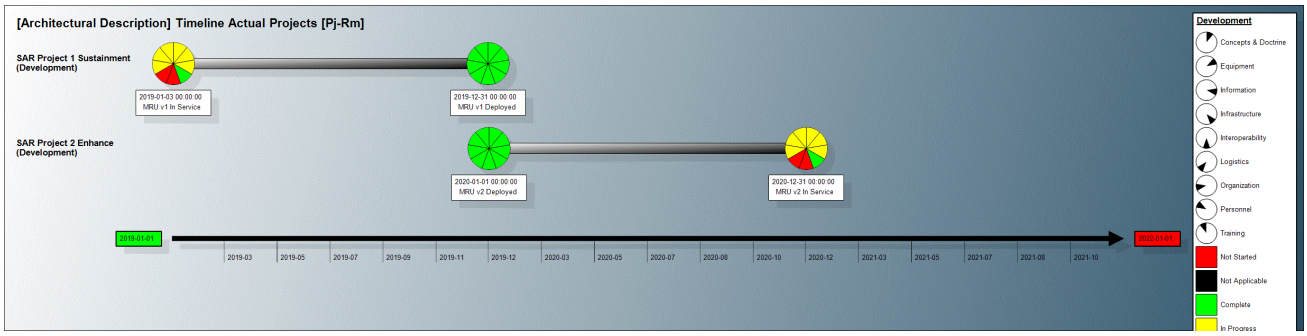

Figure 15:6 - Project Roadmap for SAR Projects

15.6 View Specifications::Projects::Traceability

Stakeholders: PMs, Project Portfolio Managers, Enterprise Architects.
Concerns: traceability between capabilities and projects that deliver them.
Definition: depicts the mapping of projects to capabilities and thus identifies the transformation of a capability(ies) into a purposeful implementation via projects.
Recommended Implementation: Matrix format, SysML Block Definition Diagram.

Figure 15-7 defines the traceability relationships between the projects and the capabilities that they will provide as well as the physical location.

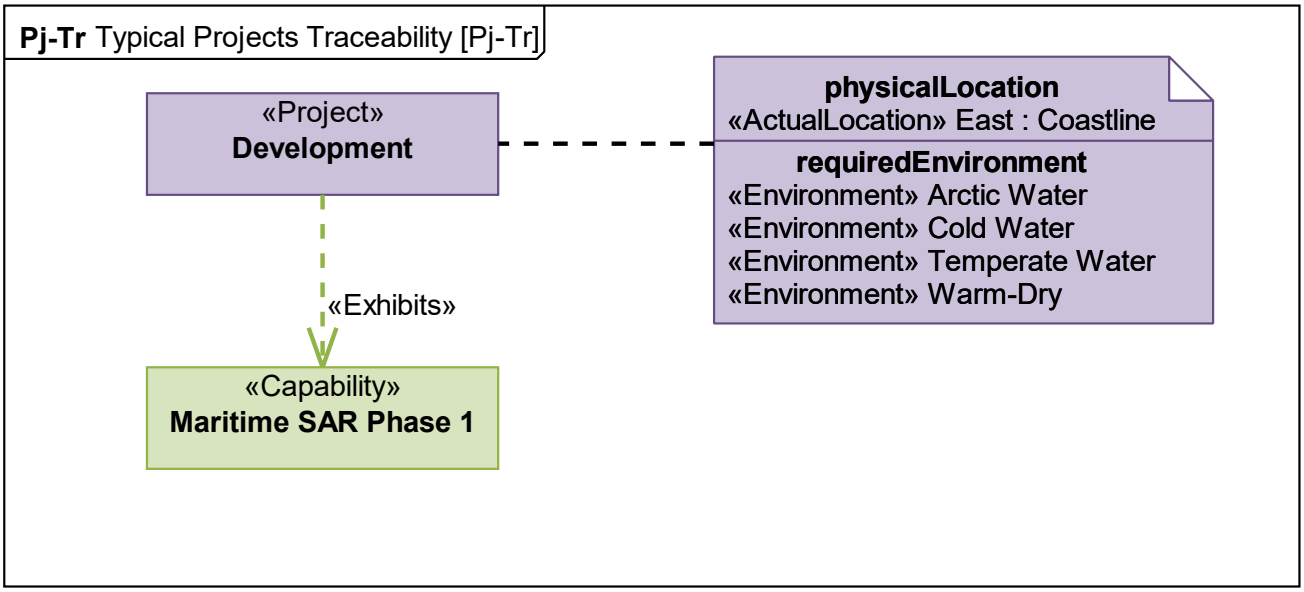

Figure 15:7 - Project Traceability from Porjects to Capabilities

Table 15-1 summarizes the capabilities that are delivered by the projects.

Table 15:1 - Project Traceability between Projects and Capabilities

Typical Projects Traceability [Pj-Tr Matrix]

		Transformed Capabilities							
		«Capability» Assistance	«Capability» Recovery	«Capability» Search	«Capability» Inform	«Capability» SAR C2	«Capability» Maritime SAR Phase 1	«Capability» Distress Signal Monitoring	«Capability» Military C2
Actual Projects	«ActualProject» SAR Project 1 Sustainment	X	X	X	X	X	X	X	X
	«ActualProject» SAR Project 2 Enhance	X	X	X	X	X	X	X	X

16. View Specifications::Standards

Stakeholders: Solution Providers, Systems Engineers, Software Engineers, Systems Architects, Business Architects.
Concerns: technical and non-technical Standards applicable to the architecture.
Definition: shows the technical, operational, and business Standards applicable to the architecture. Defines the underlying current and expected Standards.
The Standards views identify the standards, rules, policy and guidance that are applicable to parts of the architecture and the architecture as a whole. Communications protocols can also be defined.

16.1 View Specifications::Standards::Taxonomy

Stakeholders: Solution Providers, Systems Engineers, Software Engineers, Systems Architects, Business Architects.
Concerns: technical and non-technical standards, guidance and policy applicable to the architecture.
Definition: shows the taxonomy of types of technical, operational, and business standards, guidance and policy applicable to the architecture.
Recommended Implementation: SysML Block Definition Diagram.

UAF provides a class diagram and report format for the Sd-Tx. The class diagram form provides a means of defining the standards and their attributes as well as linking the standards forecasts to them. Figure 16-1 shows the various SAR standards provided by ASTM.

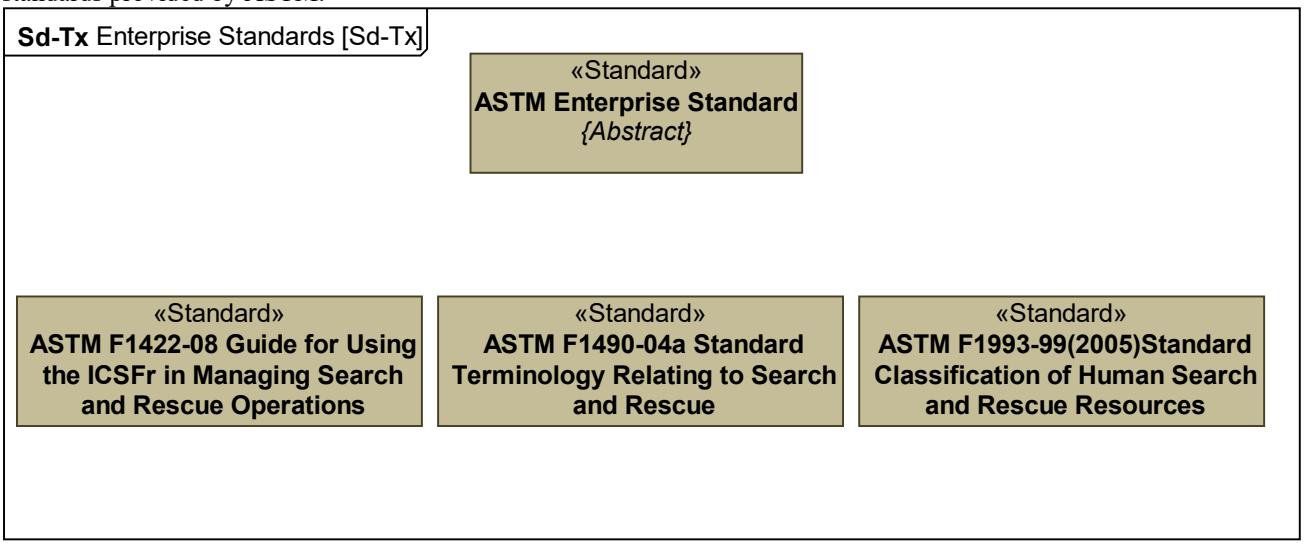

Figure 16:1 - Standards Taxonomy for ASTM Standards

Figure 16-2 is an example of the definition of a protocol stack and the various protocols used, in this case the internet protocol.

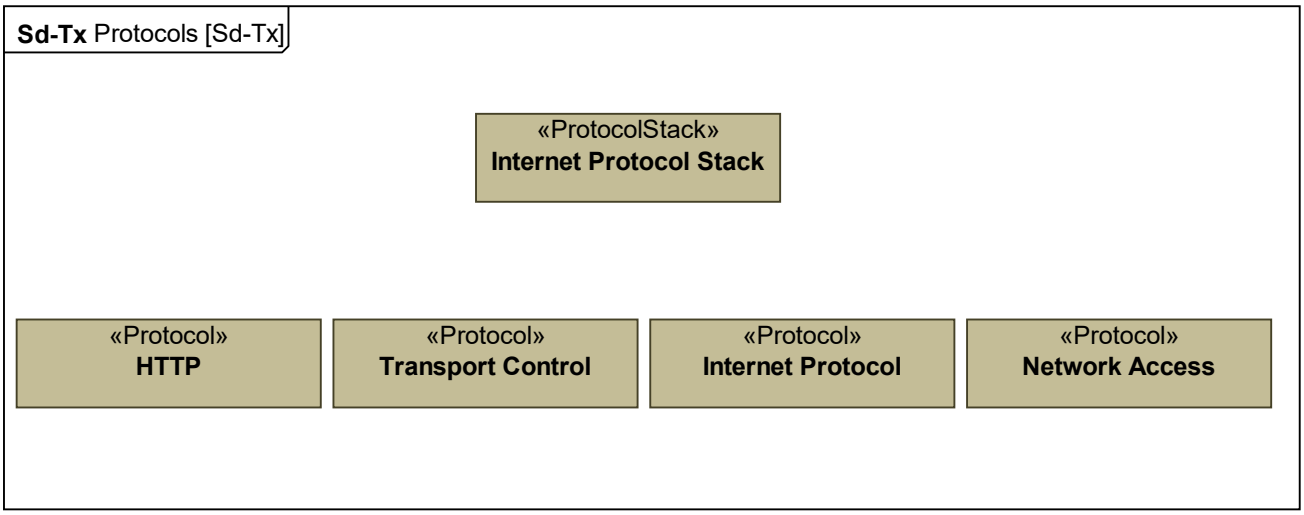

Figure 16:2 - Standards Taxonomy for the Internet Protocol Stack

16.2 View Specifications::Standards::Structure

Stakeholders: Solution Providers, Systems Engineers, Software Engineers, Systems Architects.
Concerns: the specification of the protocol stack used in the architecture.
Definition: shows the composition of standards required to achieve the architecture's objectives.
Recommended Implementation: SysML Internal Block Diagram.

Figure 16-3 is an example of the internal definition of a protocol stack and the various protocols used, in this case the internet protocol.

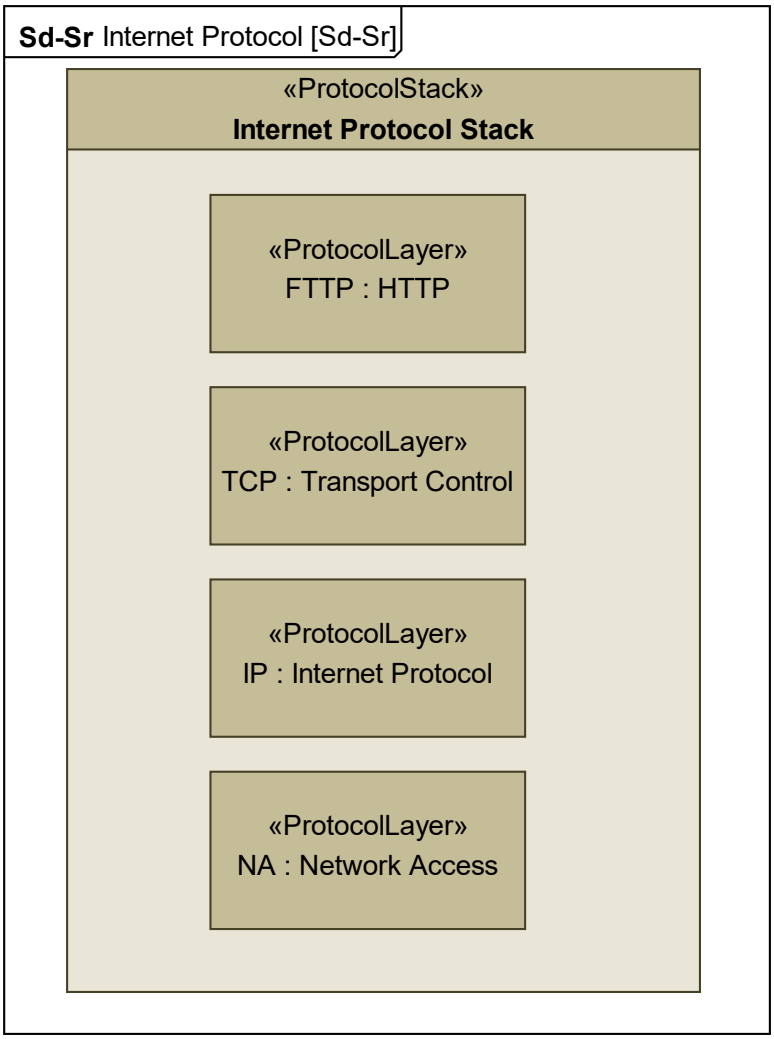

Figure 16:3 - Standards Structure Internal Diagram for the Internet Protocol Stack

16.3 View Specifications::Standards::Roadmap

Stakeholders: Solution Providers, Systems Engineers, Systems Architects, Software Engineers, Business Architects.
Concerns: expected changes in technology-related standards and conventions, operational standards, or business standards and conventions.
Definition: defines the underlying current and expected standards. Expected standards are those that can be reasonably forecast given the current state of technology and expected improvements / trends.
Recommended Implementation: timeline, tabular format, SysML Block Definition Diagram.

UAF provides a class diagram and report format for the Sd-Tx. The class diagram form provides a means of defining the standards and their attributes as well as linking the standards forecasts to them. Figure 16-6 shows the various SAR standards provided by ASTM. ASTM International, originally known as the American Society for Testing and Materials (ASTM) is now an international standards body with standards ranging from safety in recreational aviation, to fiber optic cable installations in underground utilities, to homeland security. More information on them can be found at www.ASTM.org. The spans shown are for illustration purposes only. They are normally shown to denote emerging standards.

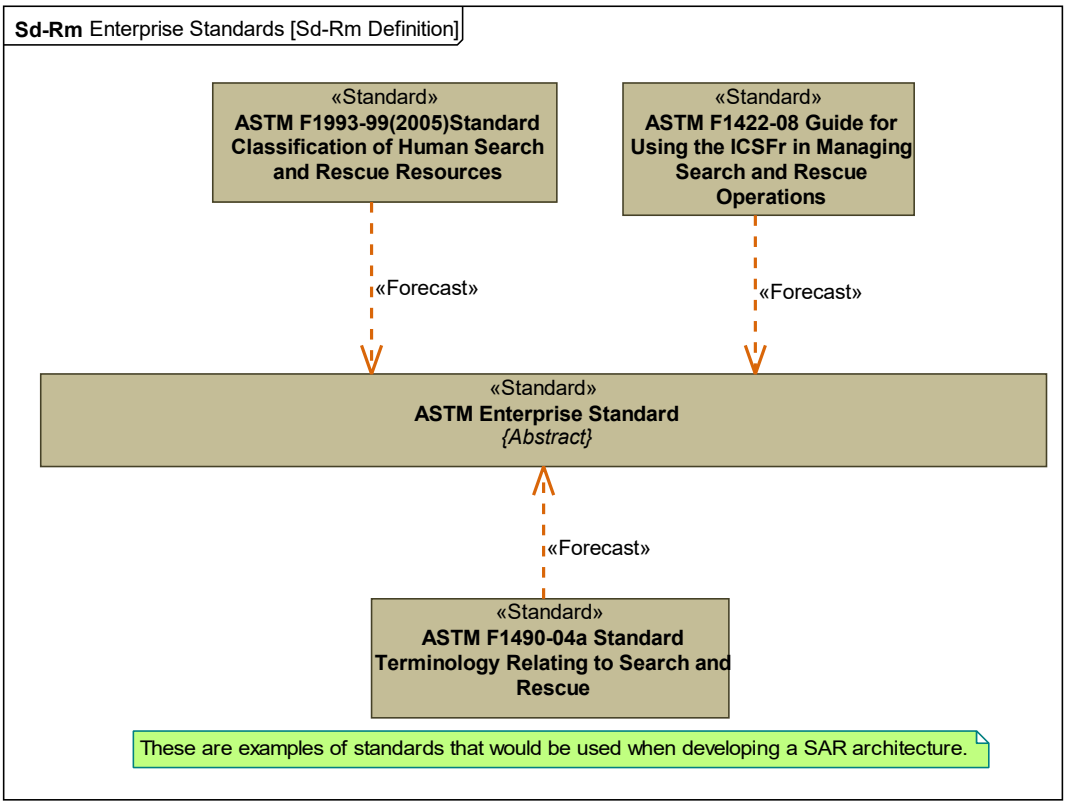

Figure 16:4 - Standards Roadmap for ASTM Standards

Figure 16-5 shows a variety of standards for marine radio, Link 16, and distress monitoring. These are part of the Capability Configuration shown in the Rs-Sr diagram.

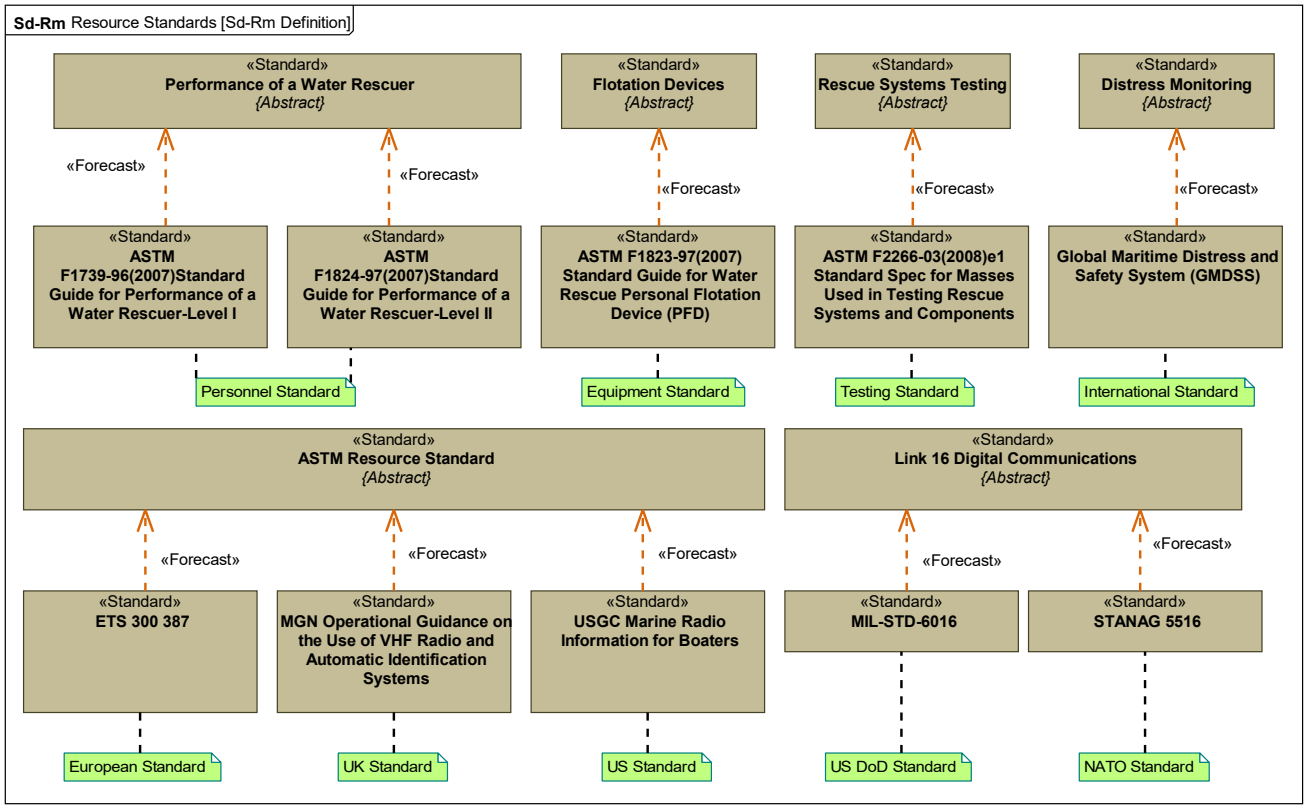

Figure 16:5 - Standards Roadmap for Procedural and Communications Standards

16.4 View Specifications::Standards::Traceability

Stakeholders: Solution Providers, Systems Engineers, Software Engineers, Systems Architects, Business Architects.
Concerns: standards that need to be taken in account to ensure the interoperability of the implementation of architectural elements.
Definition: shows the applicability of standards to specific elements in the architecture.
Recommended Implementation: tabular format, matrix format, SysML Block Definition Diagram.

The Sd-Tr report is in the form of a matrix and summarizes the architecture elements that conform to the various defined standards. Tables 16-1 and 16-2 show the conforming elements on the left and the applicable standards across the top. Systems can conform to multiple standards.

Table 16:1 - Standards Traceability
Resource Standards [Sd-Tr]

Conforming Elements	«Standard» ASTM F1739-96(2007)Standard Guide for Performance of a Water Rescuer-Level I	«Standard» ASTM F1823-97(2007) Standard Guide for Water Rescue Personal Flotation Device (PFD)	«Standard» ASTM F1824-97(2007)Standard Guide for Performance of a Water Rescuer-Level II	«Standard» ASTM F2256-03(2008)e1 Standard Spec for Masses Used in Testing Rescue Systems and Components	«Standard» ASTM Resource Standard	«Standard» Distress Monitoring	«Standard» ETS 300 387	«Standard» Flotation Devices	«Standard» Global Maritime Distress and Safety System (GMDSS)	«Standard» Link 16 Digital Communications	«Standard» MGN Operational Guidance on the Use of VHF Radio and Automatic Identification Systems	«Standard» MIL-STD-6016	«Standard» Performance of a Water Rescuer	«Standard» Rescue Systems Testing	«Standard» STANAG 5516	«Standard» USCG Marine Radio Information for Boaters
«CapabilityConfiguration» Civilian Boat							X									
«System» Marine Radio										X						X
«CapabilityConfiguration» Monitoring System						X			X							
«CapabilityConfiguration» Naval Ship							X					X				
«CapabilityConfiguration» Rescue Ship	X		X										X			
«System» Tactical Radio									X					X		

Table 16:2 - Standards Traceability
Resource Standards [Sd-Tr Matrix]

Conforming Elements	«Standard» ASTM F1739-96(2007)Standard Guide for Performance of a Water Rescuer-Level I	«Standard» ASTM F1823-97(2007) Standard Guide for Water Rescue Personal Flotation Device (PFD)	«Standard» ASTM F1824-97(2007)Standard Guide for Performance of a Water Rescuer-Level II	«Standard» ASTM F2256-03(2008)e1 Standard Spec for Masses Used in Testing Rescue Systems and Components	«Standard» ASTM Resource Standard	«Standard» Distress Monitoring	«Standard» ETS 300 387	«Standard» Flotation Devices	«Standard» Global Maritime Distress and Safety System (GMDSS)	«Standard» Link 16 Digital Communications	«Standard» MGN Operational Guidance on the Use of VHF Radio and Automatic Identification Systems	«Standard» MIL-STD-6016	«Standard» Performance of a Water Rescuer	«Standard» Rescue Systems Testing	«Standard» STANAG 5516	«Standard» USCG Marine Radio Information for Boaters
«Person» Marine Radio Operator																
«Organization» SAR Rescue Boat Team	X		X													

17. View Specifications::Services

Stakeholders: Enterprise Architects, Solution Providers, Systems Engineers, Software Architects, Business Architects..
Concerns: specifications of services required to exhibit a Capability.
Definition: shows Service Specifications and required and provided service levels of these specifications required to exhibit a Capability or to support an Operational Activity.

The Service Oriented views describe the services needed to directly support the Search and Rescue operations described in the Operational View and System View. They are normally used when creating Service Oriented Architectures (SOA). The Service Oriented Views do not specify how the service is to be implemented, but the requirements for the services. The implementation of the services is normally implemented by the Systems Views. In this example, various services are defined to support Search and Rescue capabilities. They are deployed in various phases and their deployment will modify the configuration of the system at the very highest level.

MODAF: The Service-Orientated View (SOV) is a description of services needed to directly support the operational domain as described in the Operational View. A service within MODAF is understood in its broadest sense, as a unit of work through which a provider provides a useful result to a consumer.
DoDAF: The Service Views within the Services Viewpoint describe the design for service-based solutions to support operational development processes (JCIDS) and Defense Acquisition System or capability development within the Joint Capability Areas.
The relationship between architecture data elements across the Service Viewpoint to the Operational Viewpoint and Capability Viewpoint can be exemplified as services are procured and fielded to support organizations and their operations or a capability.

17.1 View Specifications::Services::Taxonomy

Stakeholders: Enterprise Architects, Solution Providers, Systems Engineers, Software Architects, Business Architects.
Concerns: service specification types and required and provided service levels of these types.
Definition: shows the taxonomy of types of services and the level of service that they are expected to provide or are required to meet through the display of ActualMeasurements associated with the Provided and Required Service Level.
Recommended Implementation: SysML Block Definition Diagram.

The Sv-Tx view specifies the hierarchy of services as well as the relationships between them. Figure 17-1 shows the hierarchy of services within the Search and Rescue Service with Land and Maritime Search and Rescue Services as specializations of the SAR Service. Additional services are also defined to support SAR such as Communications, Coordination and so forth. These will be used in the rest of the Svs s as well as the Op and Rs.

Figure 17-1 links the Service Specifications to the Service Policies.

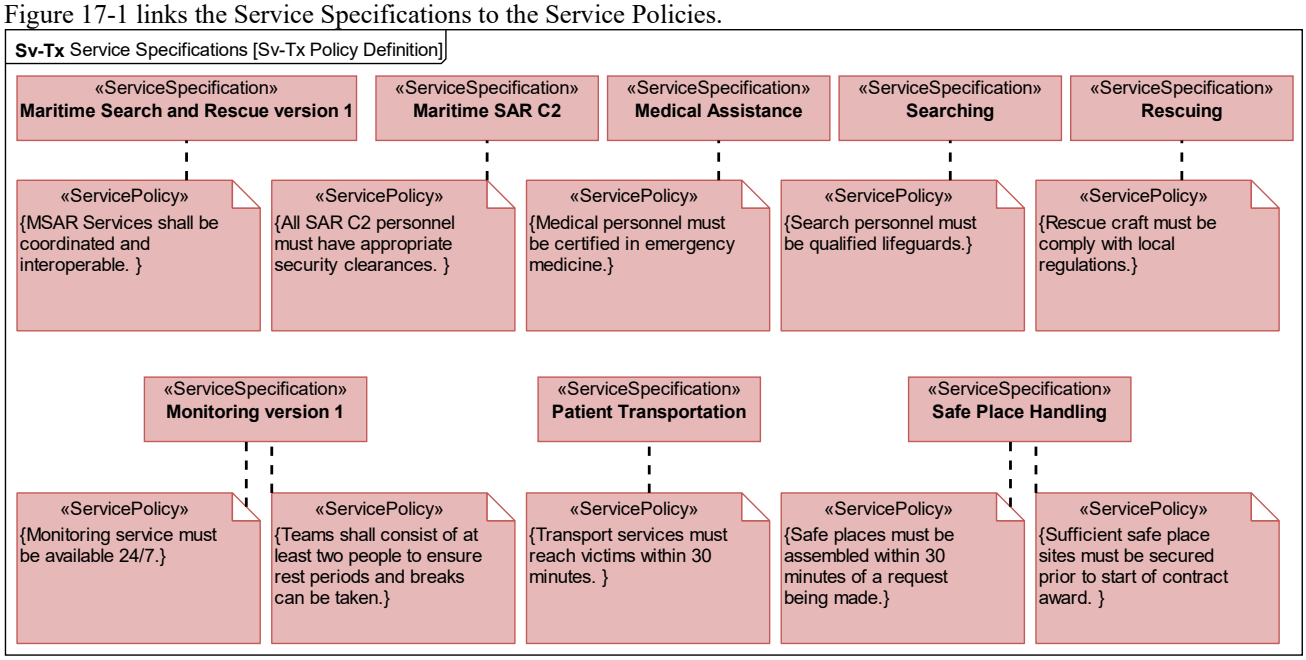

Figure 17:1 - Services Taxonomy of Service Specifications and Service Policies

Figure 17-2 defines the Services taxonomy for the Service Specifications.

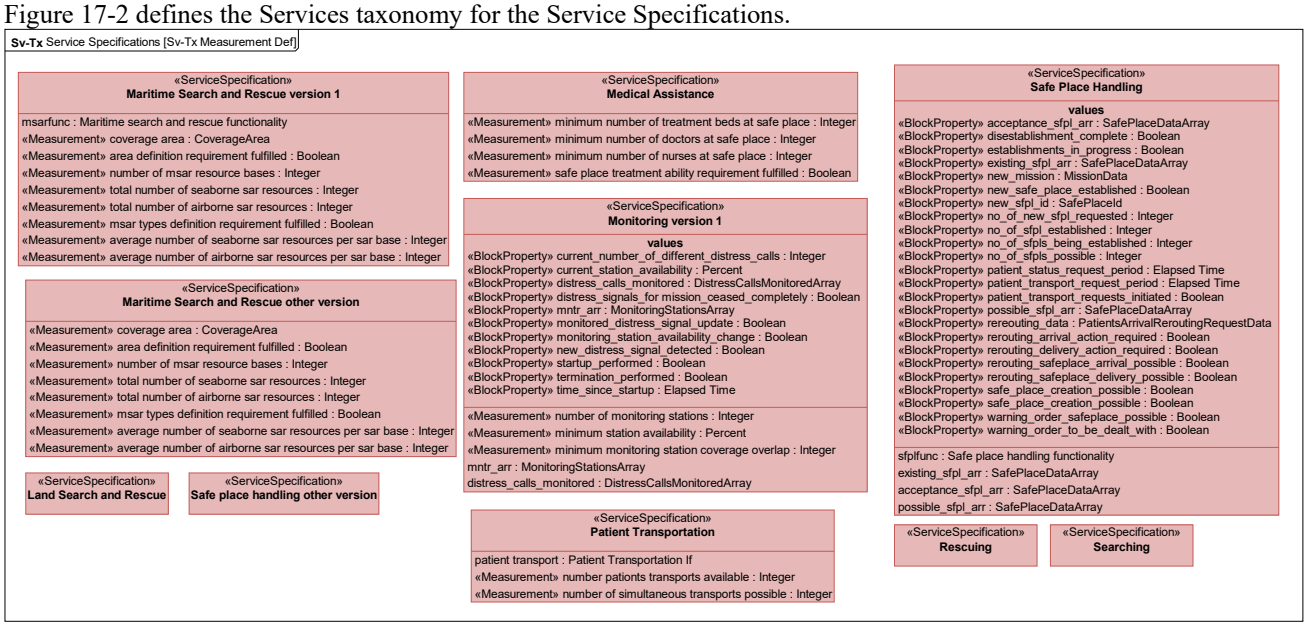

Figure 17:2 - Services Taxonomy for the Service Specifications.

17.2 View Specifications::Services::Structure

Stakeholders: Solution Providers, Systems Engineers, Software Architects, Business Architects.
Concerns: combination of services required to exhibit a capability.
Definition: shows the composition of services and how services are combined into a higher-level service required to exhibit a capability or support an operational activity.
Recommended Implementation: SysML Block Definition Diagram, SysML Internal Block Diagram.

Figure 17-3 defines the interfaces that will provide access to the services and those required by services. Many UAF elements can provide and consume services. Specifying the interface for the service provides a means of determining compatibility between service consumers and providers.

This interface defines the consumer interactions possible with the Maritime search and rescue service. The interface shows one method: RequestForMaritimeSearchAndRescue that invokes the service as a whole for the area defined in the request data. The remainder of the interface deals with information propagated by asynchronous messages either provided, i.e. sent by the consumer to the service or required i.e. sent by the service to the consumer. The interface indicates reception or transmission of the signals that have been defined as required by the service. There are several receptions and transmissions that deal with the service as a whole dealing with service payments as well as reports concerning specific periods. There is also information concerning in individual operations as they are stated, their status as well as when they are concluded.

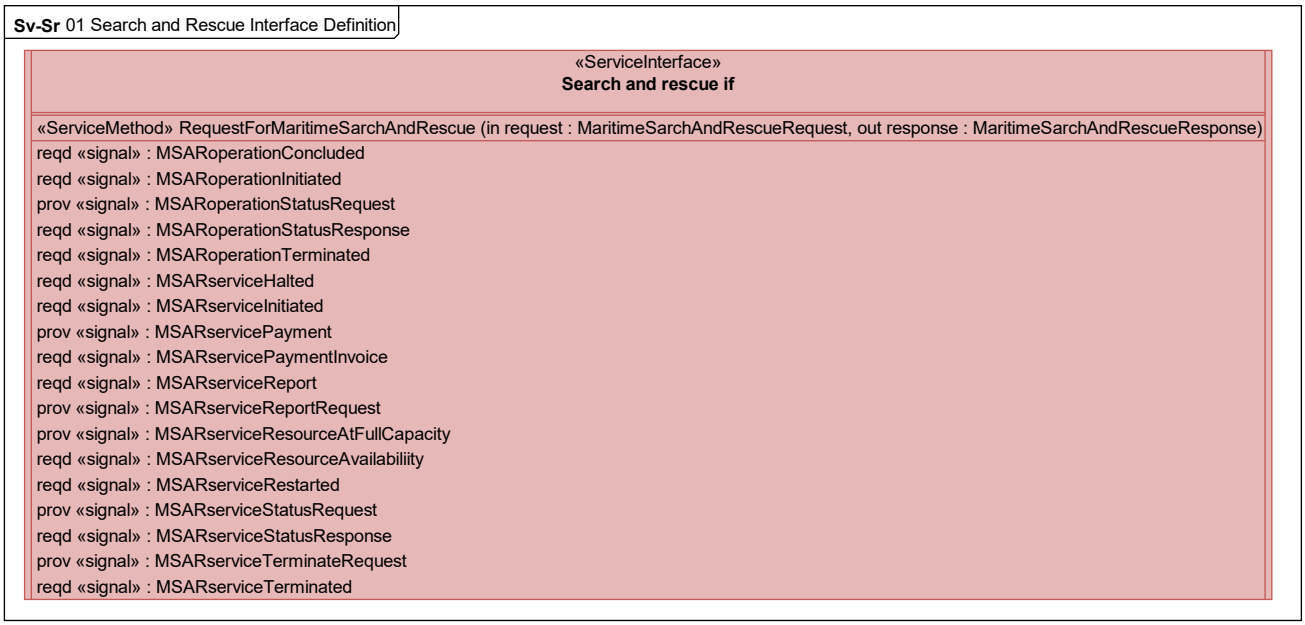

Figure 17:3 - Services Structure: search and Rescue Interface Definition

This interface defines the consumer interactions possible with the Monitoring service. The interface shows one method: InitiateMaritimeDistressMonitoring that invokes the service as a whole for the area defined in the request data. The remainder of the interface deals with information propagated by asynchronous messages either provided, i.e. sent by the consumer to the service or required i.e. sent by the service to the consumer. The interface indicates reception or transmission of the signals that have been defined as required by the service. The signals are concerned with detected distress signal from the set of deployed monitoring stations, updates from stations concerning detected distress signals. There is also a signal that defines a mission assignment if the distress call has been determined as valid.

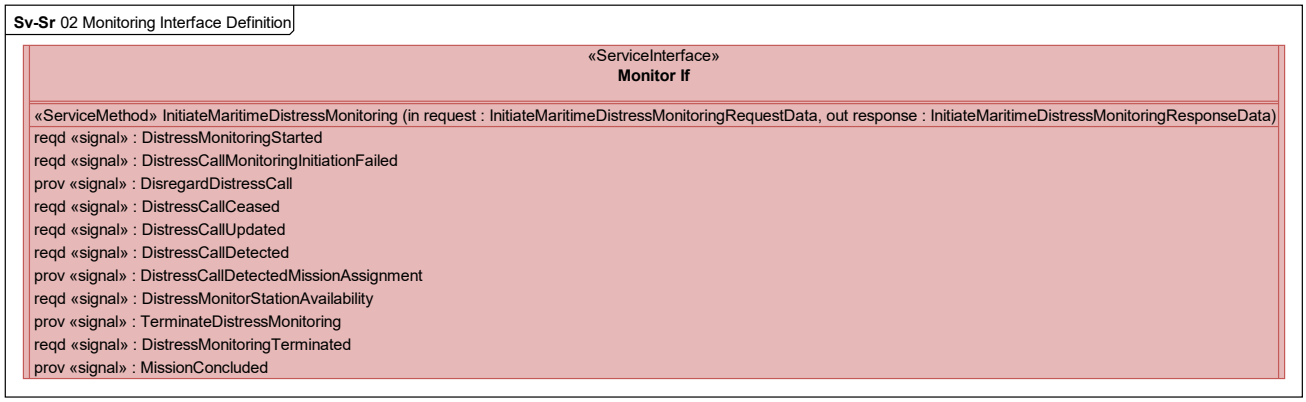

Figure 17:4 - Services Structure for the Monitoring Interface

This interface defines the consumer interactions possible with the Maritime SAR C2 service. The interface deals with information propagated by asynchronous messages either provided, i.e. sent by the consumer to the service or required i.e. sent by the service to the consumer. The interface indicates reception or transmission of the signals that have been defined as required by the service. The signals are concerned with the initiation of an SAR operation as well as the status of any that are ongoing. It also allows for updates of the distress signals that the monitoring service has forwarded to the consumer of the maritime sar c2 service.

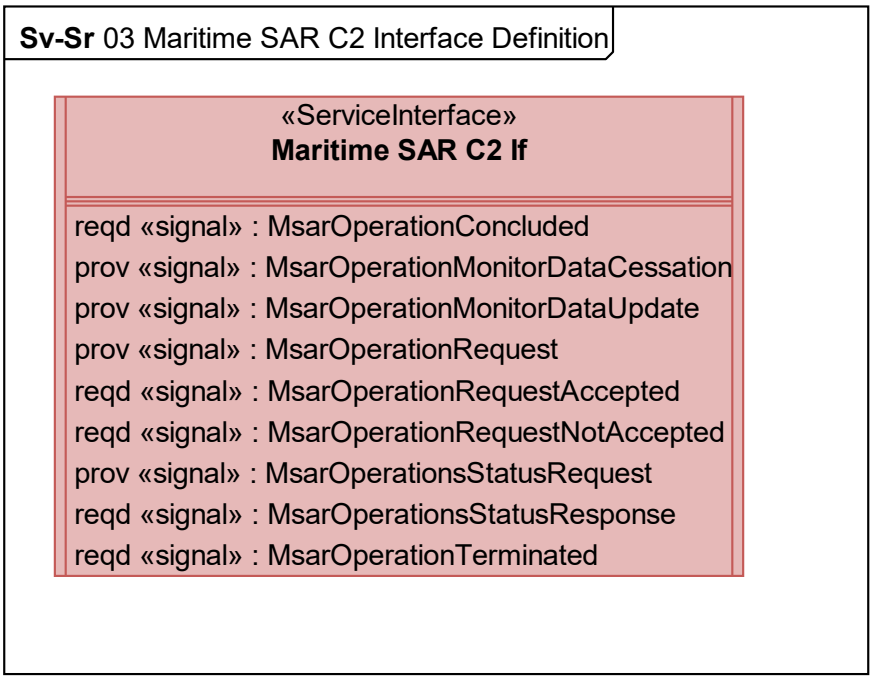

Figure 17:5 - Services Structure for the Maritime C2 Interface

This interface defines the consumer interactions possible with the Rescuing service. The interface deals with information propagated by asynchronous messages either provided, i.e. sent by the consumer to the service or required i.e. sent by the service to the consumer. The interface indicates reception or transmission of the signals that have been defined as required by the service. The signals deal with individual operational handling of a rescue as well as possible rerouting of rescue assets because of changing conditions. It also is used to indicate the need for a safe place to be determined for rescued personnel.

Figure 17:6 - Services Structure for the Rescue Interface

This interface defines the consumer interactions possible with the Searching service. The interface deals with information propagated by asynchronous messages either provided, i.e. sent by the consumer to the service or required i.e. sent by the service to the consumer. The interface indicates reception or transmission of the signals that have been defined as required by the service. The signals deal with individual operational handling of a search as well as possible rerouting of search assets because of changing conditions. Some search assets can be used to rescue as well and therefore there is also a need to indicate the need for a safe place to be determined for rescued personnel.

Figure 17:7 - Services Structure for the Search Interface

This interface defines the consumer interactions possible with the Safe place handling service. The interface shows one method: RequestForPossibleSafePlaceEstablishment that invokes the service for a specific establishment. The remainder of the interface deals with information propagated by asynchronous messages either provided, i.e. sent by the consumer to the service or required i.e. sent by the service to the consumer. The interface indicates reception or transmission of the signals that have been defined as required by the service. As can be seen, the signals deal with the handling of patient arrival and handling as well as transportation. It also deals with the establishment and disestablishment of safe places.

Figure 17:8 - Services Structure for the Safe Place Handling Interface

This interface defines the consumer interactions possible with the Maritime search and rescue service. The remainder of the interface deals with information propagated by asynchronous messages either provided, i.e. sent by the consumer to the service or required i.e. sent by the service to the consumer. The interface indicates reception or transmission of the signals that have been defined as required by the service. The signals deal with patient arrival as well as release. It is also concerned with pickup and handling.

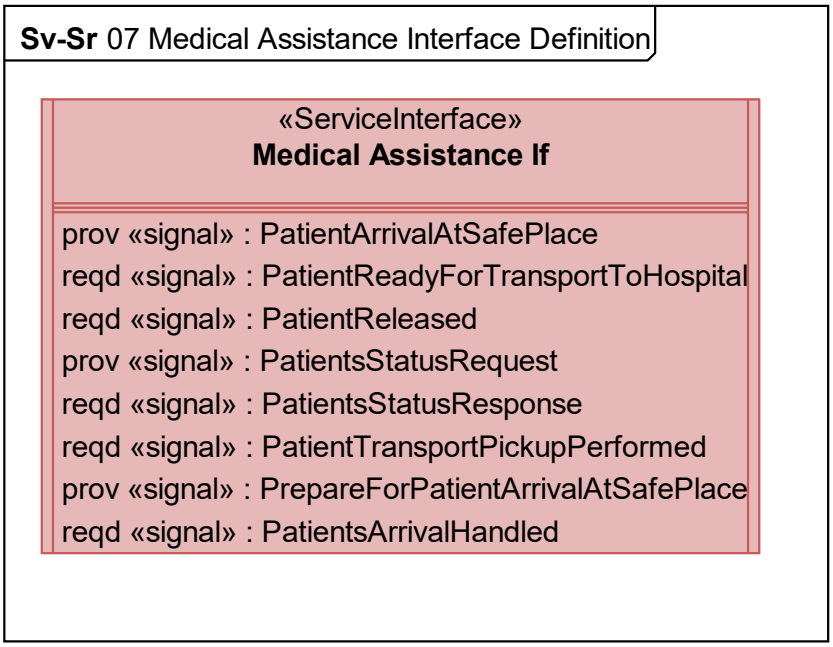

Figure 17:9 - Services Structure for the Medical Assistance Interface

This interface defines the consumer interactions possible with the Patient transportation service. The interface shows one method: Transport request for patients that invokes a specific patient transport. The remainder of the interface deals with information propagated by asynchronous messages either provided, i.e. sent by the consumer to the service or required i.e. sent by the service to the consumer. The interface indicates reception or transmission of the signals that have been defined as required by the service. The signals are concerned with patient pickup and transportation started as well as being completed.

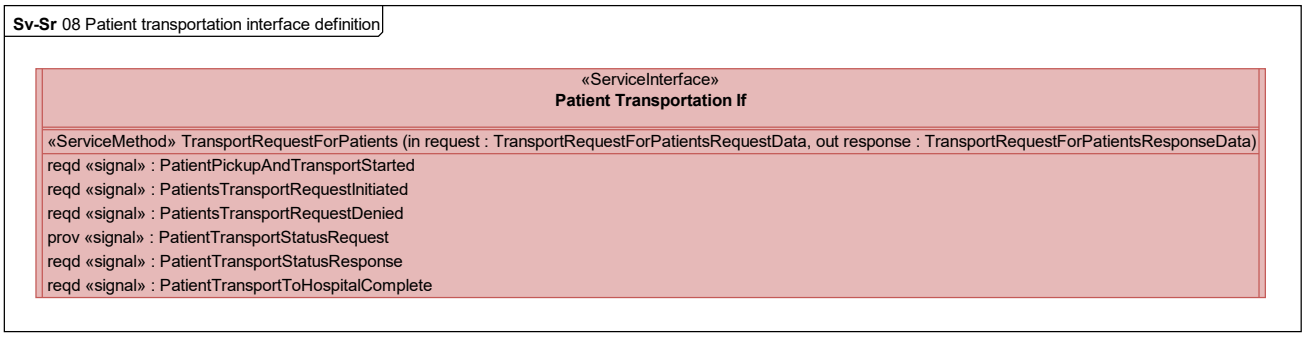

Figure 17:10 - Services Structure for the Patient Transport Interface

The intent of the Maritime search and rescue service is to describe a way for a customer to consume a service that effectively outsources the entire maritime search and rescue for a defined maritime area for a given period of time. This means that when the service is invoked it means that once it has started all maritime distress calls are being dealt with by the service.

To define the service from a requirements perspective the service is described as being composed of a set of other services and this is what is shown here. By describing the service in this manner, it makes it possible to consider appropriate measurements for each of the different services.

The different services that the big service is subdivided into are:

- Monitoring: Responsible for monitoring the area for distress signals.
- Maritime SAR c2: Command and control for sar operations once they have been initiated. This service is further subdivided into:
    - Rescuing: A service that is responsible for rescuing persons in distress.
    - Searching: A service responsible for searching for vessels or persons issuing a distress signal.
- Safe place handling: A service that manages the establishment and disestablishment of safe places where distressed persons can be handled before being transported to hospital or released. It is subdivided into the following services:
- Medical assistance: This service deals with the treatment of persons at a safe place.
- Patient transportation: This service deals with the transport of patients from safe places to a designated hospital.

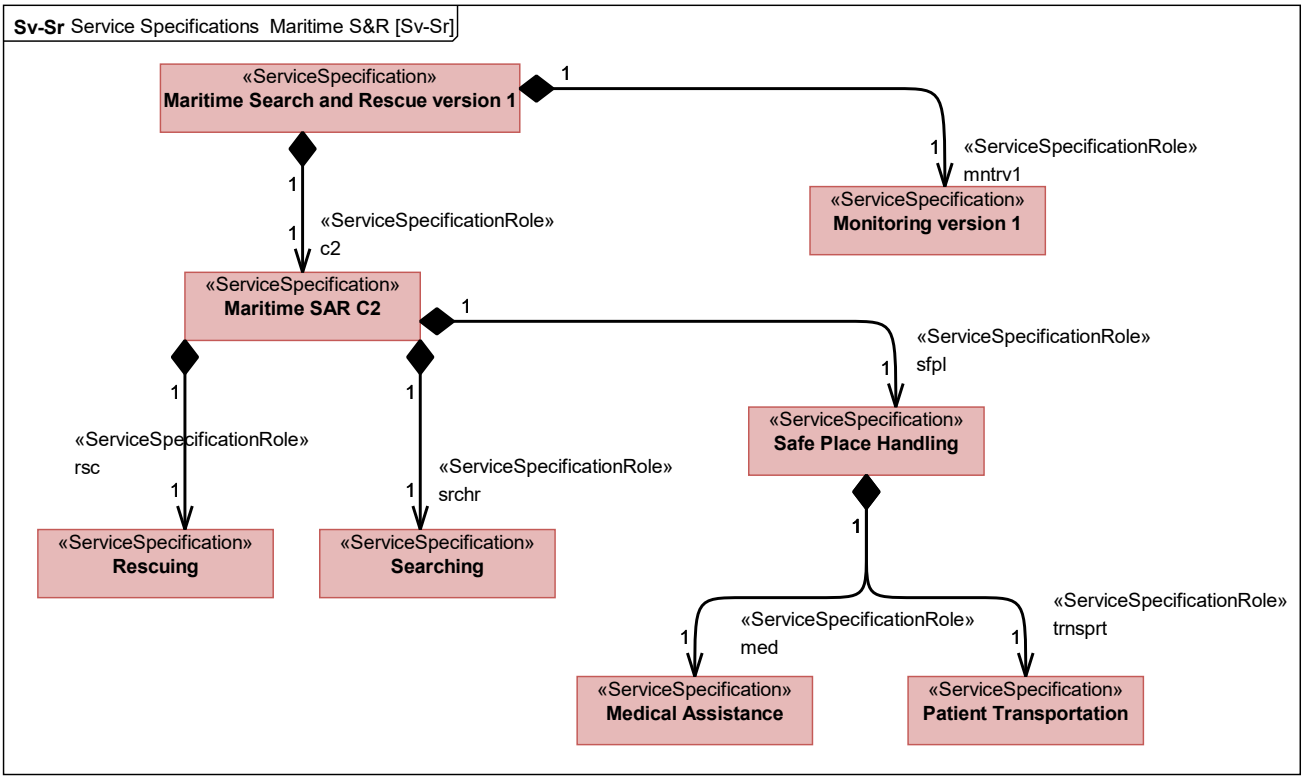

Figure 17:11 - Services Structure for the Maritime Search and Rescue Service Specification

This diagram defines a set of different measurements that have been associated with the different services that have been defined. A few other elements also show up, but the key here are the measurements themselves since these define the parameters that are important for the different services made use of.

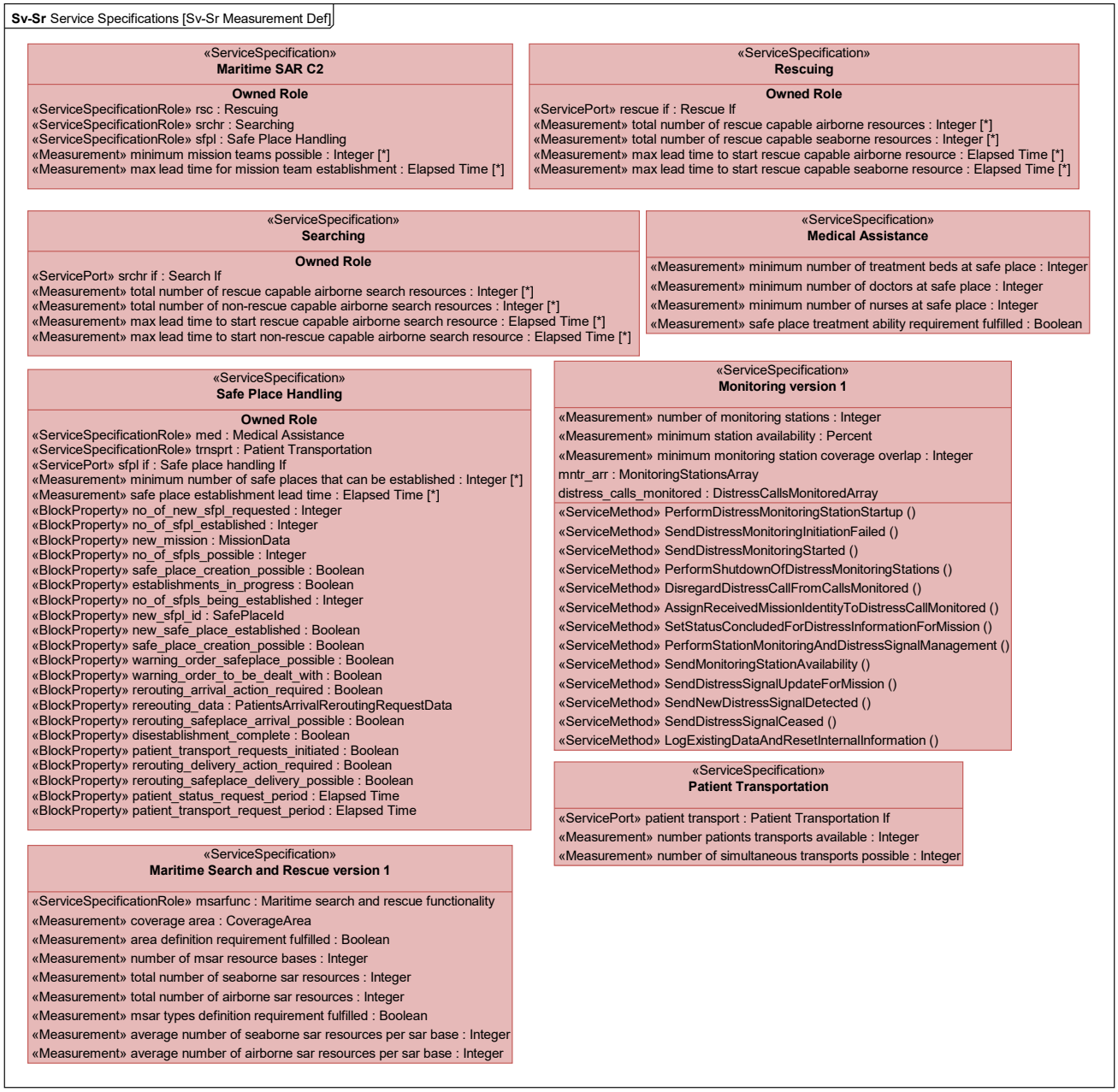

Figure 17:12 - Services Structure of Service Specifications and their Measurements

This diagram shows the internal structure of the Maritime search and rescue other version service specification. This is less descriptive but more correct than the service specification that is just called Maritime search and rescue. Here the sar service port, the msarc2 service port and the sfpl if service ports are defined by isBehavior=True. This implies that each of these have behavior on their own. This behavior is responsible for acting as a consumer of the services shown as internal, i.e. Maritime search and rescue other version can invoke the mntr and the c2 service. The Maritime SAR C2 other version service can invoke the srchr, rcr and the sfpl service, Finally the Safe place handling other version service specification can invoke the medical and patient transport service.

Connectors cannot be shown here since this would imply behavior as part of the port, something that cannot be done since proxy ports cannot contain behavior.

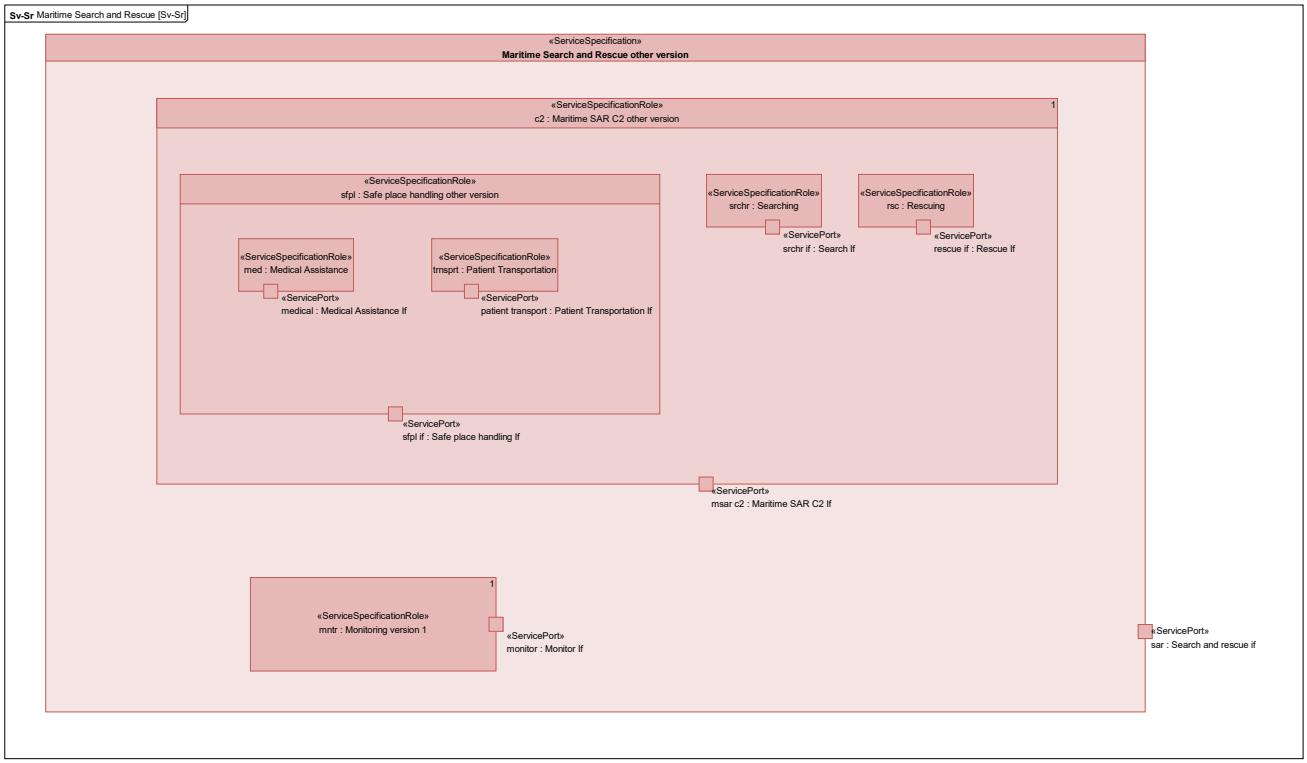

Figure 17:13 - Services Structure for Maritime Search and Rescue

This description is an attempt to make the description of the service invocations easier to understand. As can be seen the functionality of the services that invoke other services have been placed within elements that can have behavior as well as proxy ports that show the invocation connections properly. This also means that the service ports here on the boundary of the services that contain internal parts are defined as isBehavior=False.

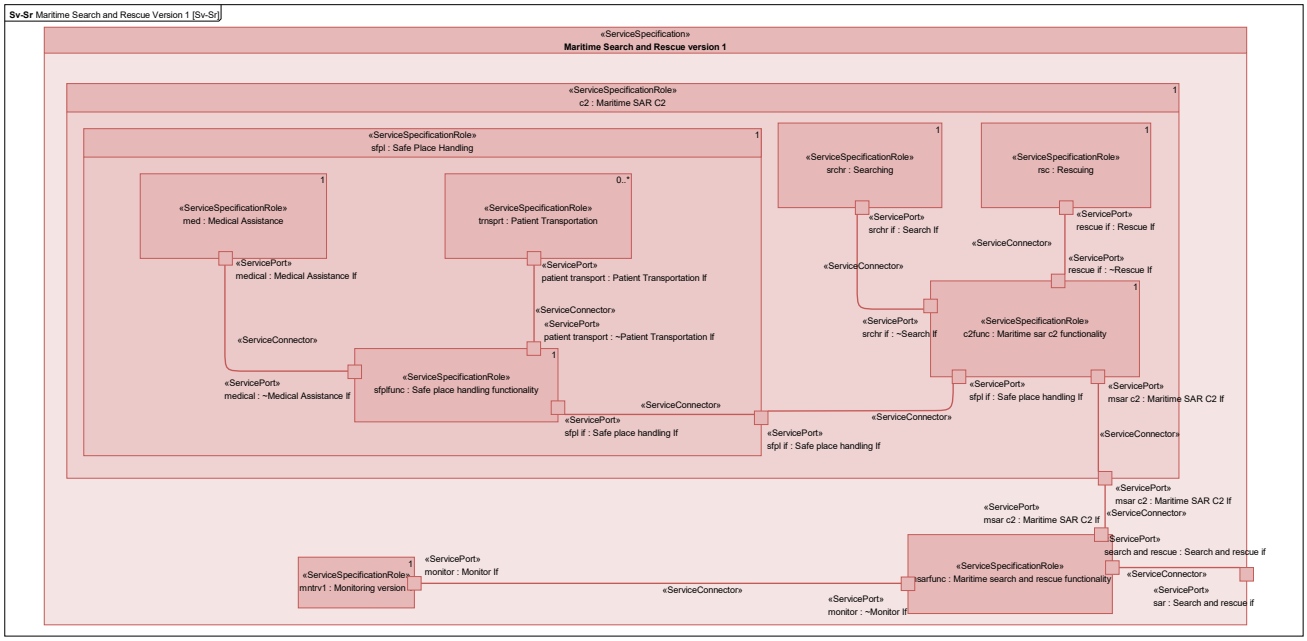

Figure 17:14 - Services Structure for Maritime Search and Rescue v1

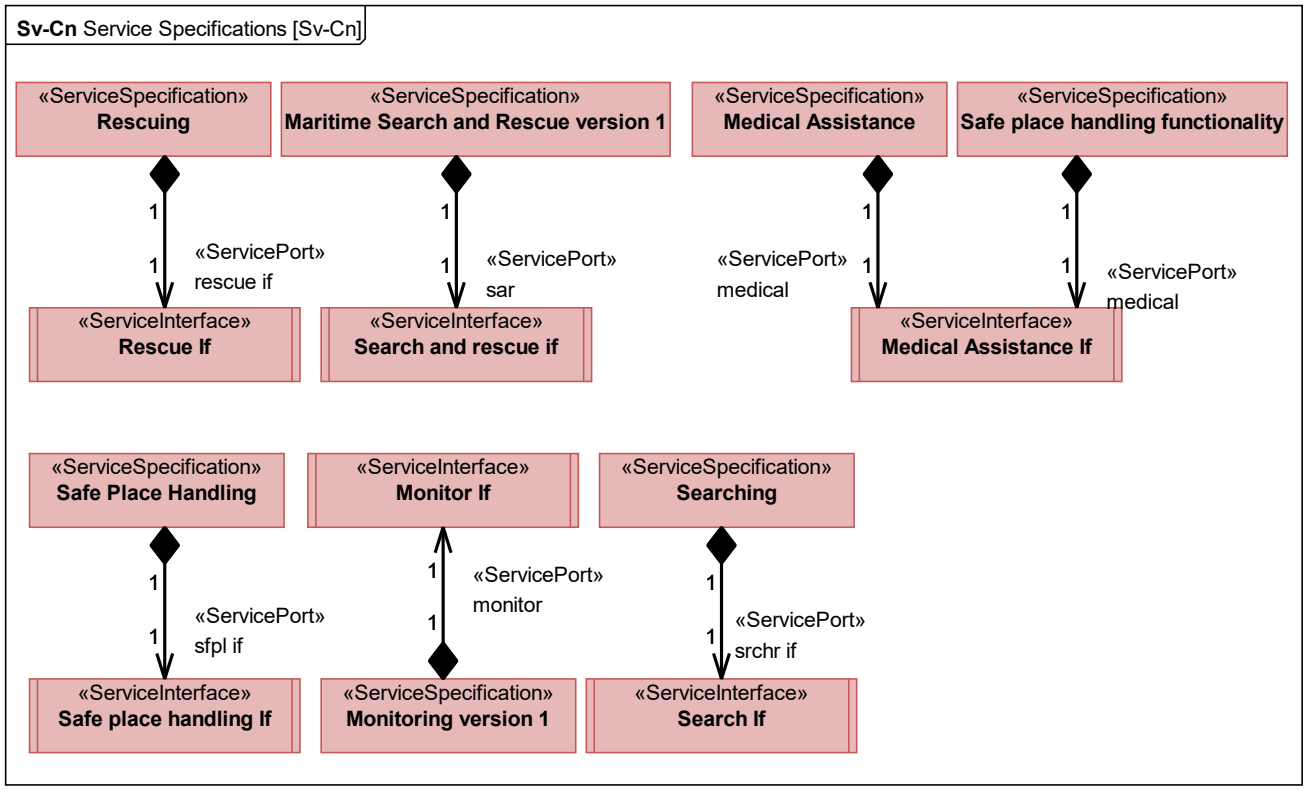

Figure 17:15 - Services Structure for Service Specifications and Service Interfaces

17.3 View Specifications::Services::Connectivity

Stakeholders: Solution Providers, Systems Engineers, Software Architects, Business Architects.
Concerns: interoperability among services
Definition: specifies service interfaces, e.g. provided and required service methods, signal receptions, and/or flow properties, to ensure compatibility and reusability of services.
Recommended Implementation: SysML Block Definition Diagram, SysML Internal Block Diagram, tabular format.

The Internal diagram shows the Service Specification and its Service Ports.

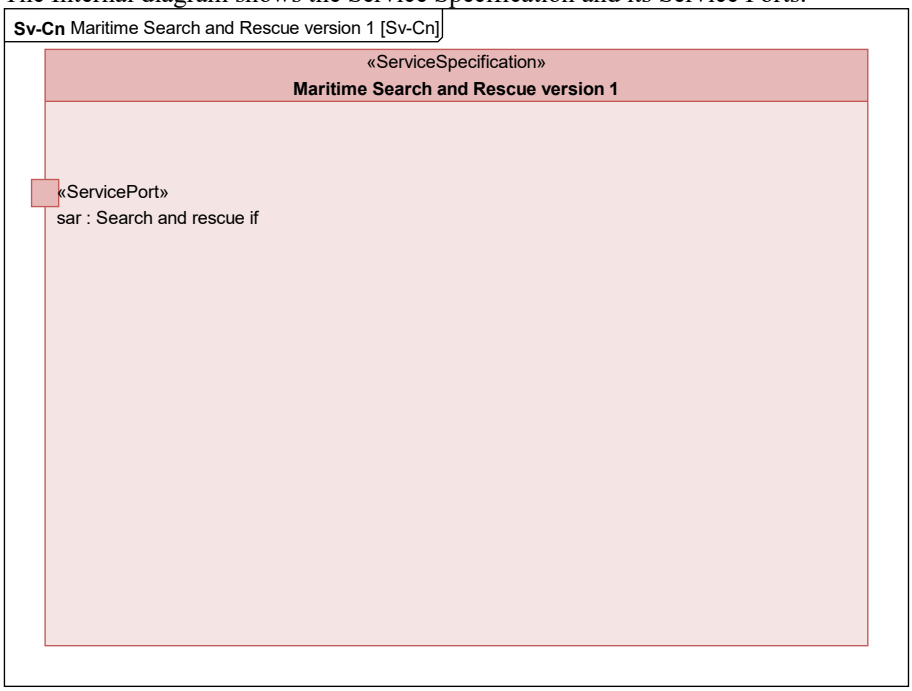

Figure 17:16 - Services Connectivity for Maritime Search and Rescue v1

17.4 View Specifications::Services::Processes

Stakeholders: Solution Providers, Systems Engineers, Software Architects, Business Architects.
Concerns: the behavior of a service in terms of the operational activities it is expected to support.
Definition: provides detailed information regarding the allocation of service functions to service specifications, and data flows between service functions.
Recommended Implementation: SysML Activity Diagram, BPMN Process Diagram, SysML Block Definition Diagram.

Figure 17-17 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. In this example, the Maritime Search and Rescue service provides the rescue function. This function is further decomposed to its sub-functions.

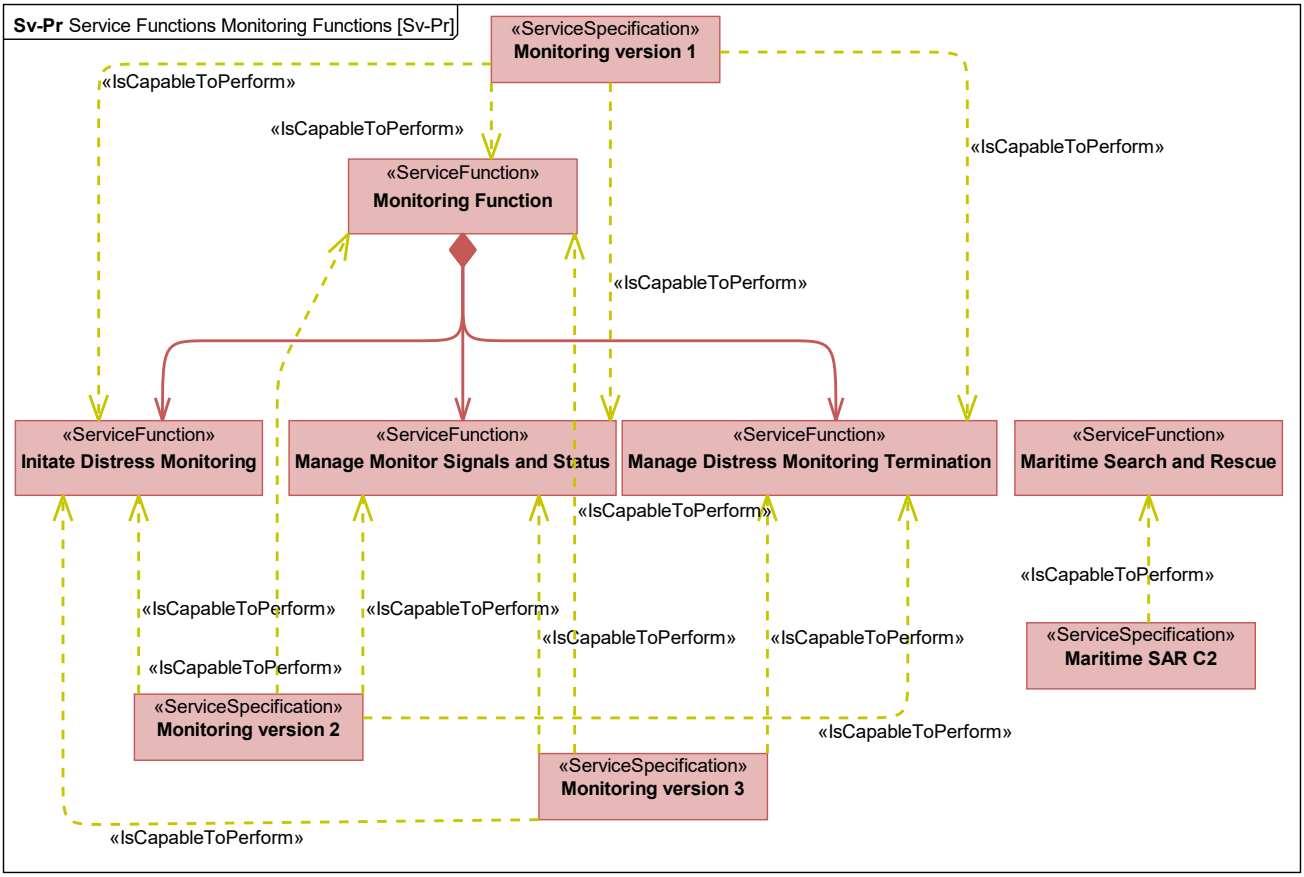

Figure 17:17 - Services Processes for Monitoring Functions

This diagram represents a simple description of the Monitoring service specification as a set of activities where the first activity initiates distress monitoring, the second manages distress monitoring and the third terminates it. All deal with a massive amount of information concerning the monitors that have been deployed.

The constraints shown for the failure at start-up and success at startup indicate that a minimum percentage of the distress monitors need to be operational in a given amount of time for the service to be considered as successfully started. The time allowed, and the minimum availability is contained within the startup request data. The current availability and time since startup are parameters of the service specification.

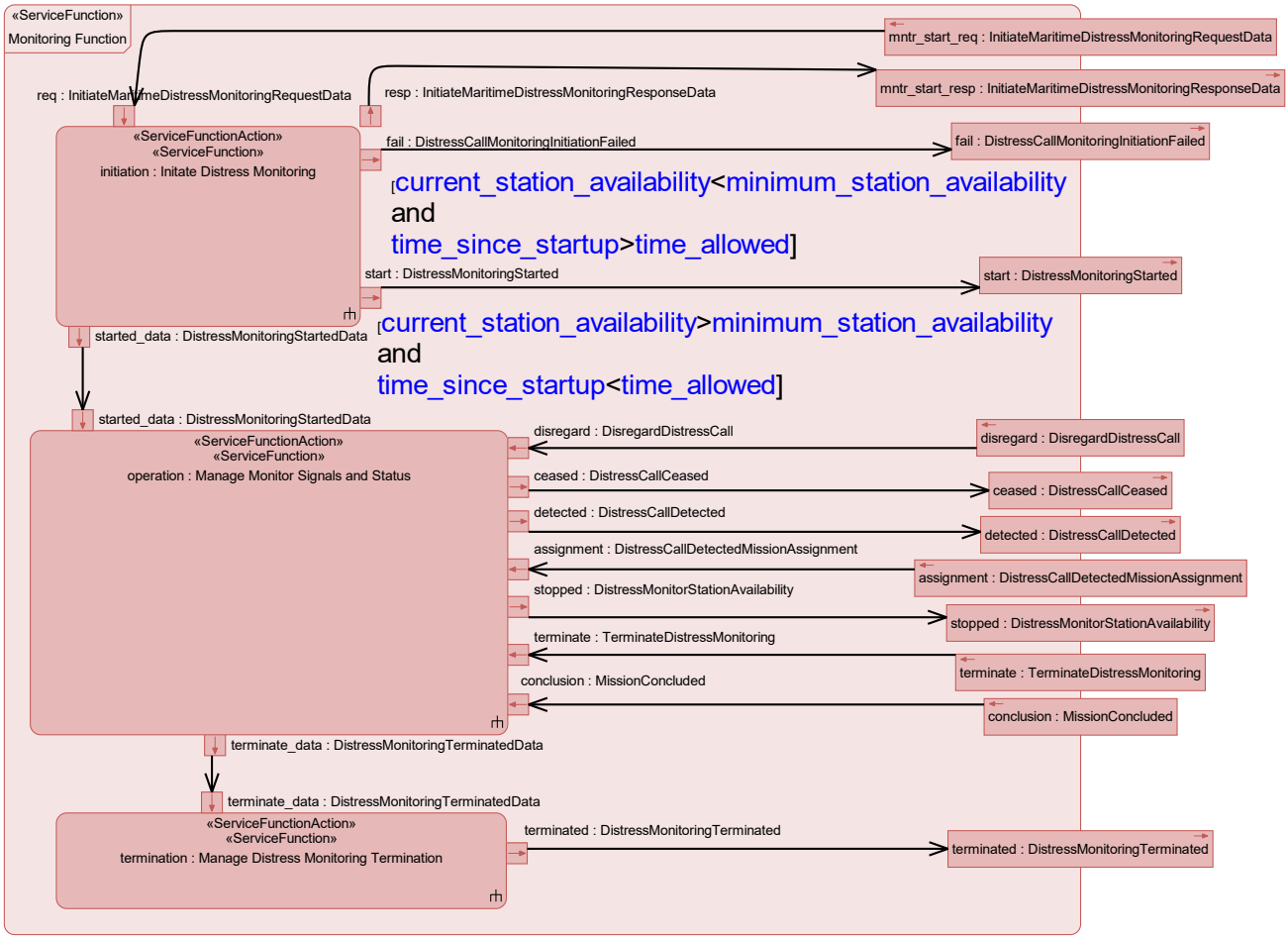

Figure 17:18 - Services Processes for the Monitoring Function

Table 17-1 is an automatically generated table of the link between the Service Functions and Service Specifications.

Table 17:1 - Services Processes

Service Functions [Sv-Pr Matrix]

Performing Service Specifications	Performed Service Functions				
	«ServiceFunction» Initate Distress Monitoring	«ServiceFunction» Manage Distress Monitoring Termination	«ServiceFunction» Manage Monitor Signals and Status	«ServiceFunction» Maritime Search and Rescue	«ServiceFunction» Monitoring Function
«ServiceSpecification» Monitoring version 1		X			X
«ServiceSpecification» Monitoring version 2	X	X	X		X
«ServiceSpecification» Monitoring version 3	X	X	X		X
«ServiceSpecification» Maritime SAR C2				X	

17.5 View Specifications::Services::States

Stakeholders: Solution Providers, Systems Engineers, Software Architects, Business Architects.
Concerns: the behavior of a service specification in terms of states and events causing transitions between states.
Definition: specifies the possible states a service specification may have, and the possible transitions between those states.
Recommended Implementation: SysML State Machine Diagram.

The Sv-St defines behavioral constraints that must be adhered to by Consumers and Providers of the Services. Specifically, it defines the state-based behavior of the service defining the states, transitions between those states, the events that cause those transitions to take place and behaviors within those states. Figures 17-19 and 17-20 show the state diagram describing the state-based behavior of the Maritime Search and Rescue Service Monitoring and safe place handling.

When dealing with behavior for a service specification, a balancing act is required since it is not the intent that the description should be an implementation. The service specification should define behavior from a logical perspective.

In the event that no safe places exist, the first that needs to be handled deals with the establishment. Until this has happened, warning orders are not accepted. The service method DetermineSafePlaceAcceptanceData checks if an establishment is possible and initiates this establishment. If establishment is possible the safe_place_creation_possible is set to True, otherwise false.

Once safe places exist there is a need to be able to manage several possible safe places. The best way to deal with this seems to be to use concurrent state machines. The first here deals with general monitoring of establishment, disestablishment and status of the safe places that exist. It is therefore assumed that safe places that exist can be monitored and that this can be used to set different attributes within the visible part of the specification.

The concurrent state Safe place handling is entered once at least one safe place is in the process of being established. It is exited after the last safe place has been disestablished. There are three parts to the concurrent state machine:

Monitoring handling, ExternalSafePlaceHandling and InternalSafePlaceHandling.

The concurrent state Monitor handling only contains one state and one action that is started at entry. Its purpose is to monitor the establishment, disestablishment as well as status of existing safe places. It feeds information as a result of this into internal data within the safe place handling service specification. Note that no attempt to describe how this is done is contained. This is therefore a logical definition of something that must be performed to make safe place handling work, not an actual implementation.

The concurrent state External safe place handling deals with handling of all the interaction originating from the external service consumer,

There may be many safe places as required by the one or more missions to be dealt with and therefore new requests for safe place establishments need to be handled. In the same manner, once the need for a given safe place has disappeared the service is able to disestablish a given safe place.

When warning orders arrive, possible safe places are considered based on the mission data as well as status at different safe places.

Depending on monitored statuses a safe place indicated as usable may turn out to be unusable something that can require rerouting of recue assets. The handling of this is very close to that of warning orders. Rerouting can occur from the sar assets in the form of delivery rerouting which implies the reception of an external request or from the safe place itself in the form of arrival rerouting

There is a need to deal with the service specifications that this service specification consumes, and this is performed in the last concurrent state: InternalSafePlaceHandling. Here the interaction with the medical assistance service as well as the patient transportation service is dealt with. Several of the signal events that originate in the consumed services are forwarded by the parent service to its consumer.

Figure 17:19 - Services States for Safe Place Handling

This diagram describes the Monitoring service specification by means of a state machine.

It awaits a service method call in the form of a service initiation request and provided that it was initiated quickly enough and that enough stations have been brought online the service specification enters the concurrent state Operational distress monitor handling.

One of the concurrent states is devoted to monitoring the stations as well as recognizing and managing detection, update, cessation of distress signals.

The other concurrent state is devoted to handling inputs and outputs across the service specification interface.

This involves marking a distress signal as false based on external handling (Disregard distress call), associating a specific distress call being monitored by one or more stations as associated with a specific sar mission and marking them as concluded once the mission has been completed or terminated.

Based on data being monitored several conditions are dealt with that needs to result in the transmission of signals to the consumer of the service such as cessation of distress signals for a mission, new distress signals, updated distress signals and changes in the availability of the set of monitoring stations in use.

Finally, the service can be terminated and once the stations have shut down, the state machine goes back to waiting for an initiation.

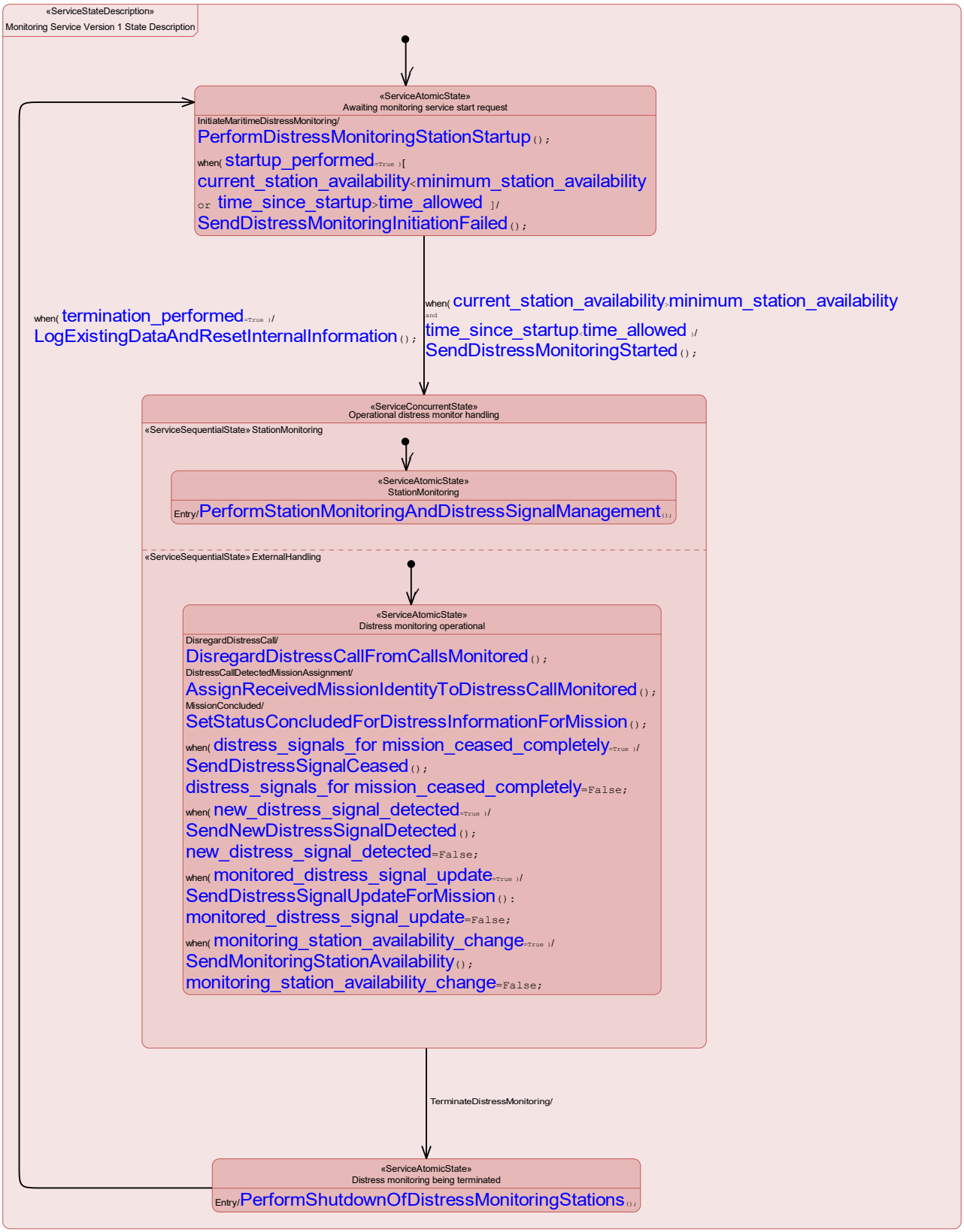

Figure 17:20 - Services States for the Monitoring Service

17.6 View Specifications::Services::Interaction Scenarios

Stakeholders: Solution Providers, Systems Engineers, Software Architects, Business Architects.
Concerns: the behavior of a service specification in terms of expected time-ordered examination of the interactions between service roles.
Definition: specifies how a service role interact with each other, service providers and consumers, and the sequence and dependencies of those interactions.
Recommended Implementation: SysML Sequence Diagram.

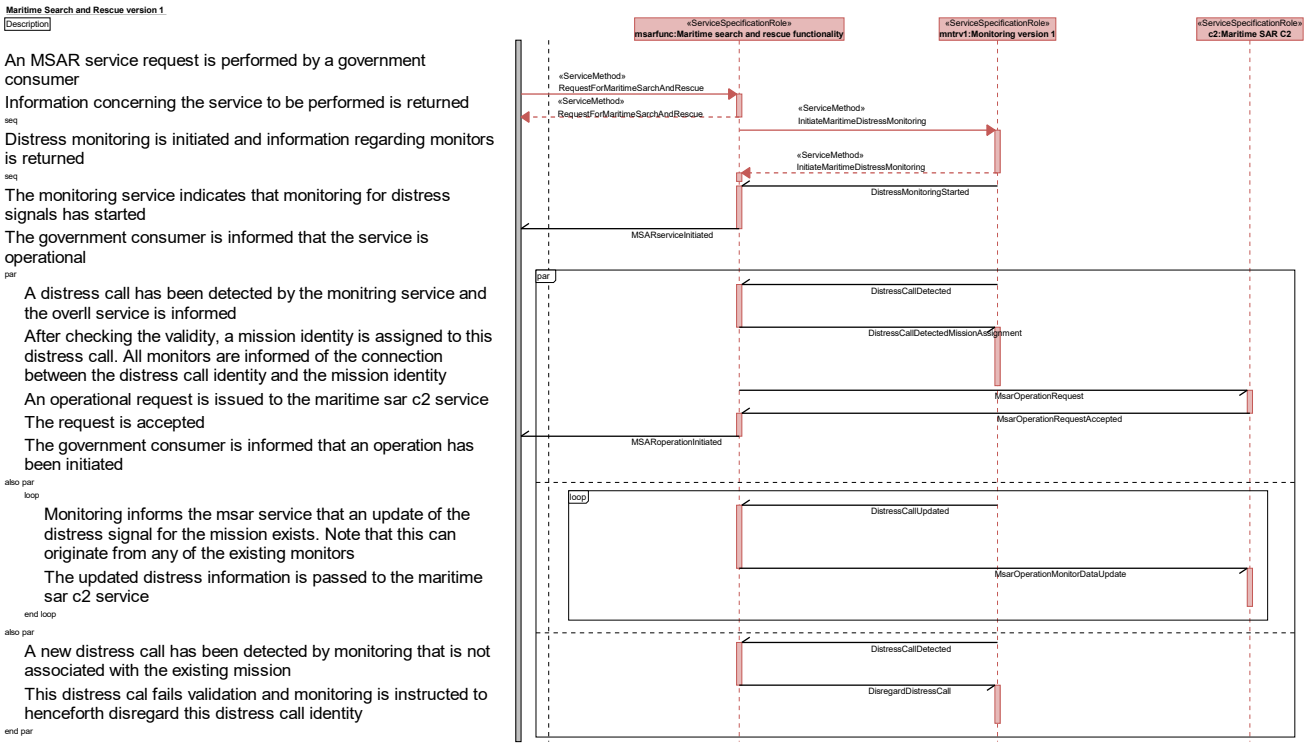

Figure 17:21 - Services Interaction Scenarios for Service Initiation

Safe Place Handling

Description

There may be a number of safe places, each used for one or more missions. Each individual safe place needs to be established and a request to the safe place service is required to do this. The pverall maritime sar service can make that determination based on the status of the missions.

Information concerning the possible establishment is returned

Once the request has been processed and accepted the overall maritime sar service (consumer) is informed.

After awhile the establishment has been performed and the msar service is informed that a given safe place is operational.

loop

Periodically the safe place services requests status information concerning all of the patients at all safe places established

The response to a patients status request

end loop

A warning order concerning rescued personnel arrives

The safe place service determines where the patients are best cared for and instructs a determined safe place to await arrival of patients

An acceptance message is issued indicating where the patients are to be delivered.

The patients have arrived at the safeplace.

The information id forwardes to the medical assistance service

The fact that the patients arrival has been handled is returned.

This is forwarded by the safe place handling service to ist consumer

It is indicated that there are patients ready for transport to hospital

This is forwarded by the safeplace service to its consumer

A transport request is issued ti the patient transport service

Response

It is indicated that a transport has been assigned and is on its wayu to the safeplace handling the patients that are to be transported to hospital

loop

Periodically, transport status requests and responses are collected.

Response

end loop

The patient transport service informs its consumer that patient pickup and transport has started

The consumer of the transport service verifies the pickup with the medical assistance service.

Performed

The safe place service forwards this information to its consumer

loop

A transport status request is sent

A transport status response

end loop

The patient transport service notifies its consumer that the transport to hospital is complete

The safeplace service forwards this to its consumer

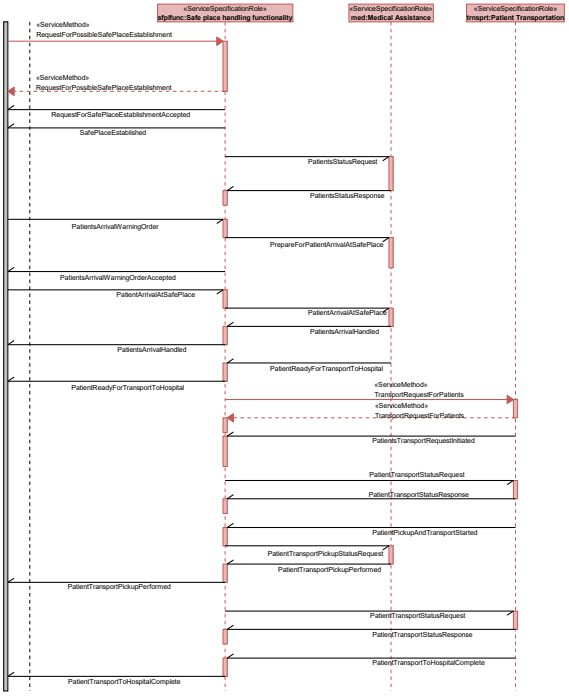

Figure 17:22 - Services Interaction Scenarios for Safe Place Handling

17.7 View Specifications::Services::Constraints

Stakeholders: Solution Providers, Systems Engineers, Software Architects, Business Architects.
Concerns: service policies that apply to implementations of service specifications.
Definition: specifies traditional textual service policies that are constraints on the way that service specifications are implemented within resources. The addition of SysML parametrics provide a computational means of defining service policies across the enterprise or within a specific service configuration.
Recommended Implementation: tabular format, SysML Parametric Diagram.

The Sv-Ct defines constraints that must be adhered to by Consumers and Providers of the Services via Service Policies. This also provides a means of performing trade-off analysis of the possible service providers. As a minimum it defines a set of criteria to determine whether the service provider meets the provision requirements defined by the constraints.

Table 17-2 shows a sample of the services and their associated service policies.

Table 17:2 - Services Constraints table of Service Policies

[Architectural Description] Service Specifications [Sv-Ct]

Policy Constrained Specification	Service Policy	
Name	**Name**	**Text**
Land Search and Rescue	[none]	[none]
Maritime SAR C2	Security Clearance	All SAR C2 personnel must have appropriate security clearances.
Maritime SAR C2 other version	[none]	[none]
Maritime Search and Rescue other version	[none]	[none]
Maritime Search and Rescue version 1	MSAR Availability	MSAR Services shall be coordinated and interoperable.
Maritime Search and Rescue version 2	[none]	[none]
Maritime Search and Rescue version 3	[none]	[none]
Medical Assistance	Personnel Qualifications	Medical personnel must be certified in emergency medicine.
Monitoring version 1	Monitor Teams	Teams shall consist of at least two people to ensure rest periods and breaks can be taken.
	Monitoring Availability	Monitoring service must be available 24/7.
Monitoring version 2	[none]	[none]
Monitoring version 3	[none]	[none]
Patient Transportation	Transport Time.	Transport services must reach victims within 30 minutes.
Rescuing	Craft Qualifications	Rescue craft must be comply with local regulations.
Safe Place Handling	Safe Place Planning	Sufficient safe place sites must be secured prior to start of contract award.
	Safe Place Setup	Safe places must be assembled within 30 minutes of a request being made.
Safe place handling other version	[none]	[none]
Searching	Lifeguard Certified	Search personnel must be qualified lifeguards.

17.8 View Specifications::Services::Roadmap

Stakeholders: Solution Providers, Systems Engineers, Software Architects, Business Architects.
Concerns: service specification changes over time.
Definition: provides an overview of how a service specification changes over time. It shows the combination of several service specifications mapped against a timeline.
Recommended Implementation: timeline, SysML Block Definition Diagram, SysML Internal Block Diagram.

Fibure 17-23 the Monitoring Services and the 3 versions.

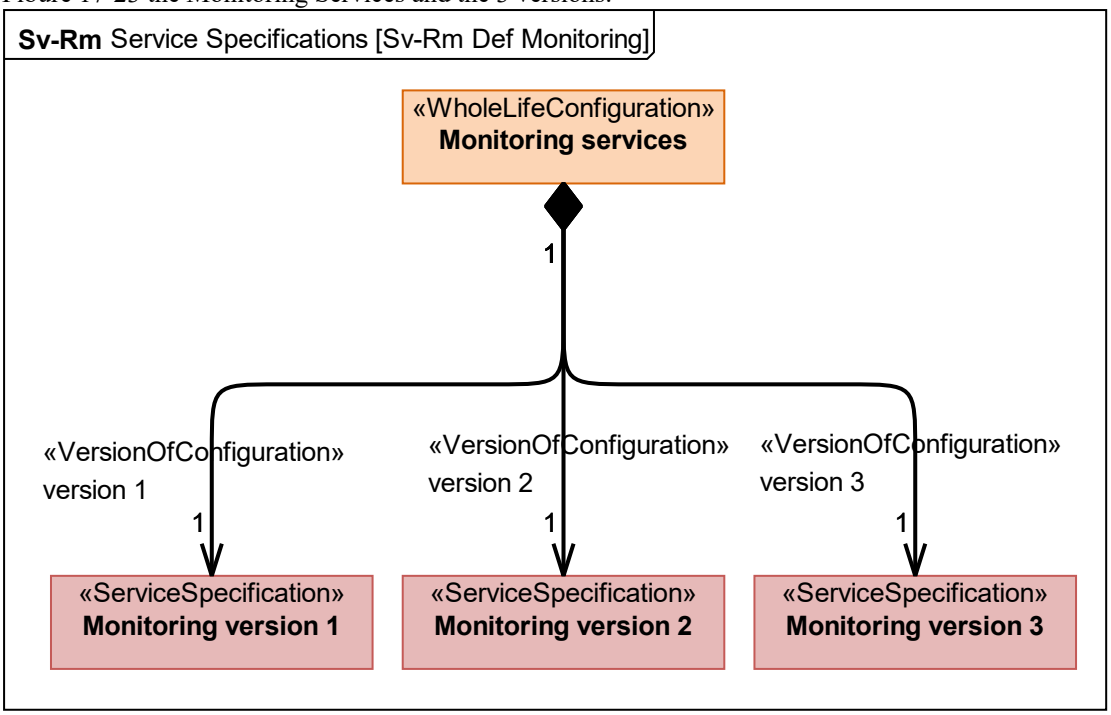

Figure 17:23 - Services Roadmap for Monitoring.

Figure 17-24 shows the configurations of the Maritime SAR and its three phases.

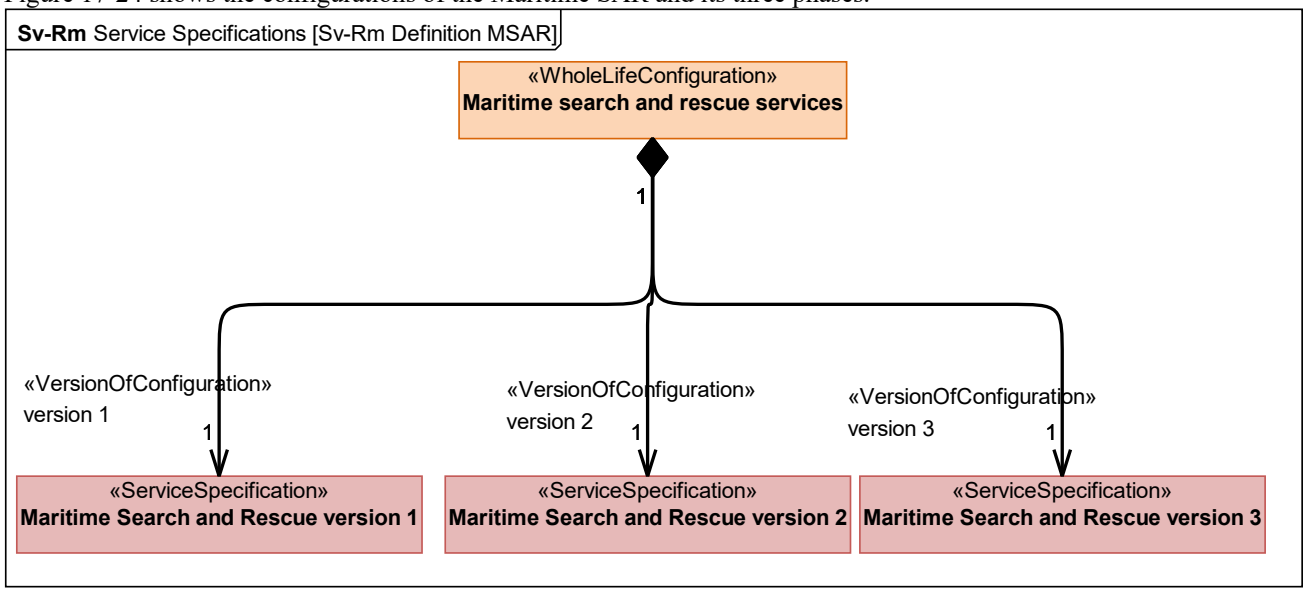

Figure 17:24 - Services Roadmap for Maritime Search and Rescue Services

Figure 17-25 shows the internal sequence of the Maritime SAR.

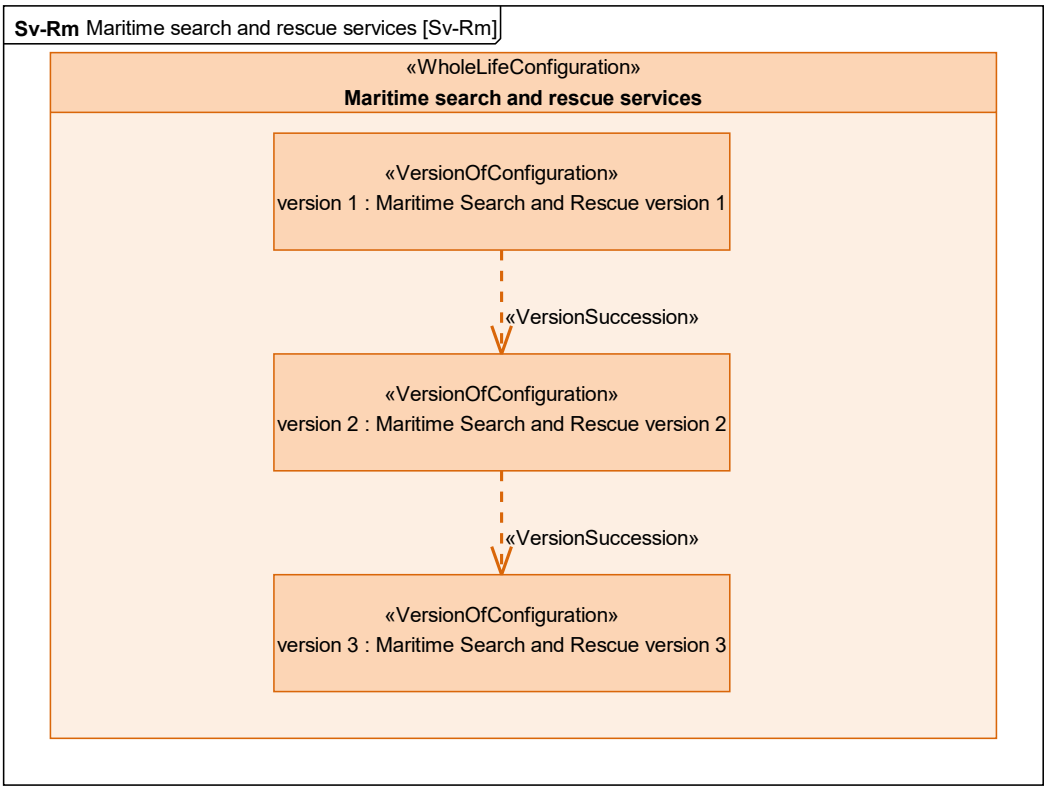

Figure 17:25 - Services Roadmap for Maritime SAR Service Internals

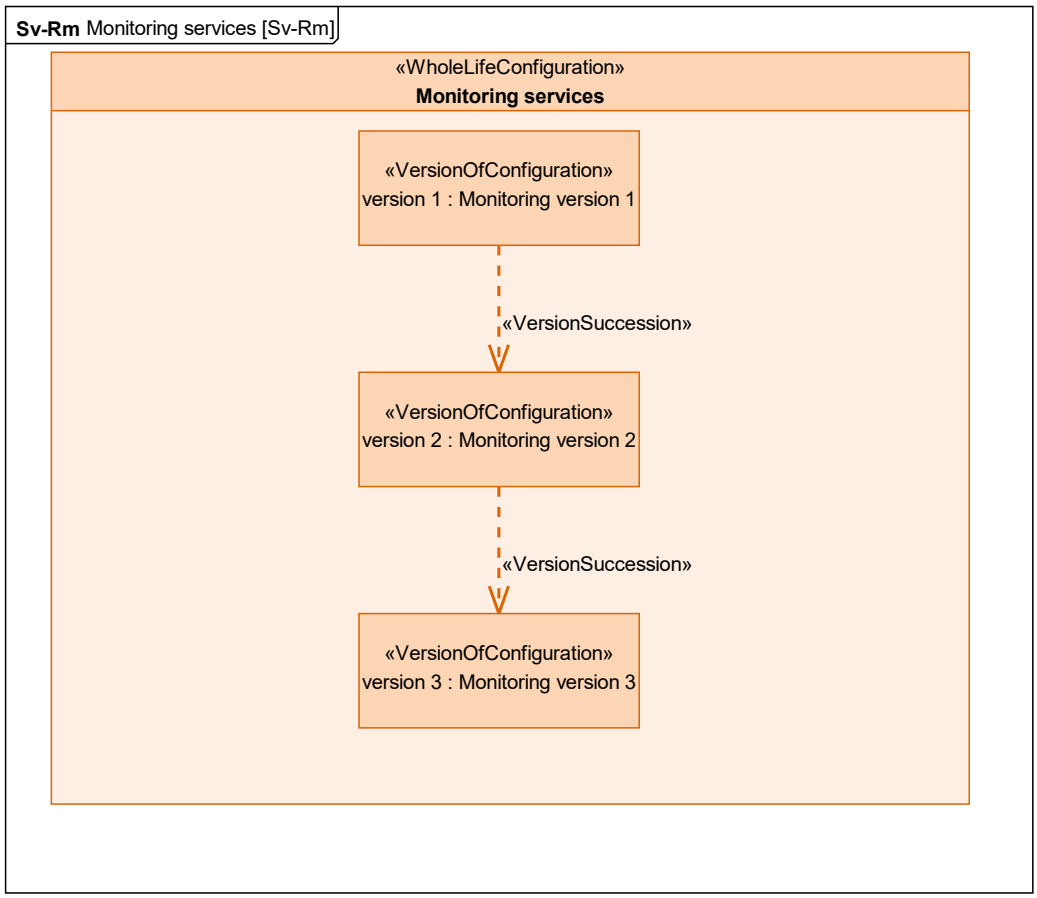

Figure 17:26 - Services Roadmap for Monitoring Service Internals

17.9 View Specifications::Services::Traceability

Stakeholders: Solution Providers, Systems Engineers, Software Architects, Business Architects.
Concerns: traceability between operational activities and service specifications that support them.
Definition: depicts the mapping of service specifications to operational activities and how service specifications contribute to the achievement of a capability.
Recommended Implementation: tabular or matrix format.

Figure 17-27 shows which services contribute to the achievement of a capability. In this example, the Land Search and Rescue Service exposes (supports/realizes) the Land SAR Capability. Likewise, the Maritime Search and Rescue Service exposes the Maritime SAR Service. MODAF specifies that the service must completely realize the capability it exposes. Additional services and capabilities are also shown.
This diagram shows the traceability between the different service specifications and the capabilities.

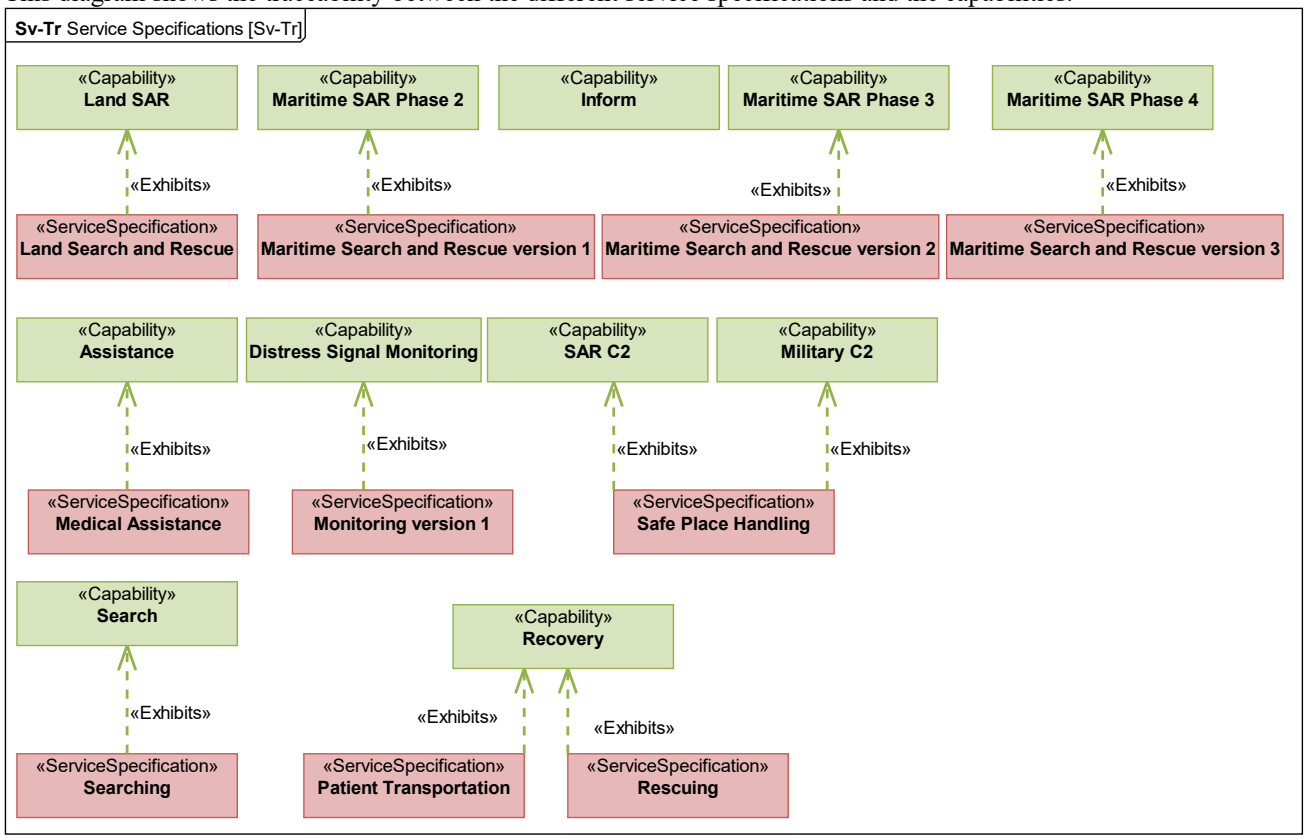

Figure 17:27 - Services Traceability from Capabilities to Service Specifications

Table 17-3 is an automatically generated table showing the mapping from Capabilities to Service Specifications

Table 17:3 - Services Traceability from Capabilities to Service Specifications

Service Specifications [Sv-Tr Matrix]

		Exhibiting Element												
		«ServiceSpecification» Land Search and Rescue	«ServiceSpecification» Maritime Search and Rescue version 1	«ServiceSpecification» Maritime Search and Rescue version 2	«ServiceSpecification» Maritime Search and Rescue version 3	«ServiceSpecification» Medical Assistance	«ServiceSpecification» Monitoring version 1	«ServiceSpecification» Monitoring version 2	«ServiceSpecification» Monitoring version 3	«ServiceSpecification» Patient Transportation	«ServiceSpecification» Rescuing	«ServiceSpecification» Safe Place Handling	«ServiceSpecification» Safe place handling other version	«ServiceSpecification» Searching
Exhibited Capability	«Capability» Land SAR	X												
	«Capability» Maritime SAR Phase 2		X											
	«Capability» Maritime SAR Phase 3			X										
	«Capability» Maritime SAR Phase 4				X									
	«Capability» Assistance					X								
	«Capability» Distress Signal Monitoring						X	X	X					
	«Capability» Recovery									X	X			
	«Capability» Military C2											X	X	
	«Capability» SAR C2											X	X	
	«Capability» Search													X

17.10 View Specifications::Services Measurements

Stakeholders: Capability owners, Systems Engineers, Solution Providers.
Concerns: identifies measurable properties that can be used to support analysis such as KPIs, MOs, TPIs etc.
Definition: Shows the measurable properties of something in the physical world, expressed in amounts of a unit of measure that can be associated with any element in the architecture.
Recommended Implementation: SysML Block Definition Diagram.
Note: The services measurements view is not a service diagram, but the measurement diagram used to demonstrate service measurements.
This diagram shows the required service levels for the different services that make up the entire maritime search and rescue service specification.

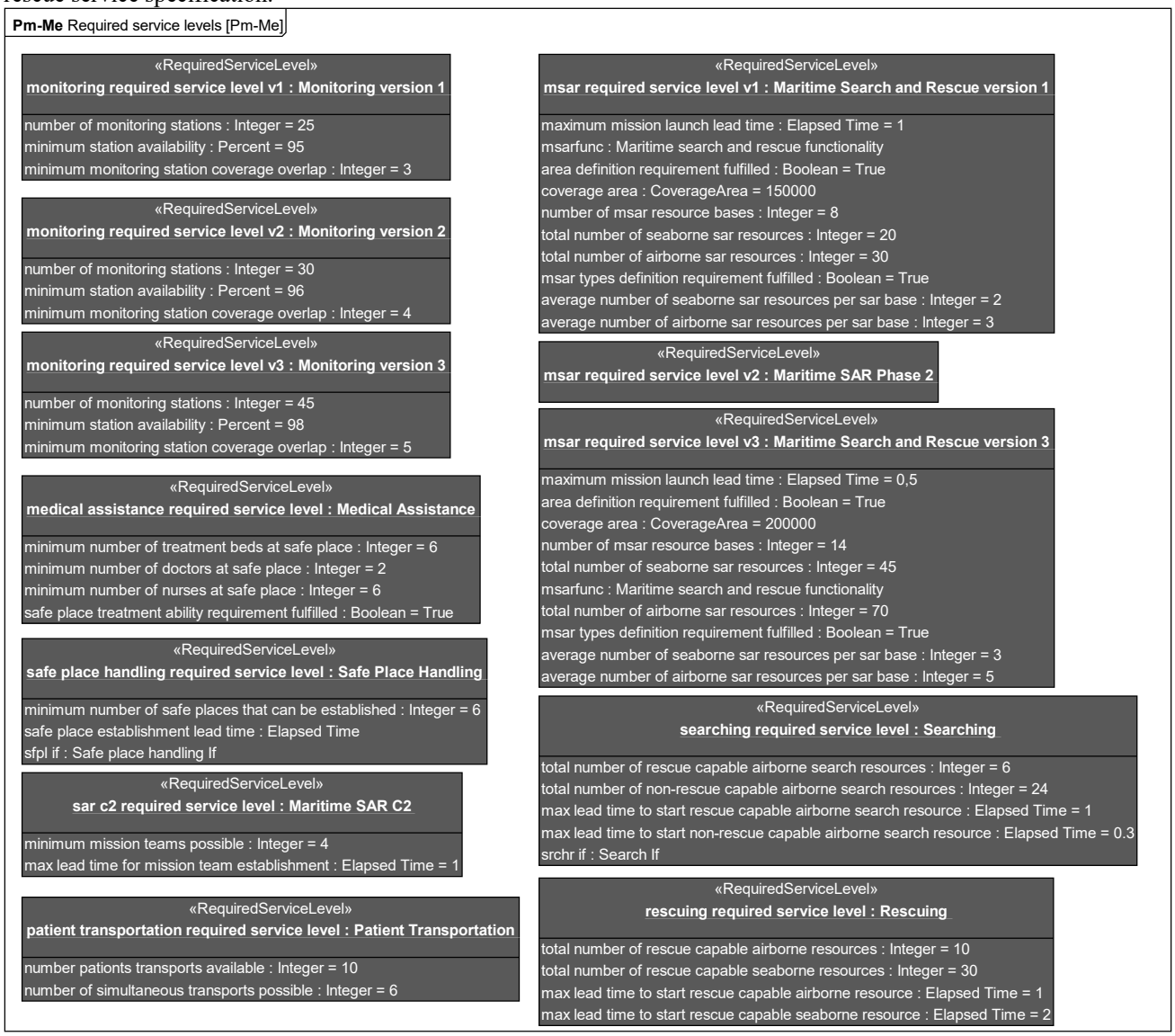

Figure 17:28 - Parameters: Measurements Required Service Levels for Service Specifications

This diagram shows the required service level for the different services that make up the entire maritime search and rescue service specification.

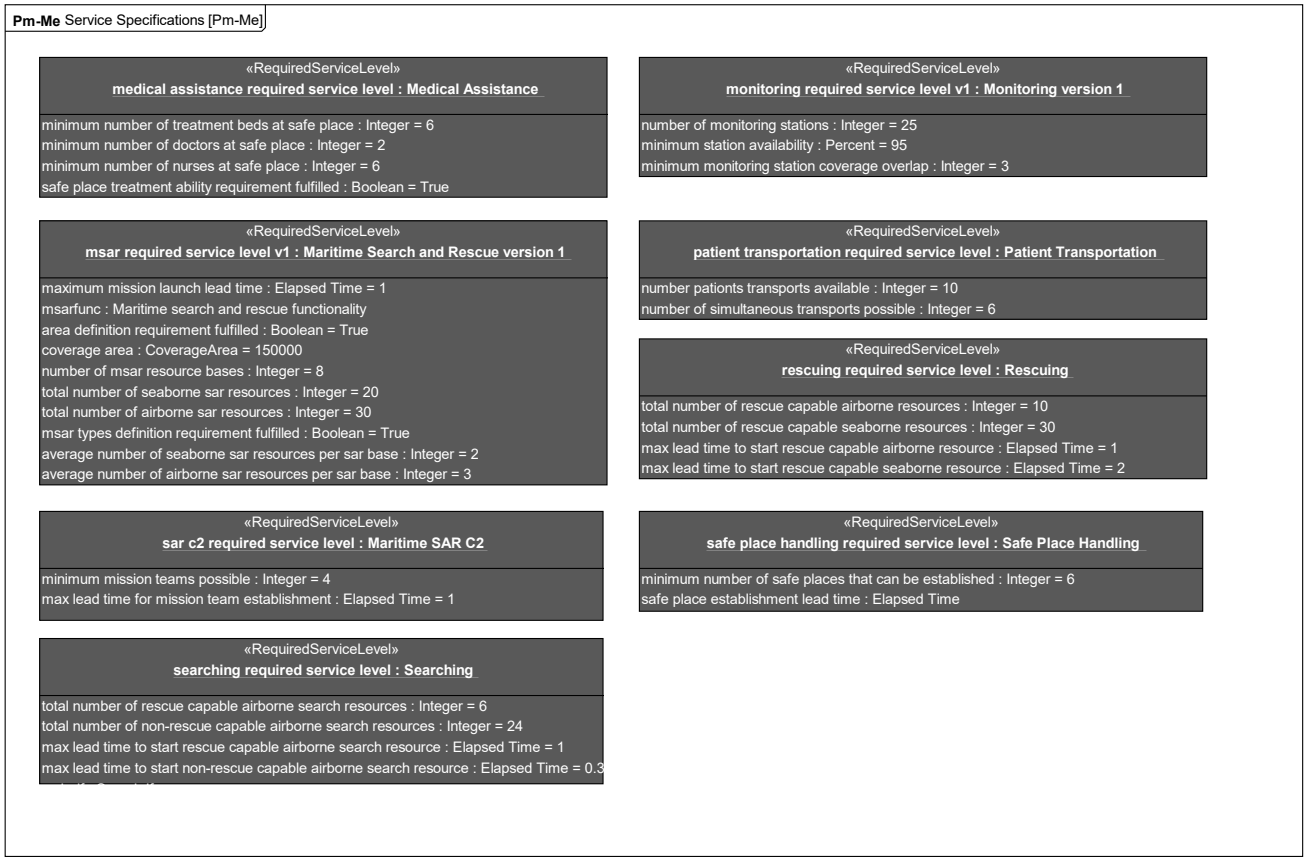

Figure 17:29 - Parameters: Measurements Required Service Levels for Service Specifications

17.11 View Specifications::Services Information

View Specifications::Information::Information Model

Stakeholders: Data Modelers, Software Engineers, Systems Engineers
Concerns: address the information perspective on operational, service, and resource architectures.
Definition: allows analysis of an architecture's information and data definition aspect, without consideration of implementation specific issues.
Recommended Implementation: SysML Block Definition Diagram.
Note: The services information view is not a service diagram, but the measurement diagram used to demonstrate service measurements.

This diagram shows value types that model data structures used in the services views.

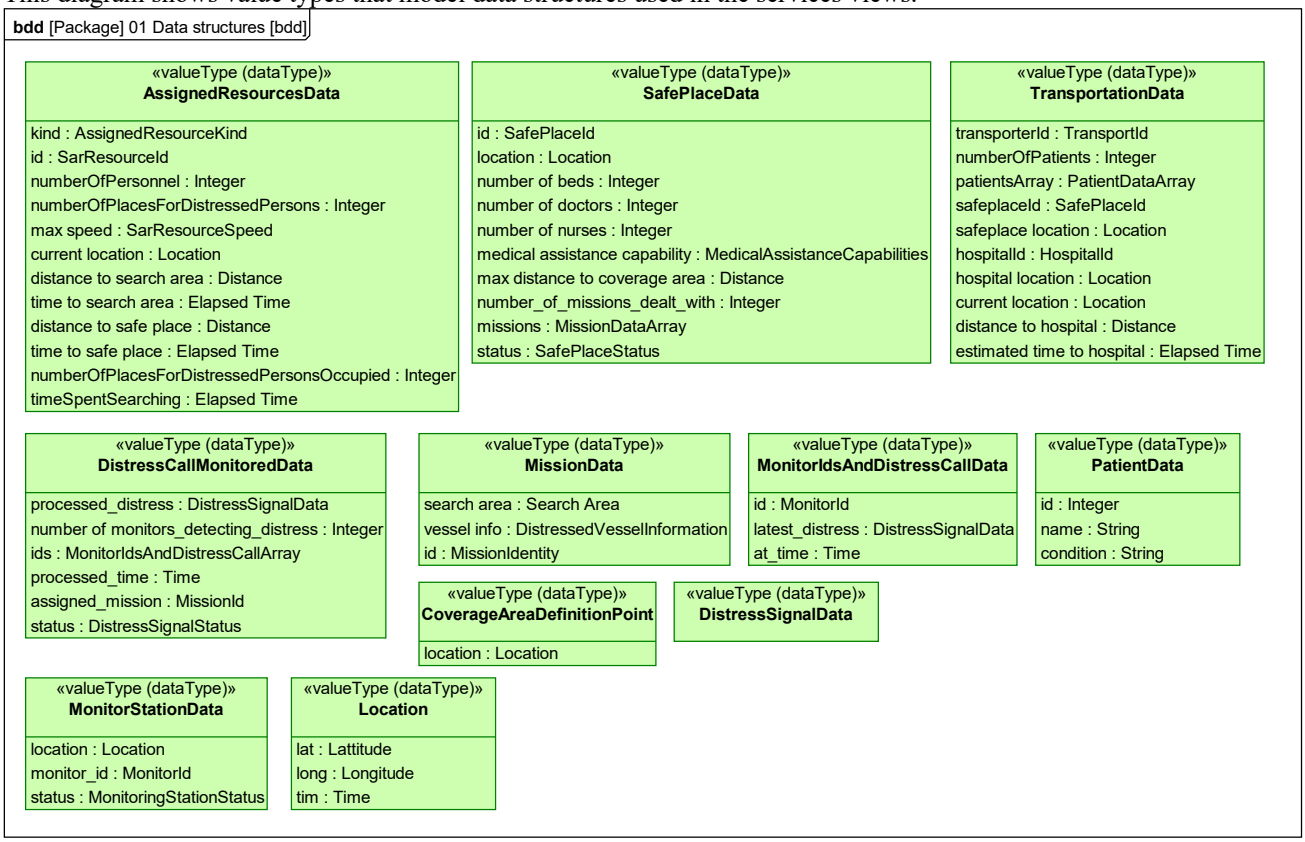

Figure 17:30 – Services Data structures

This diagram shows value types that are Integers.

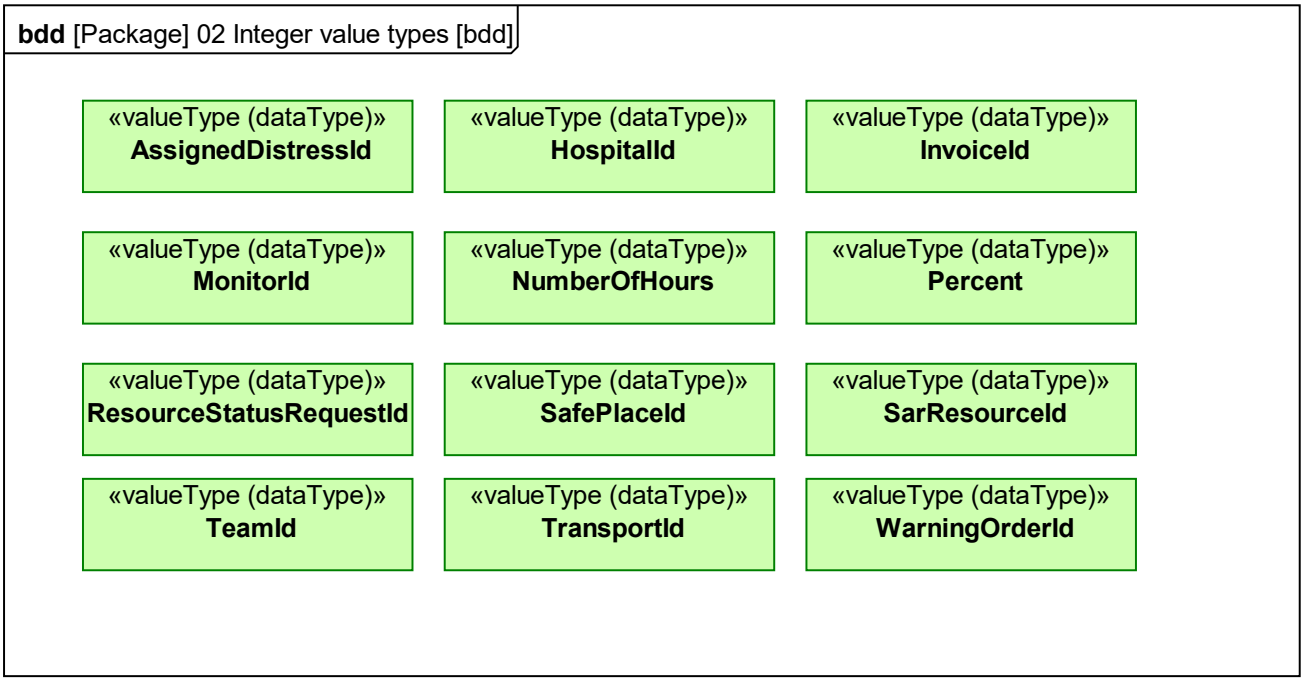

Figure 17:31 – Services Information Model of Integer Types

This diagram shows value types that are text i.e. Strings.

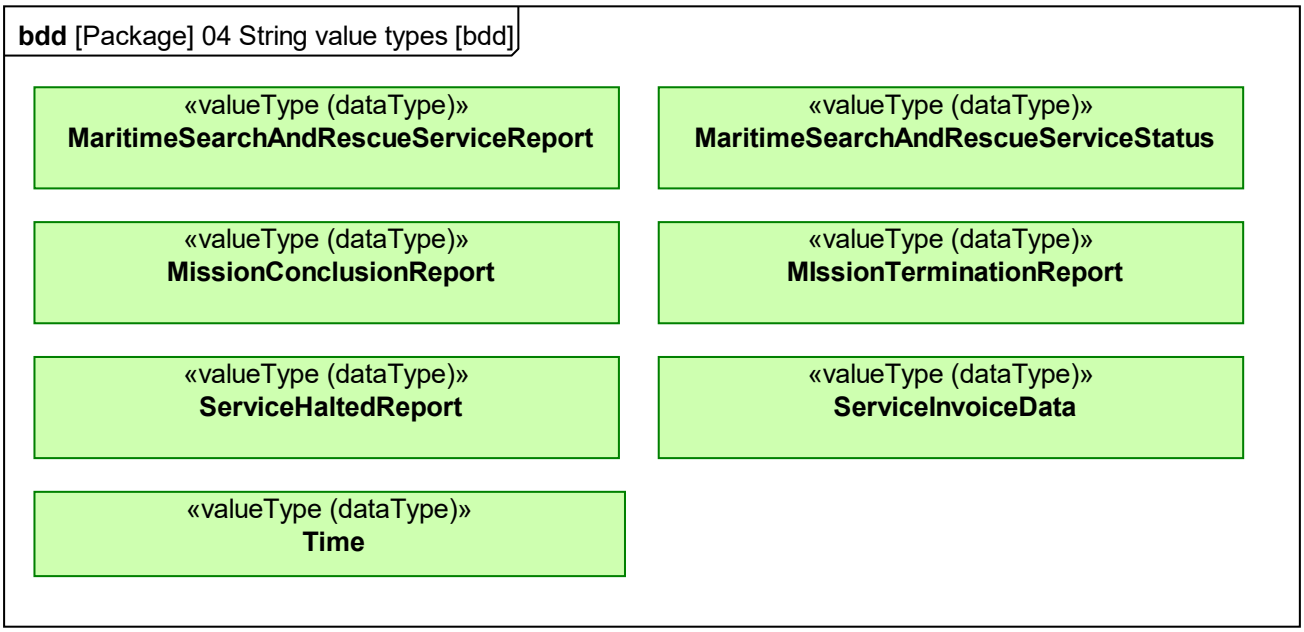

Figure 17:32 – Services Information Model of String Types

The set of enumerations used within the example model are shown here.

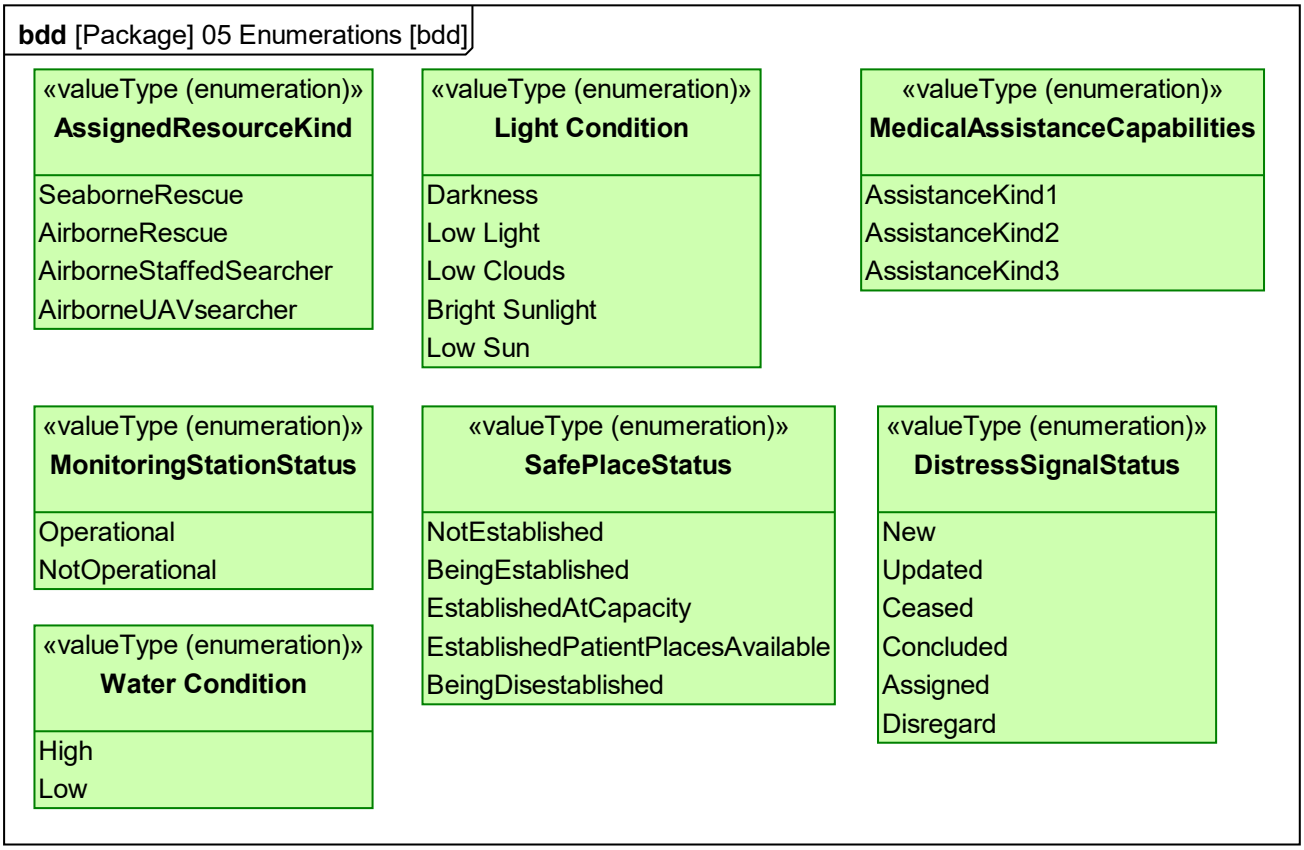

Figure 17:33 – Services Information Model of Enumeration Types

This diagram shows value types that are arrays.

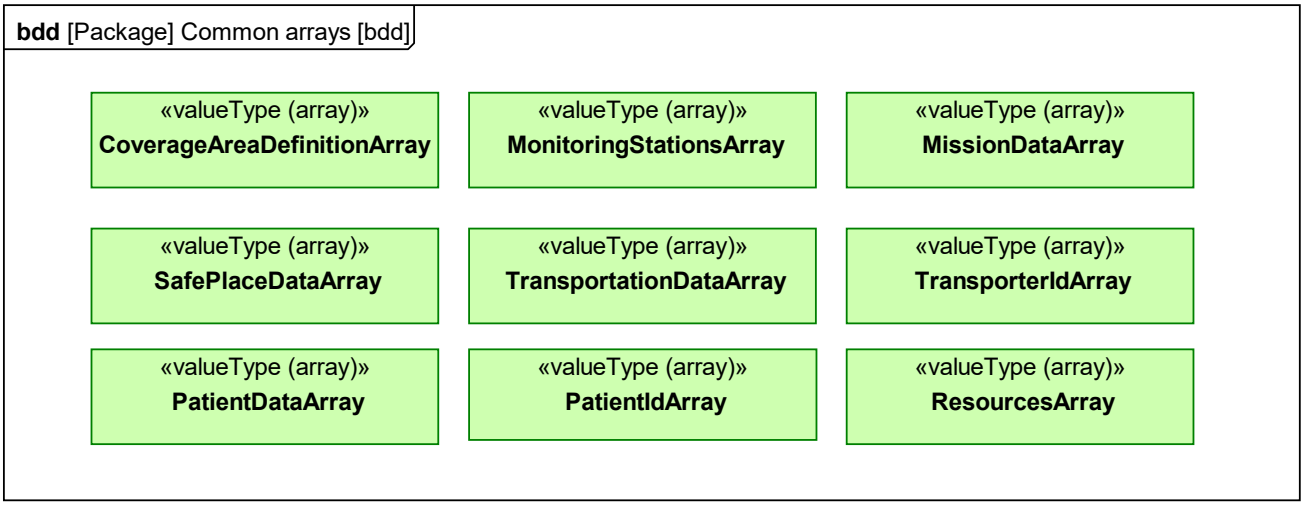

Figure 17:34 – Services Information Model for Common Arrays

The signals that are transmitted or received by the maritime C2 service port.

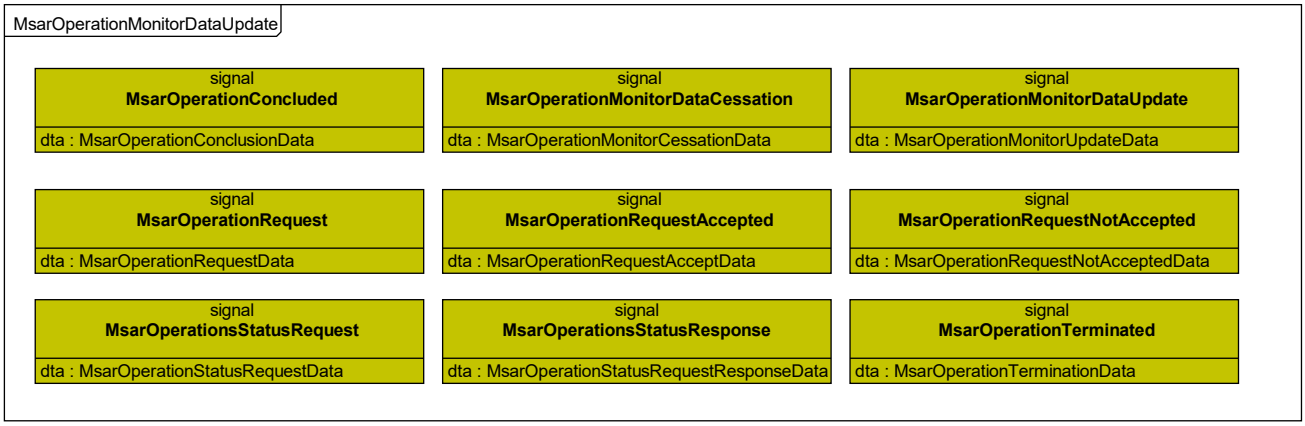

Figure 17:35 – Services Information Model for Maritime C2 Signals

Specific data structures used as part of the Maritime SAR C2 service interface.

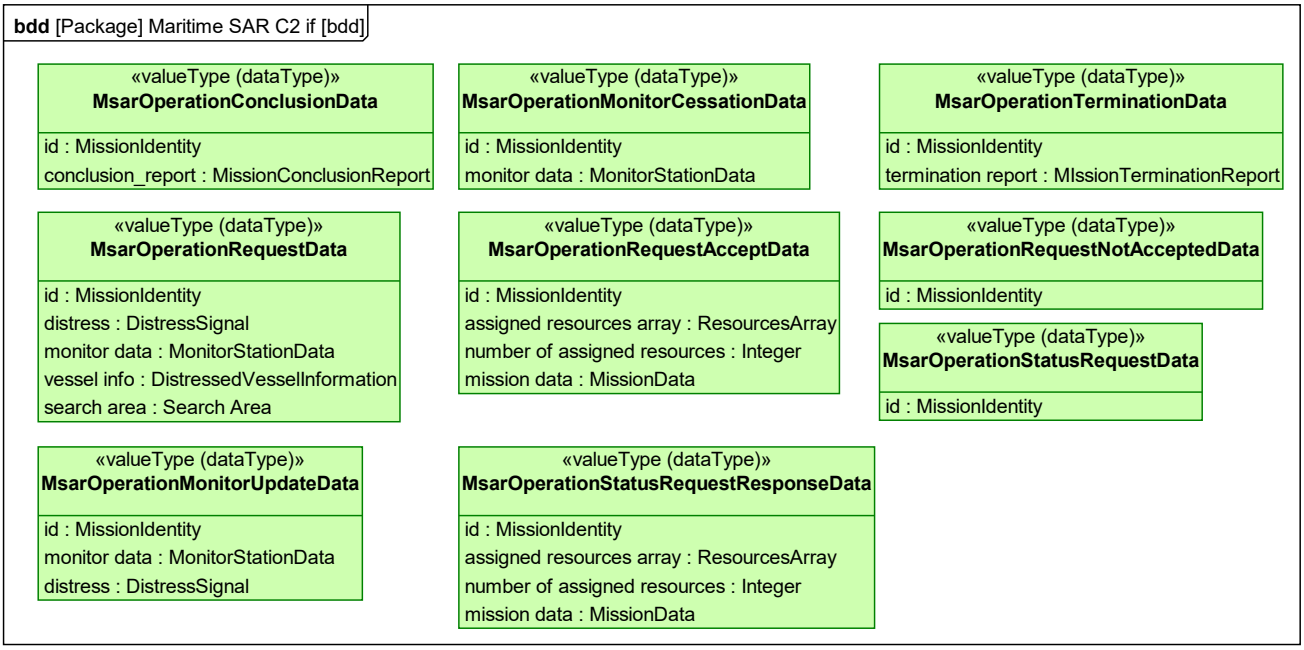

Figure 17:36 – Services Information Model Maritime SAR C2 service interface

The signals received or transmitted via the maritime search and rescue service port.

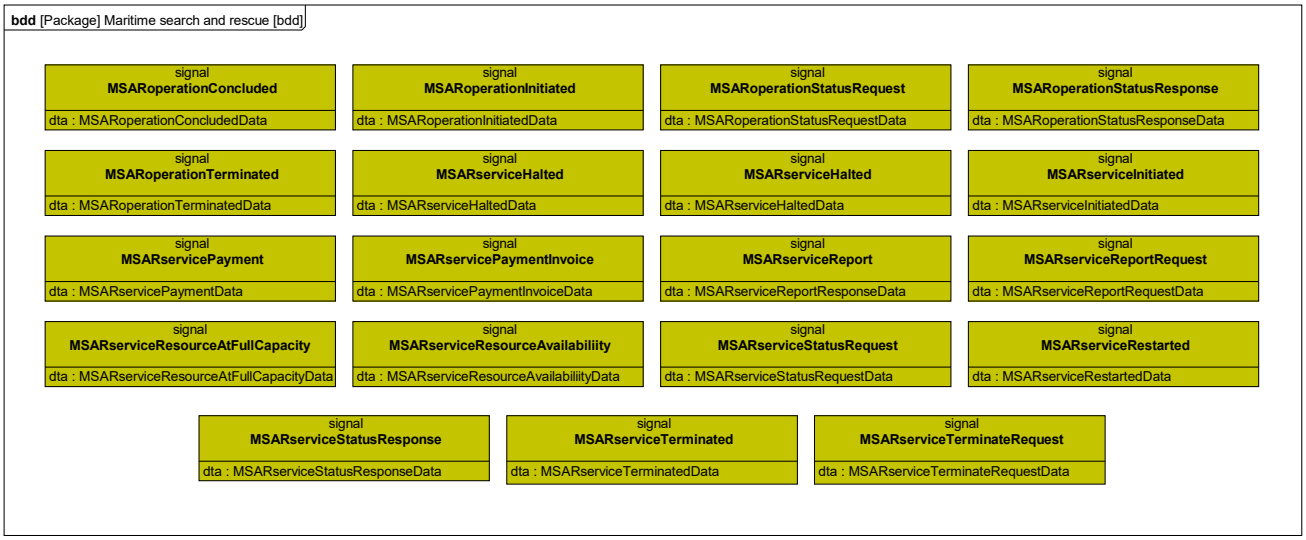

Figure 17:37 – Services Information Model for Maritime SAR Service Port

Specific data structures used as part of the Maritime search and rescue service interface.

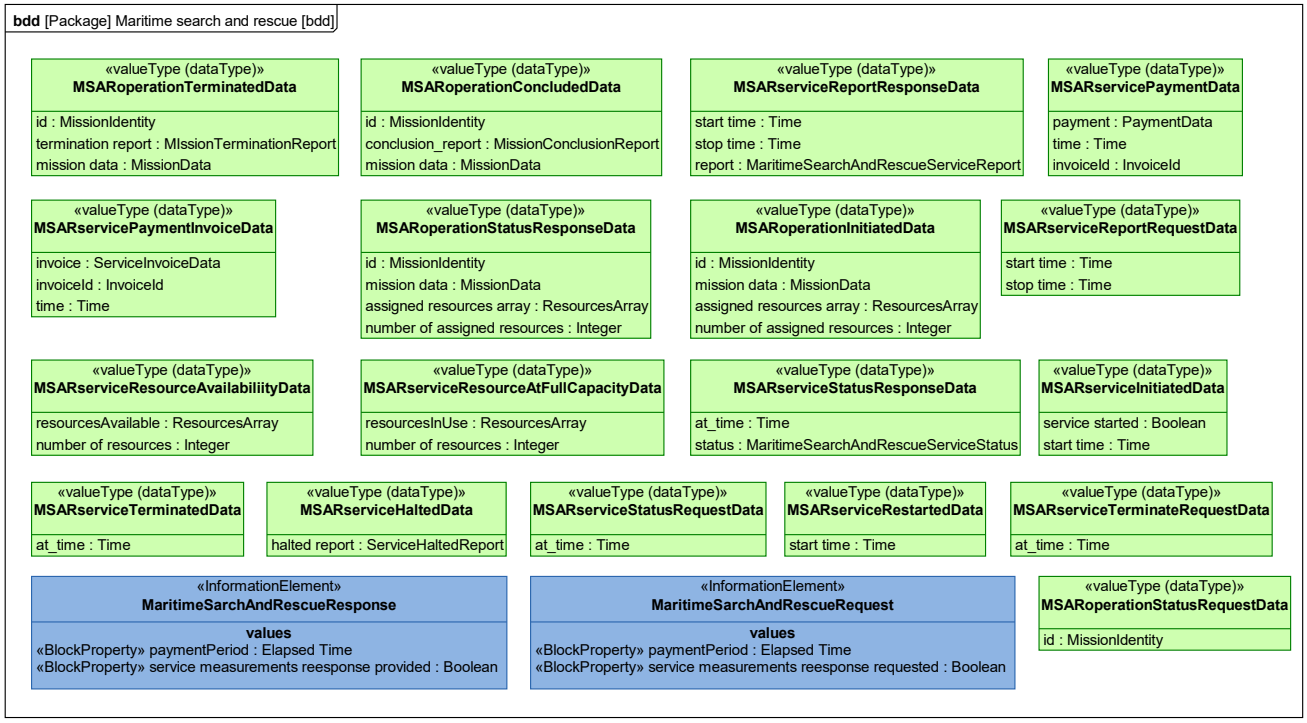

Figure 17:38 – Services Information Model for Maritime SAR Interface

Specific data structures used as part of the medical assistance service interface.

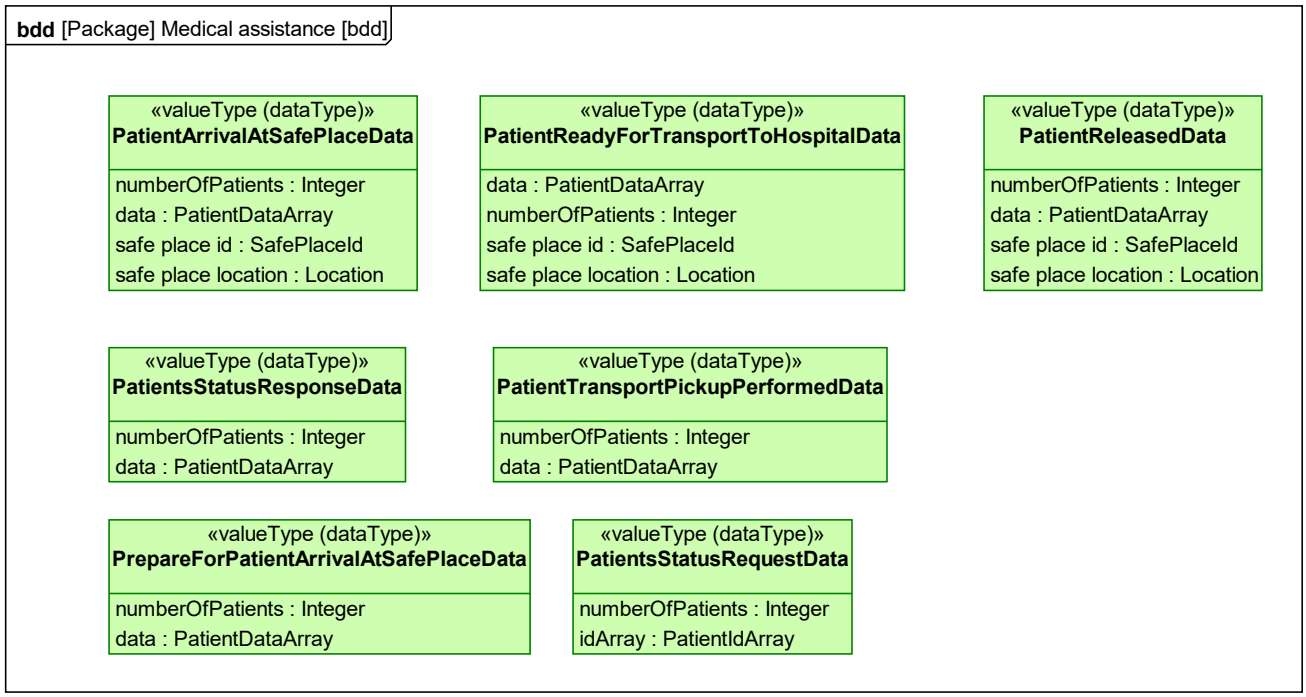

Figure 17:39 – Services Information Model for the Medical Assistance Interface

The signals received or transmitted via the medical assistance service port.

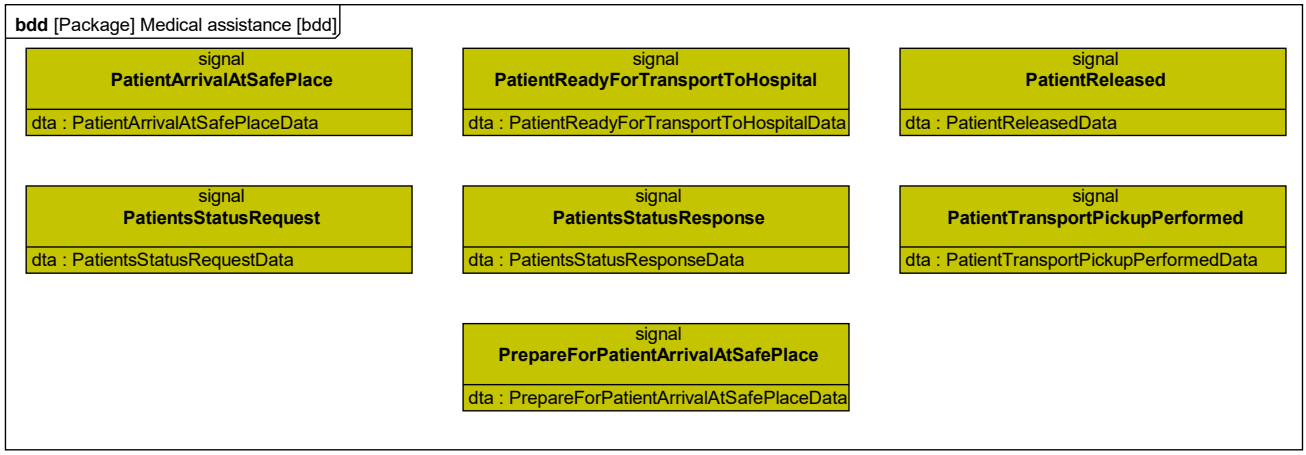

Figure 17:40 – Services Information Model signals for the Medical Assistance Service Port

Specific data structures used as part of the monitoring service interface.

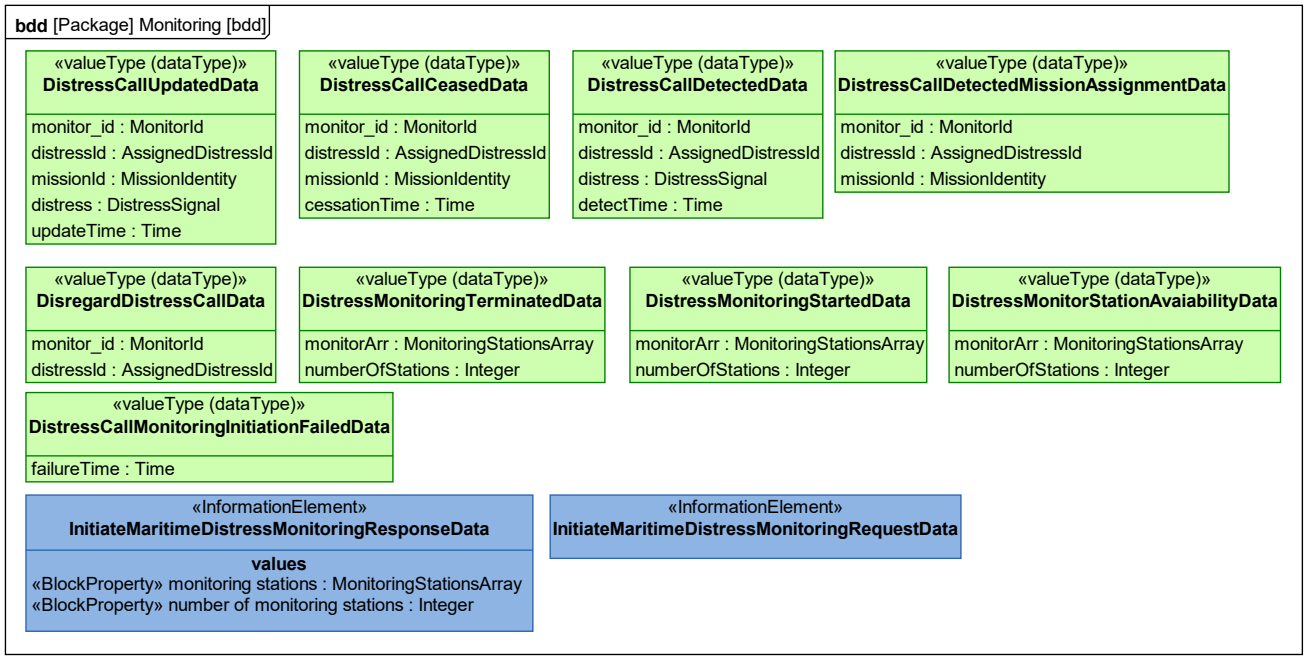

Figure 17:41 – Services Information Model Data Structures for the Monitoring Service Interface

The signals received or transmitted via the monitoring service port.

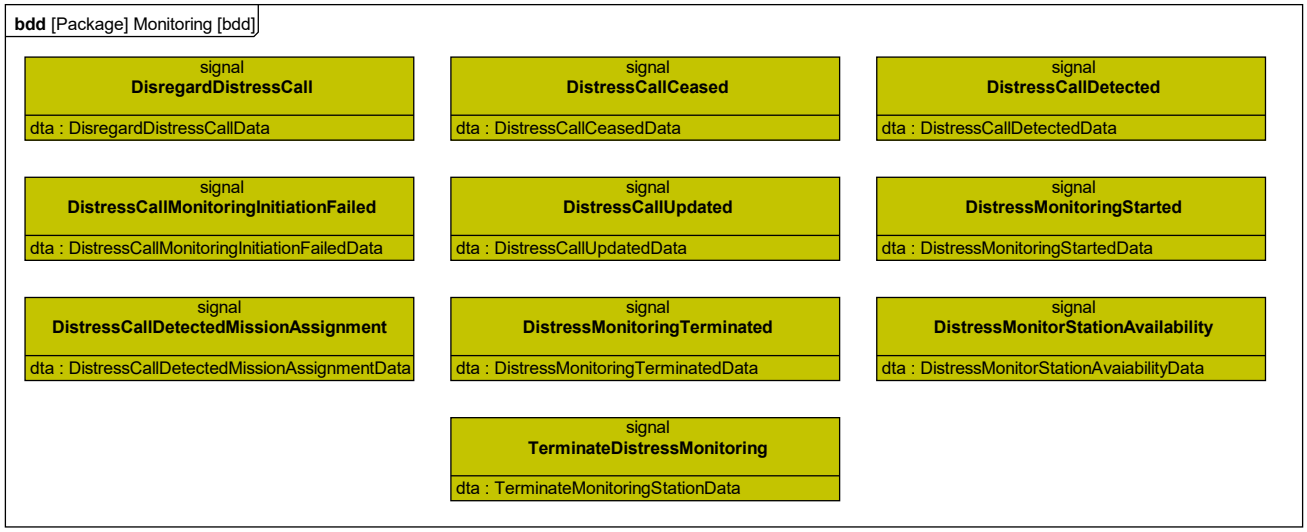

Figure 17:42 – Services Information Model Signals for the Monitoring Service Port

The signals received or transmitted via the patient transportation service port.

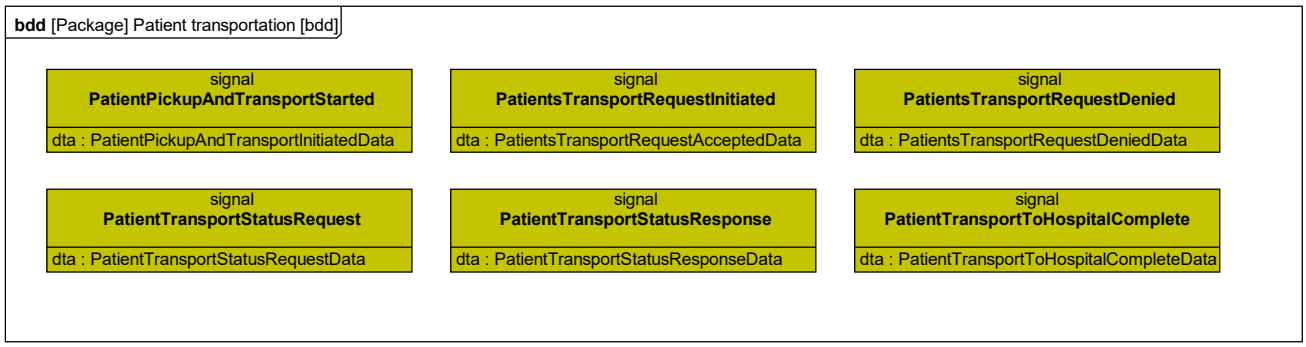

Figure 17:43 – Services Information Model Signals for the Patient Transportation Service Port

Specific data structures used as part of the Patient transportation service interface.

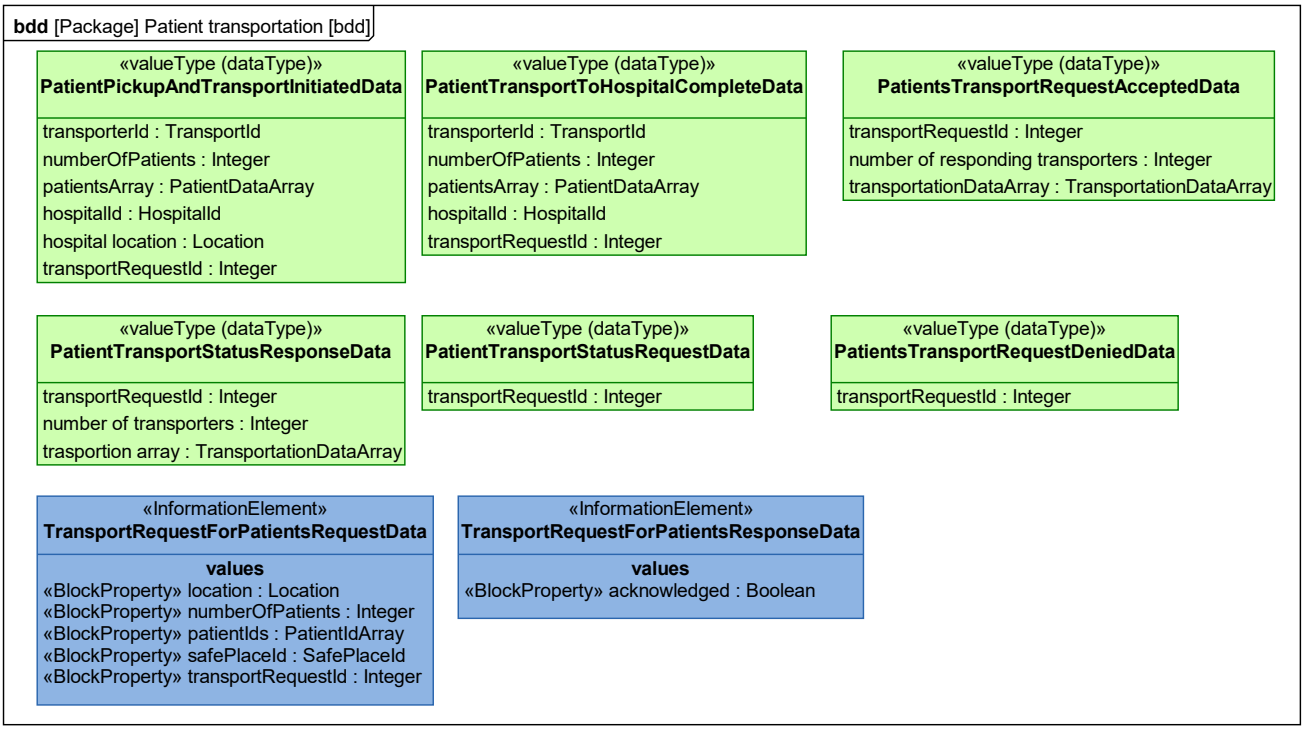

Figure 17:44 – Services Information Model Data for Patient Transportation Services

Specific data structures used as part of the rescuing service interface.

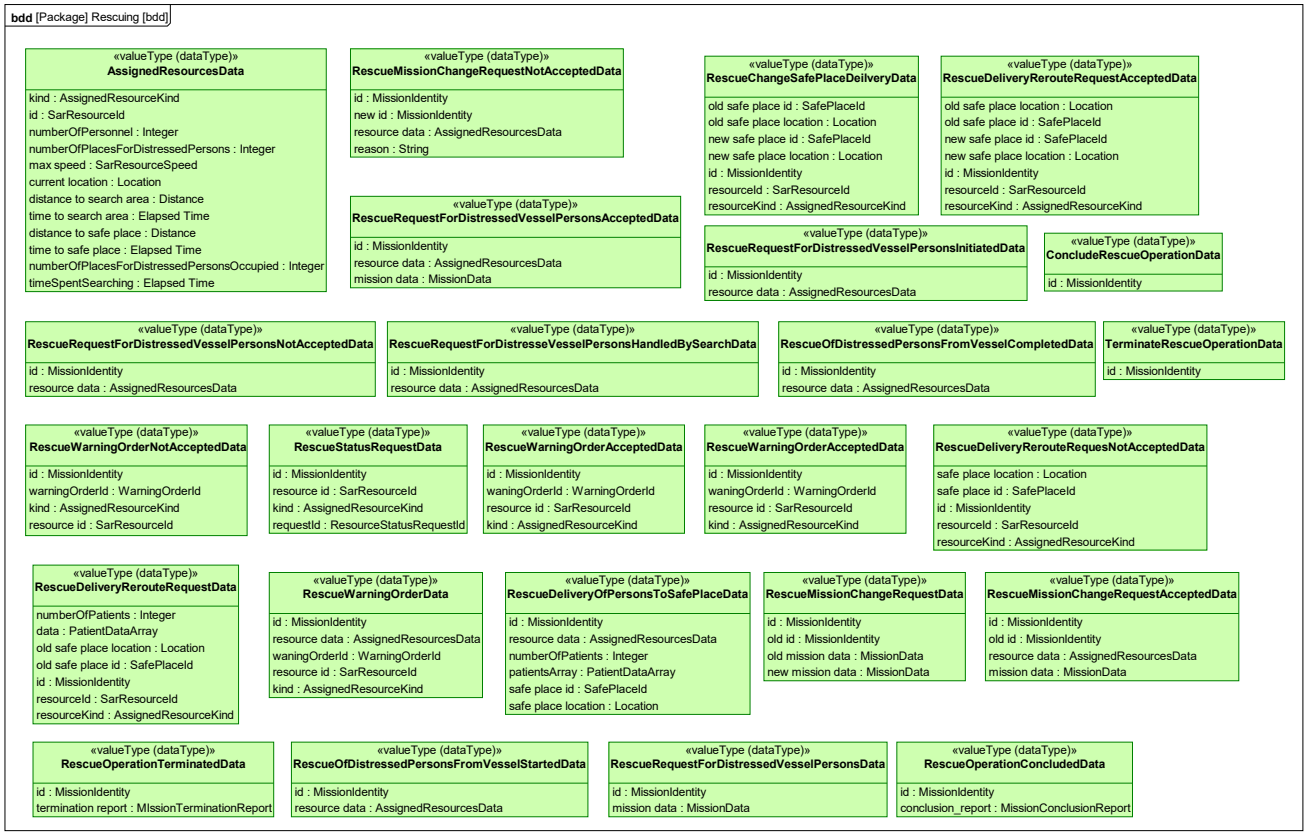

Figure 17:45 – Services Information Model Data for Rescuing Service Interface

The signals received or transmitted via the rescuing service port.

Figure 17:46 – Services Information Model Signals for the Rescuing Service Port

The signals received or transmitted via the safe place handling service port.

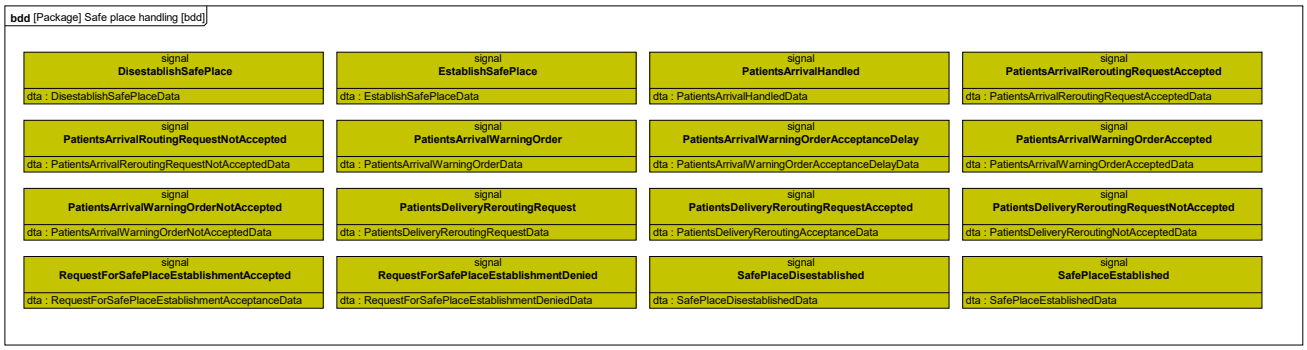

Figure 17:47 – Services Information Model Signals for the Safe Place Handling Service Port

Specific data structures used as part of the safe place handling service interface.

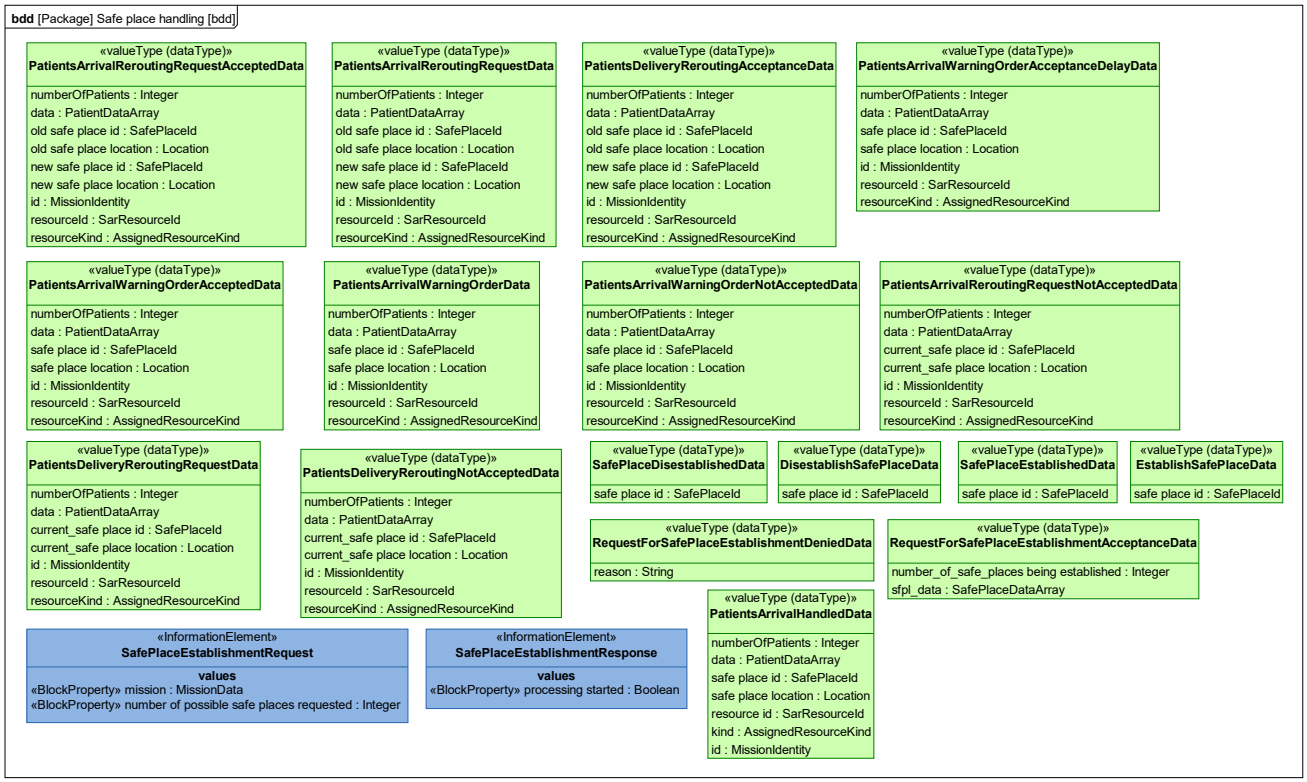

Figure 17:48 – Services Information Model Data for the Safe Place Handling Service Port

Specific data structures used as part of the Searching service interface.

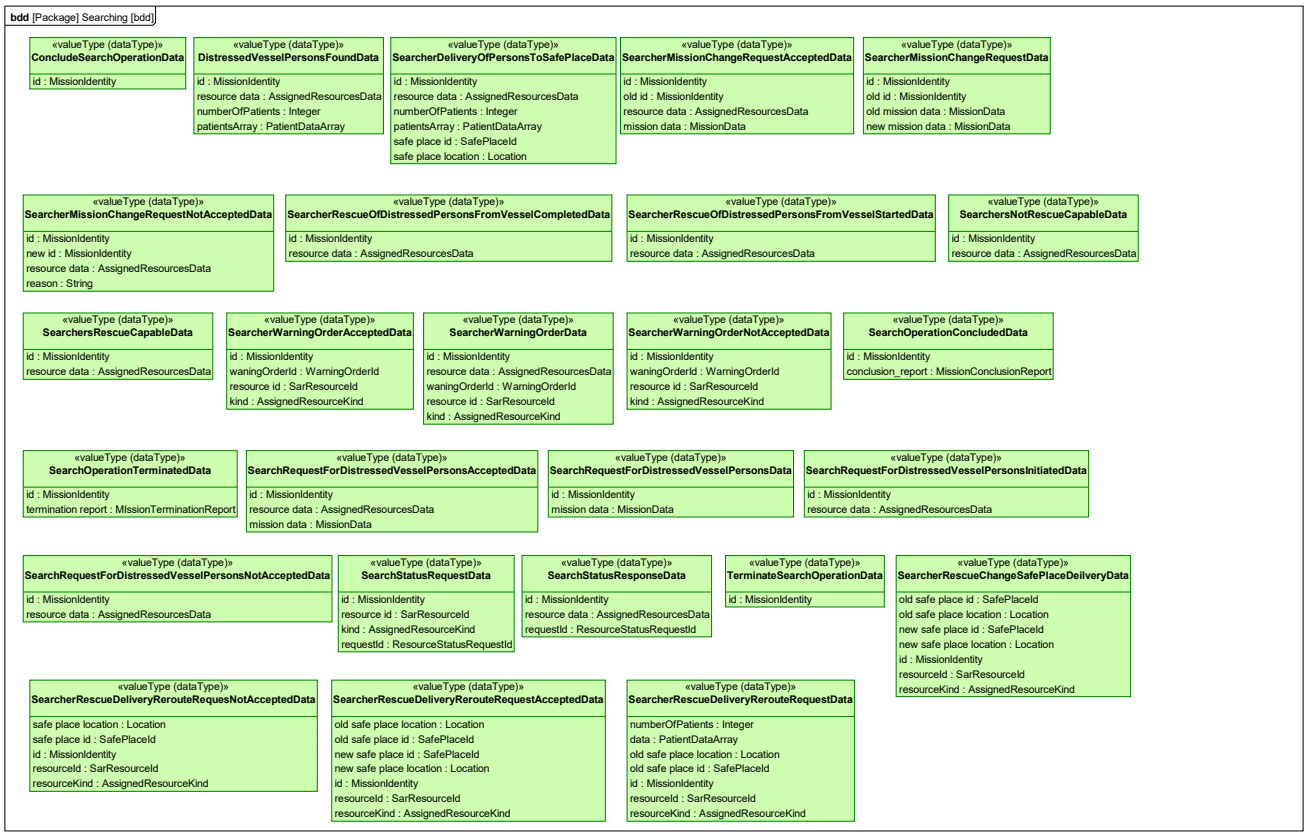

Figure 17:49 – Services Information Model Data for the Searching Interface

This diagram shows Services Information Model Signals for the Distressed Vessel Interface

Figure 17:50 – Services Information Model Signals for the Distressed Vessel Interface

17.12 Service Architecture Phase 2

This description is an attempt to make the description of the service invocations easier to understand. As can be seen the functionality of the services that invoke other services have been placed within elements that can have behavior as well as proxy ports that show the invocation connections properly. This also means that the service ports here on the boundary of the services that contain internal parts are defined as isbehavior=False.

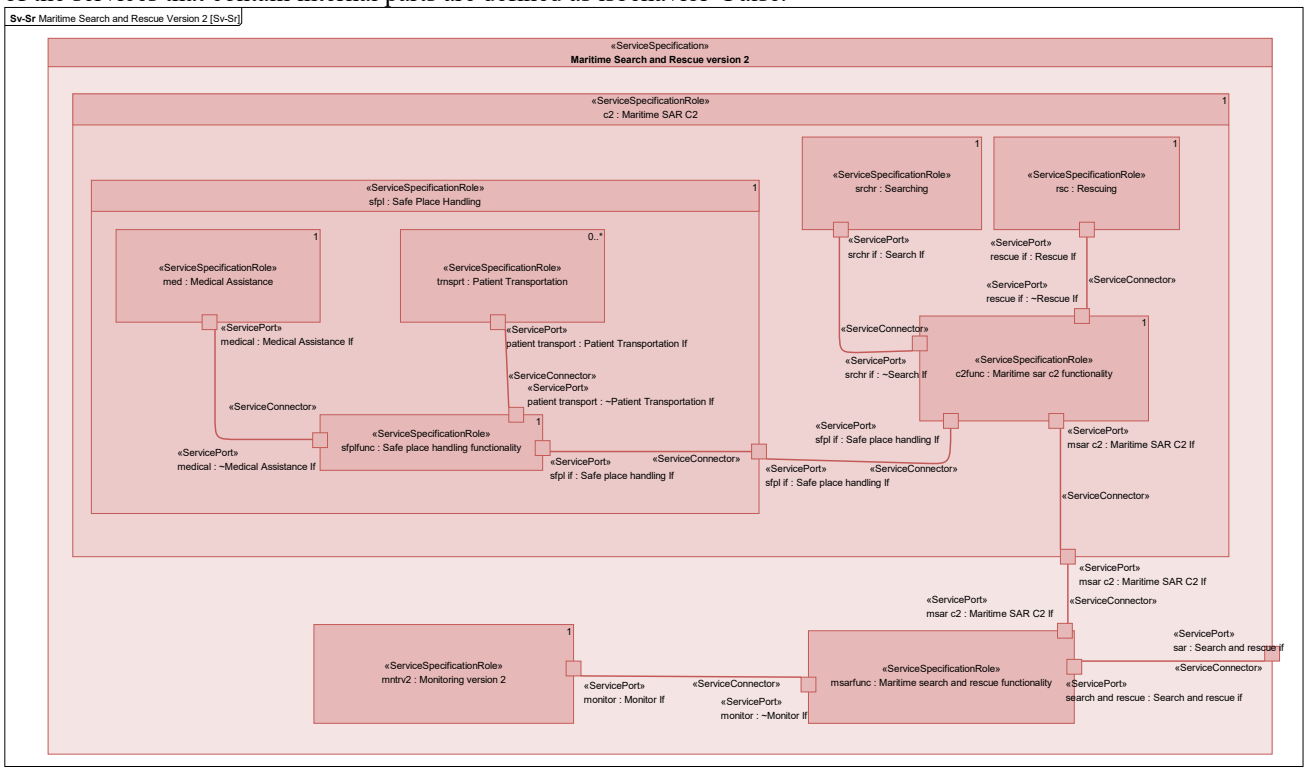

Figure 17:51 - Services Structure for Maritime SAR v2

This diagram describes the Monitoring service specification by means of a state machine.

It awaits a service method call in the form of a service initiation request and provided that it was initiated quickly enough and that enough stations have been brought online the service specification enters the concurrent state Operational distress monitor handling.

One of the concurrent states is devoted to monitoring the stations as well as recognizing and managing detection, update, cessation of distress signals.

The other concurrent state is devoted to handling inputs and outputs across the service specification interface.

This involves marking a distress signal as false based on external handling (Disregard distress call), associating a specific distress call being monitored by one or more stations as associated with a specific sar mission and marking them as concluded once the mission has been completed or terminated.

Based on data being monitored several conditions are dealt with that needs to result in the transmission of signals to the consumer of the service such as cessation of distress signals for a mission, new distress signals, updated distress signals and changes in the availability of the set of monitoring stations in use.

Finally, the service can be terminated and once the stations have shut down, the state machine goes back to waiting for an initiation.

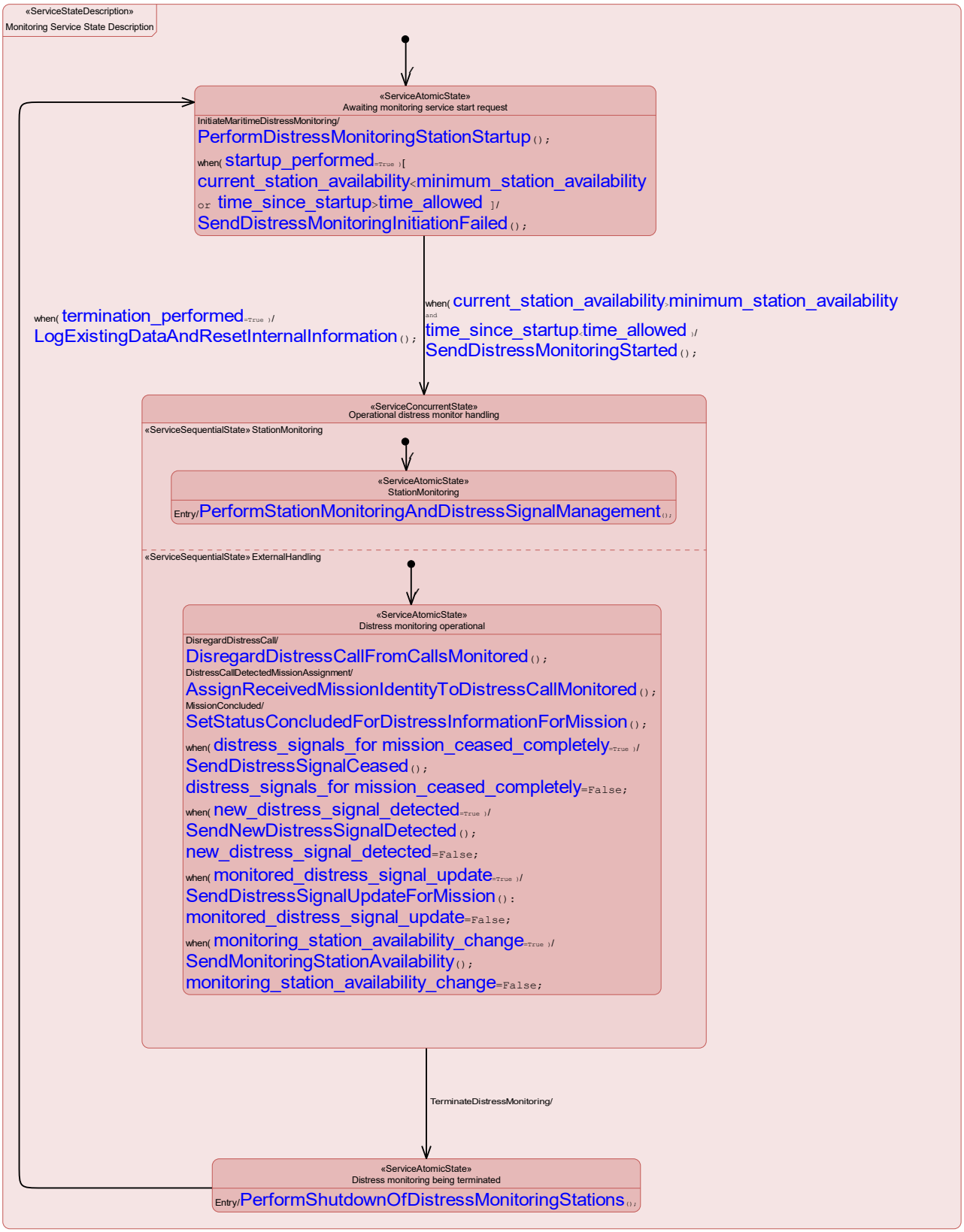

Figure 17:52 - Services States for Monitoring Service v2

17.13 Service Architecture Phase 3

This description is an attempt to make the description of the service invocations easier to understand. As can be seen the functionality of the services that invoke other services have been placed within elements that can have behavior as well as proxy ports that show the invocation connections properly. This also means that the service ports here on the boundary of the services that contain internal parts are defined as isBehavior=False.

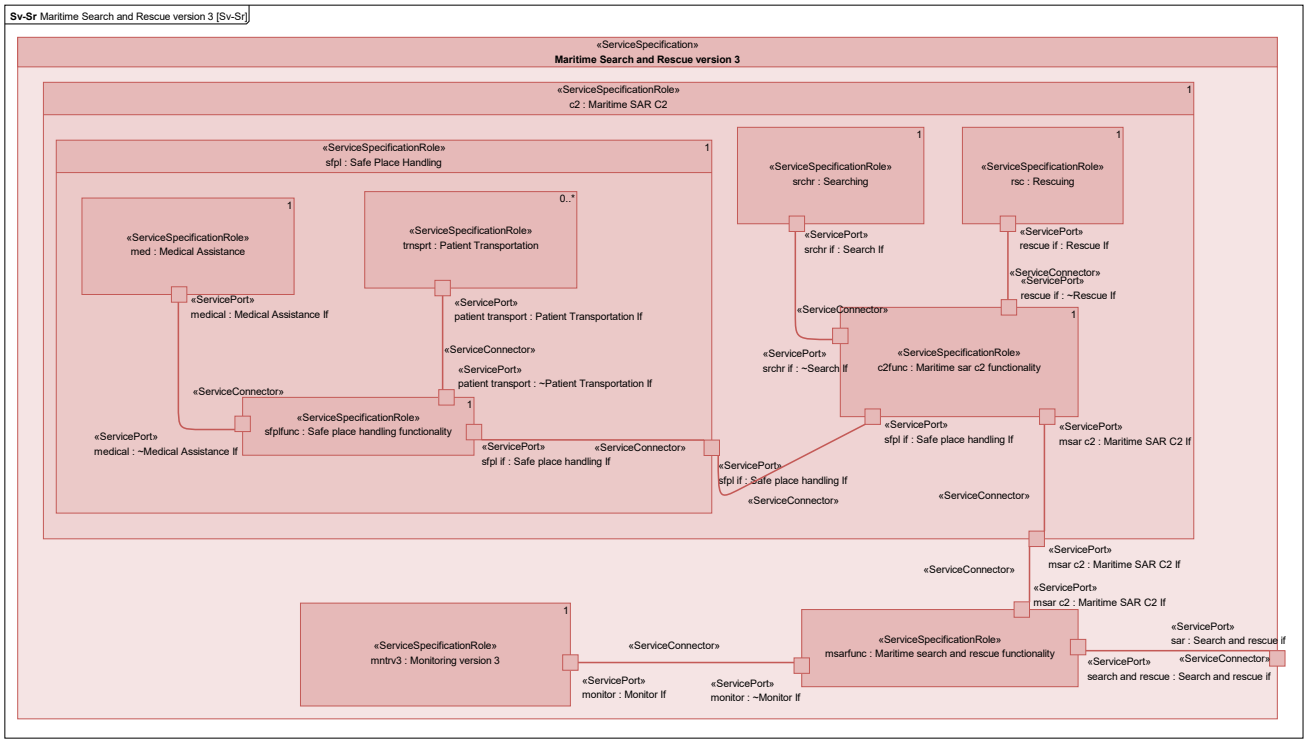

Figure 17:53 - Services Structure for Maritime SAR v2

This diagram describes the Monitoring service specification by means of a state machine.

It awaits a service method call in the form of a service initiation request and provided that it was initiated quickly enough and that enough stations have been brought online the service specification enters the concurrent state Operational distress monitor handling.

One of the concurrent states is devoted to monitoring the stations as well as recognizing and managing detection, update, cessation of distress signals.

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This involves marking a distress signal as false based on external handling (Disregard distress call), associating a specific distress call being monitored by one or more stations as associated with a specific sar mission and marking them as concluded once the mission has been completed or terminated.

Based on data being monitored several conditions are dealt with that needs to result in the transmission of signals to the consumer of the service such as cessation of distress signals for a mission, new distress signals, updated distress signals and changes in the availability of the set of monitoring stations in use.

Finally, the service can be terminated and once the stations have shut down, the state machine goes back to waiting for an initiation.

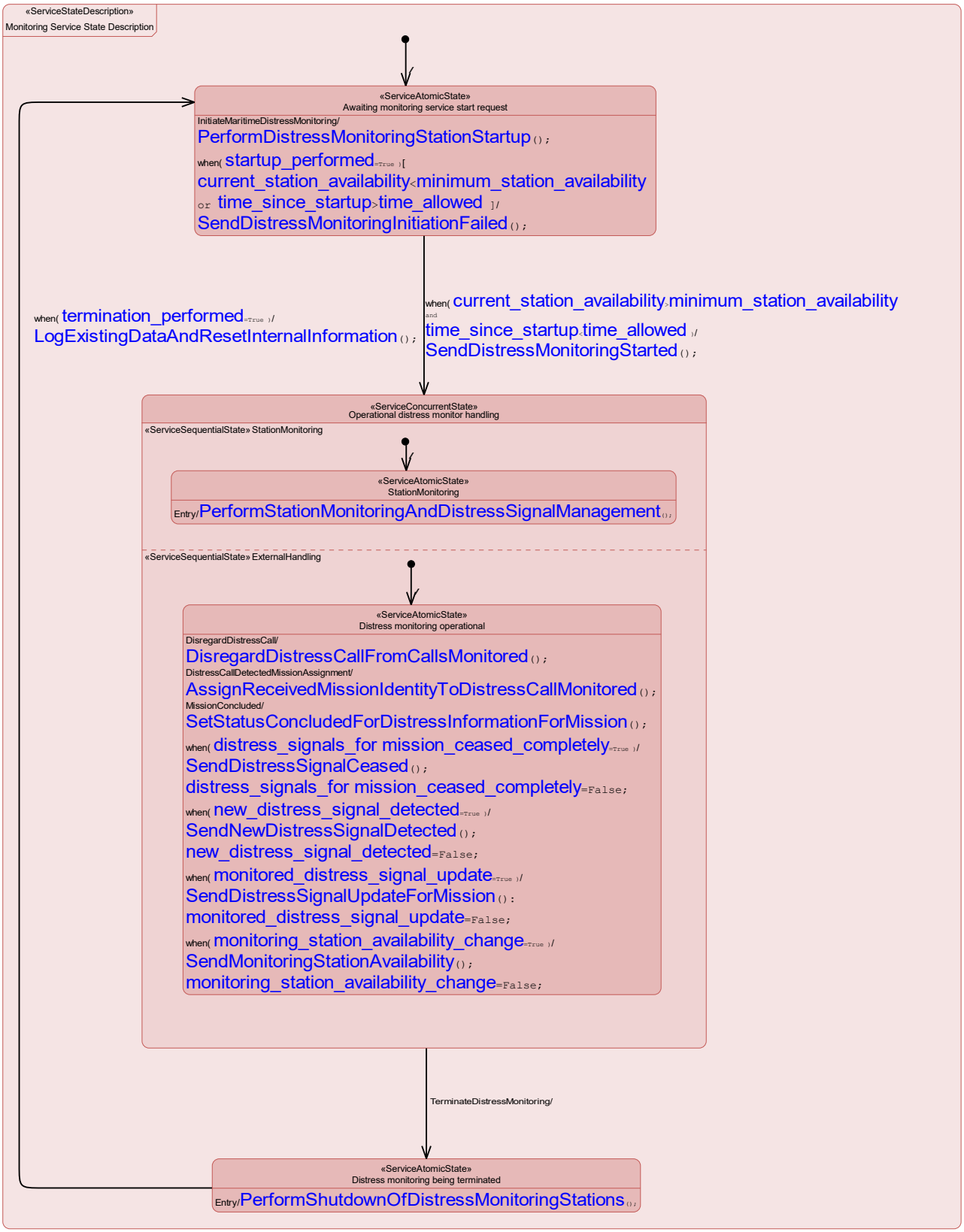

Figure 17:54 - Services State Model for Monitoring v2