Annex C

(non-normative)

Sample Problem

C.1 Purpose

The purpose of this annex is to illustrate how UPDM can support DODAF and MoDAF requirements for organizations developing Network Enabled Capability (NEC) systems using some of the basic features of the specification. This example provides a model which illustrates a sample of DoDAF and MoDAF views addressing the problem space described below.

C.2 Scope

The scope of this example is to provide a diagram for the views that are most used and most requested by the defense community. The intent is to select portions of the sample problem to illustrate how the diagrams can be applied, and demonstrate some of the possible interrelationships among the model elements in the different diagrams. The sample problem does not highlight all of the features of the specification.

C.3 Problem ~~Summary~~Scenario

C.3.1 Problem Domain Suitability. [EDIT]

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[1].
- The scenario and modeling was easily updated to include UPDM concepts including US DoDAF 1.5.
- SAR is internationally recognized problem domain with easy-to-recognize typical scenarios.
- SAR is based on publicly available International Agreements[2] and and implementing or conforming National Plans including the US[3] and the UK[4].

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[1] See Acknowledgements.

[2] See for example, 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 is Organization and Management; Volume II is Mission Co-ordination; & Volume III is Mobile Facilities.

[3] See for example, 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

[4] See for example, 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 seperate

- The documentation is generally unclassified as opposed to many equilvalent defence or military plans.
- Subject matter experts and periodicals are readily available.[5]
- The domain is sufficiently large and complex involving mixed human, software, and hardware solutions. As such, it will support the current specification that includes parametirc modeling from systems engineering (SysML)[6] as well as future evolutions of UPDM which may include more national and multinational architecture frameworks. Several of the countries share usage of the same automated information systems and sensors.

C.3.2 Acknowledgements

~~The sample problem is based on a concept derived for the UK MOD by VEGA. It~~ The scenario is derived from the UK Search and Rescue framework, which is publicly available on the internet[7]. The sample problem is based on a concept derived by VEGA under contract for the UK MOD.[8] The UPDM Group 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

C.3.3 Summary [EDIT]

C.3.4 The "Yacht in Distress" Scenario

The Sample Problem applies UPDM to a common scenario ~~It describes the use of UPDM as it applies to a~~in civilian ~~M~~maritime Search and Rescue (SAR) operations -- ~~of~~ a yacht in distress. A monitoring unit picks up the distress signal from the yacht and passes it on to the Command and Control (C2) Center. The C2 Center coordinates the search and rescue operation among helicopters, a naval ship and a Royal National Lifeboat Institution (RNLI) Lifeboat. This section is structured to show each diagram in the context of how it might be used in such an example problem.

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)". http://www.mcga.gov.uk/c4mca/mcga-uk_sar_framework_document.pdf

[5] See for example, 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.

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

[7] See "MODAF: Examples: Search and Rescue Example" and the corresponding files are at http://www.modaf.org.uk/file_download/33/SAR.zip (as of 29 April 2009)

[8] http://www.modaf.org.uk/vExamples/163/search-and-rescue-example

C.4 Diagrams

C.4.1 Package Overview (Structure of the Sample Model)

Acronyms

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

Table C.1 - Acronyms

DoT	Department of Transport
NIMROD	Aircraft name
MRA	Maritime Role Aircraft
ESM	Electronic Signal Monitoring
RN ASR Helo	Royal Navy Approach Surveillance Radar Helicopter
RNLI	Royal National Lifeboat Institution
HMG	Her Majesty's Government
TDM	Time Division Multiplex
MRT	Maritime Rescue Team
SAR	Search and Rescue
C2	Command and Control

Flow of SAR Example Models

Figure C. 1 shows the flow of the SAR example models through the different viewpoints. Beginning with the All Viewpoint, the natural progression is through the key Strategic Views, the key Operational Views, ~~the key Strategic Views,~~ the key Service Oriented Views, the key Systems Views and finally to the Acquisition~~Systems~~ Views.

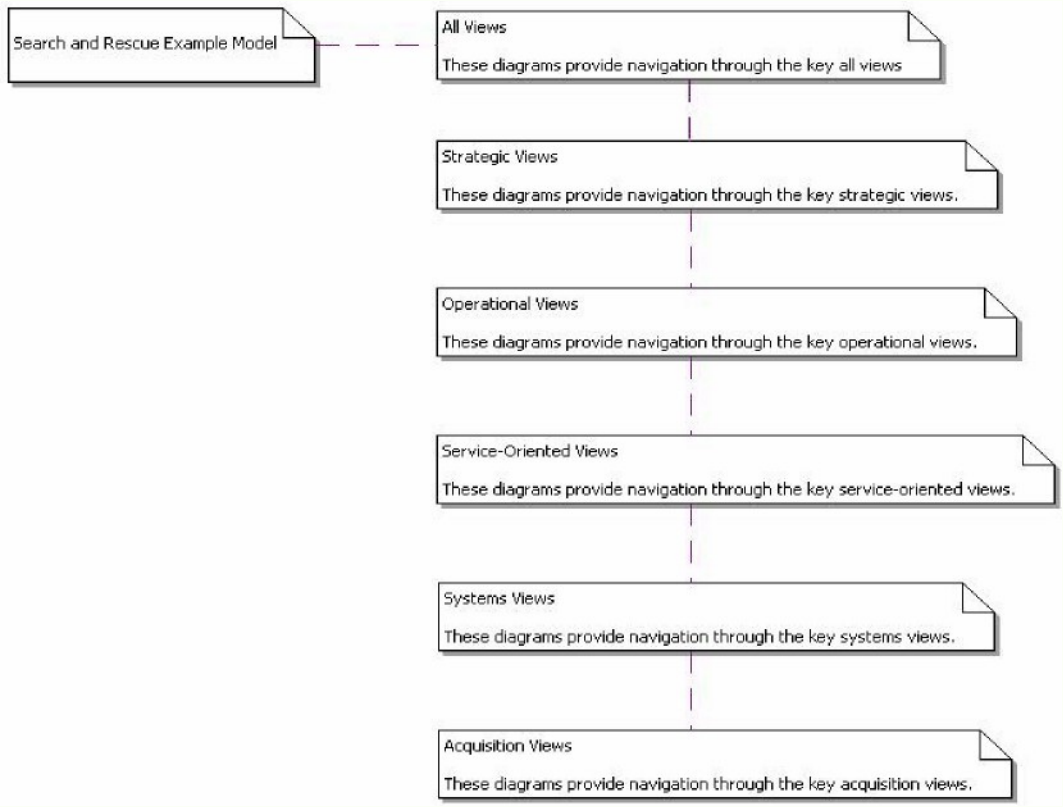


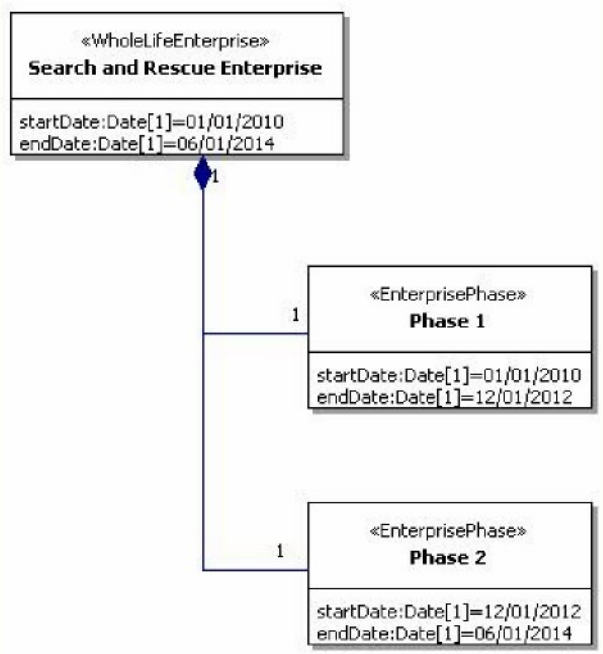
Figure C.1 - Diagram Flow

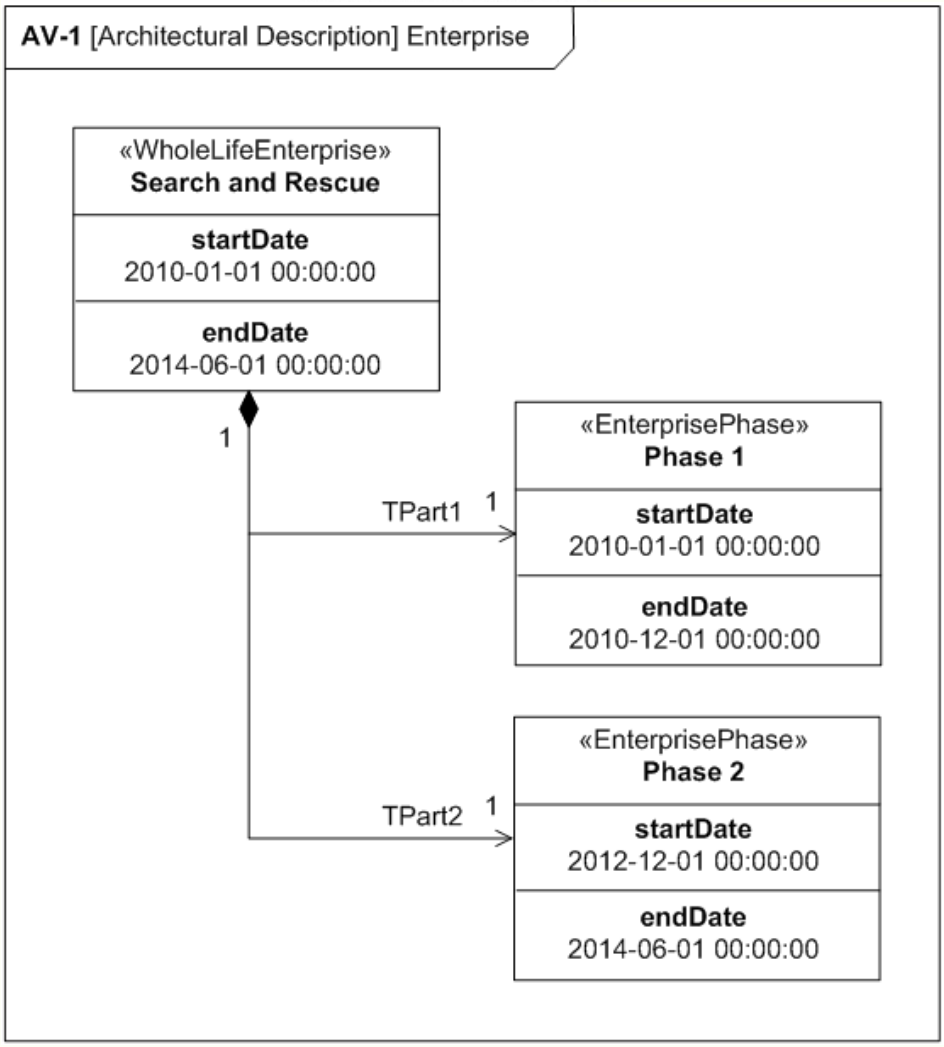
C.5 All Views

The All Views provide 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.

C.5.1 AV-1 Enterprise Definition

Figure C.2 shows the top level context item, the Search and Rescue Enterprise, broken down into Temporal Phases with start and end dates.


«WholeLifeEnterprise»
Search and Rescue Enterprise
startDate:Date[1]=01/01/2010
endDate:Date[1]=06/01/2014
1
1
«EnterprisePhase»
Phase 1
startDate:Date[1]=01/01/2010
endDate:Date[1]=12/01/2012
1
«EnterprisePhase»
Phase 2
startDate:Date[1]=12/01/2012
endDate:Date[1]=06/01/2014


AV-1 [Architectural Description] Enterprise
«WholeLifeEnterprise»
Search and Rescue
startDate
2010-01-01 00:00:00
endDate
2014-06-01 00:00:00
1
TPart1
1
«EnterprisePhase»
Phase 1
startDate
2010-01-01 00:00:00
endDate
2010-12-01 00:00:00
TPart2
1
«EnterprisePhase»
Phase 2
startDate
2012-12-01 00:00:00
endDate
2014-06-01 00:00:00

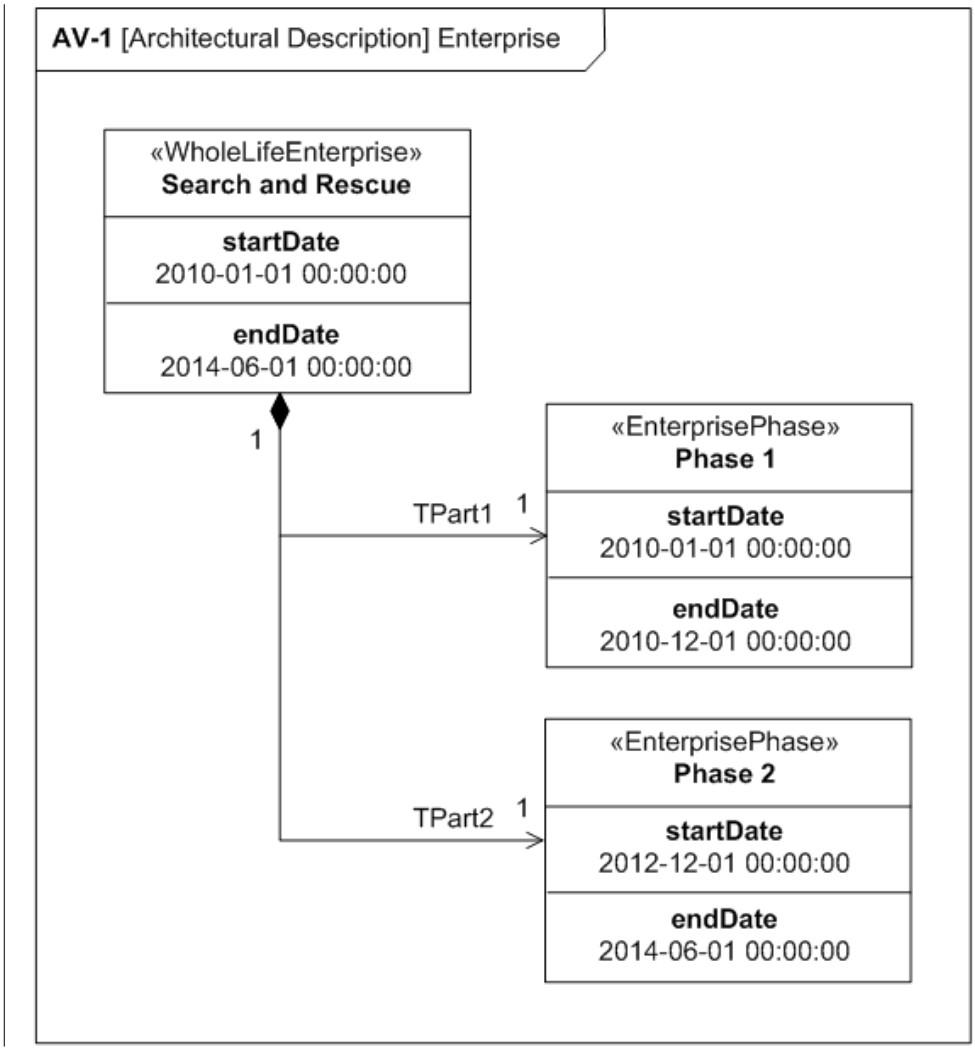


Figure C.2 - AV-1

Below, Figure C.3, is alternate way of showing the AV-1. It 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.

AV-1 Overview and Summary Information

- **Architecture Project Identification**
  - Name: **SAR Satellite Aid Tracking System**
  - Architect: **Coastguard Agency Architecture 4**
  - Organization Developing the Architecture: **Maritime & Coastguard** Agency
  - Assumptions and Constraints: **None**
  - Approval Authority: **Howard Overtree, Project Manager**
  - Date Completed:

- **Scope: Architecture Views and Products Identification**
  - Views and Products Developed: **AV1, StV1, StV2, StV4, StV5, StV6, OV1, OV2, OV3, OV4, OV5, OV6b, OV7, ~~StV1, StV2, StV4, StV6,~~ AcV1, AcV3, SOV1, SOV2, SOV3, SOV4a, SOV5, SV1, SV2, SV4, SV7**
  - Time Frames Addressed: **Present**
  - Organizations Involved: **Dept. of Transport, Maritime & Coastguard Agency**

- **Purpose and Viewpoint**
  - Purpose of the Architecture: **To detect and locate mariners, aviators and recreational enthusiasts in distress**
  - From Whose Viewpoint Architecture is Developed: **Users of System**
- **Context**
  - Mission: **Manage, coordinate and implement SAR activities**
  - Tasking for Architecture Project: **Tasking by UK SAR Steering Committee**
  - Tools and File Formats Used: **Together, Word, Excel**

Figure C.3 - AV-1 Alternate

C.5.2 AV Measurements Definition

Figure C.4 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 measureable 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 All Views, as they can pertain to all elements in all views of the model. Metrics specific toSystem elements are addressed in the SV-7. As there is no diagram MODAF or DoDAF in All Views for expressing this information, we have created a new diagram. This could be called AV-n, Measurements Definition or other suitable name. This is an example of the extensibility features provided by UML and SysML.

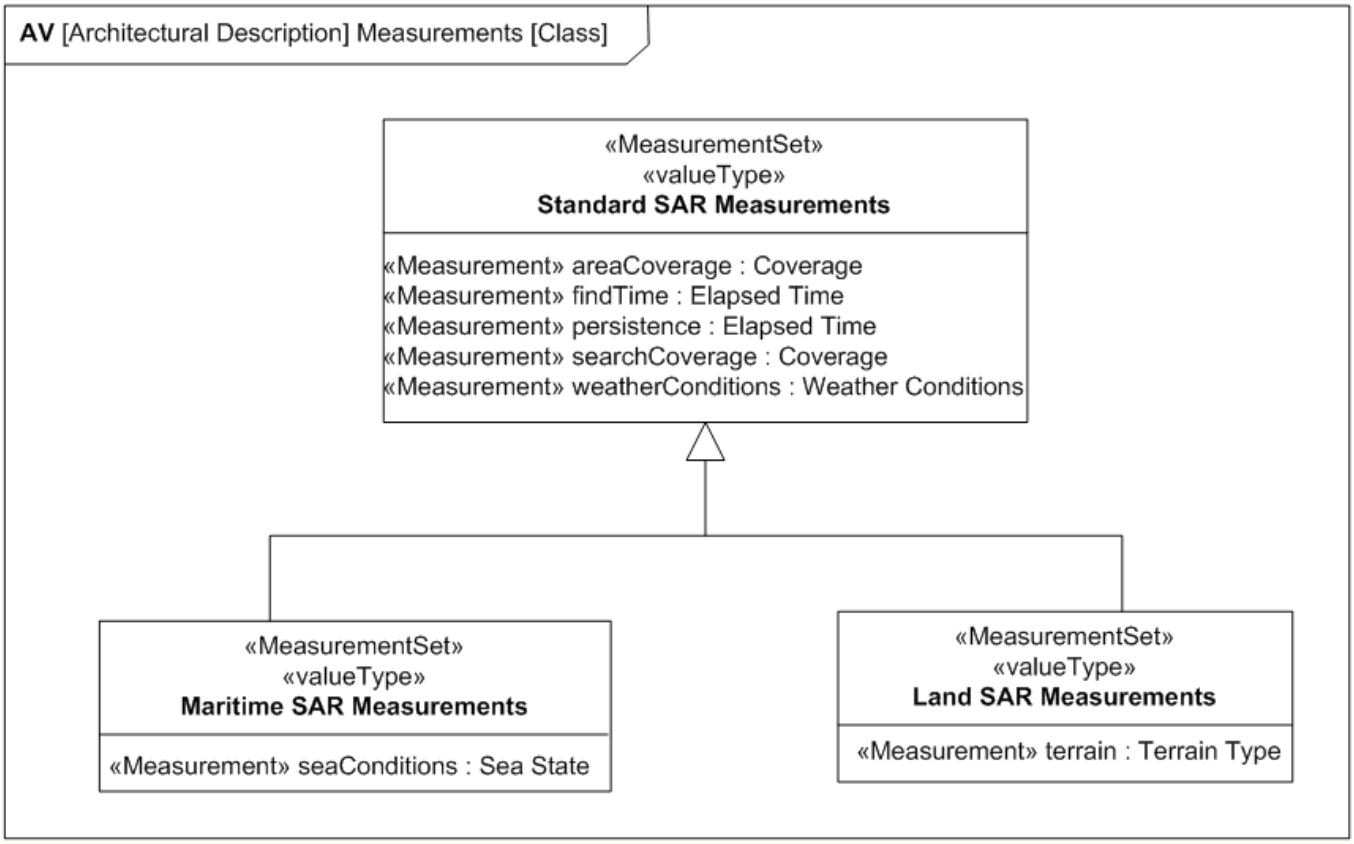


Figure C.4 - AV Measurements Class Diagram

C.5.3 AV Measurements Instances

Figure C.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, required and final values for SAR capabilities.

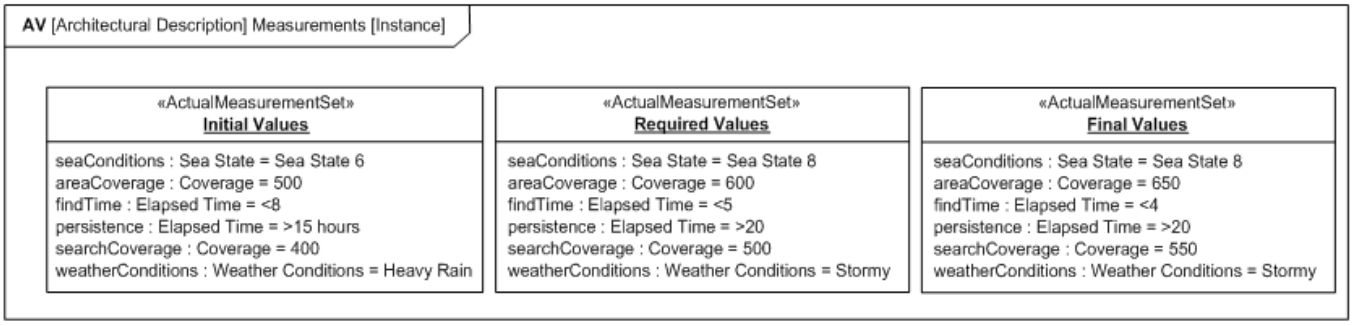


Figure C.5 – AV Measurements Instance Diagram

C.6 Strategic Views

The diagrams in the Strategic View provide a capability view of the SAR operation. These views will show the relationships between capabilities and the resources required to realize them.

C.6.1 StV-1 Capability Vision

Figure C.64 describes the strategic context for Search and Rescue Capabilities. It outlines the vision for a capability area over a specified period of time. It describes how high level goals and strategy are to be delivered in terms of capability.

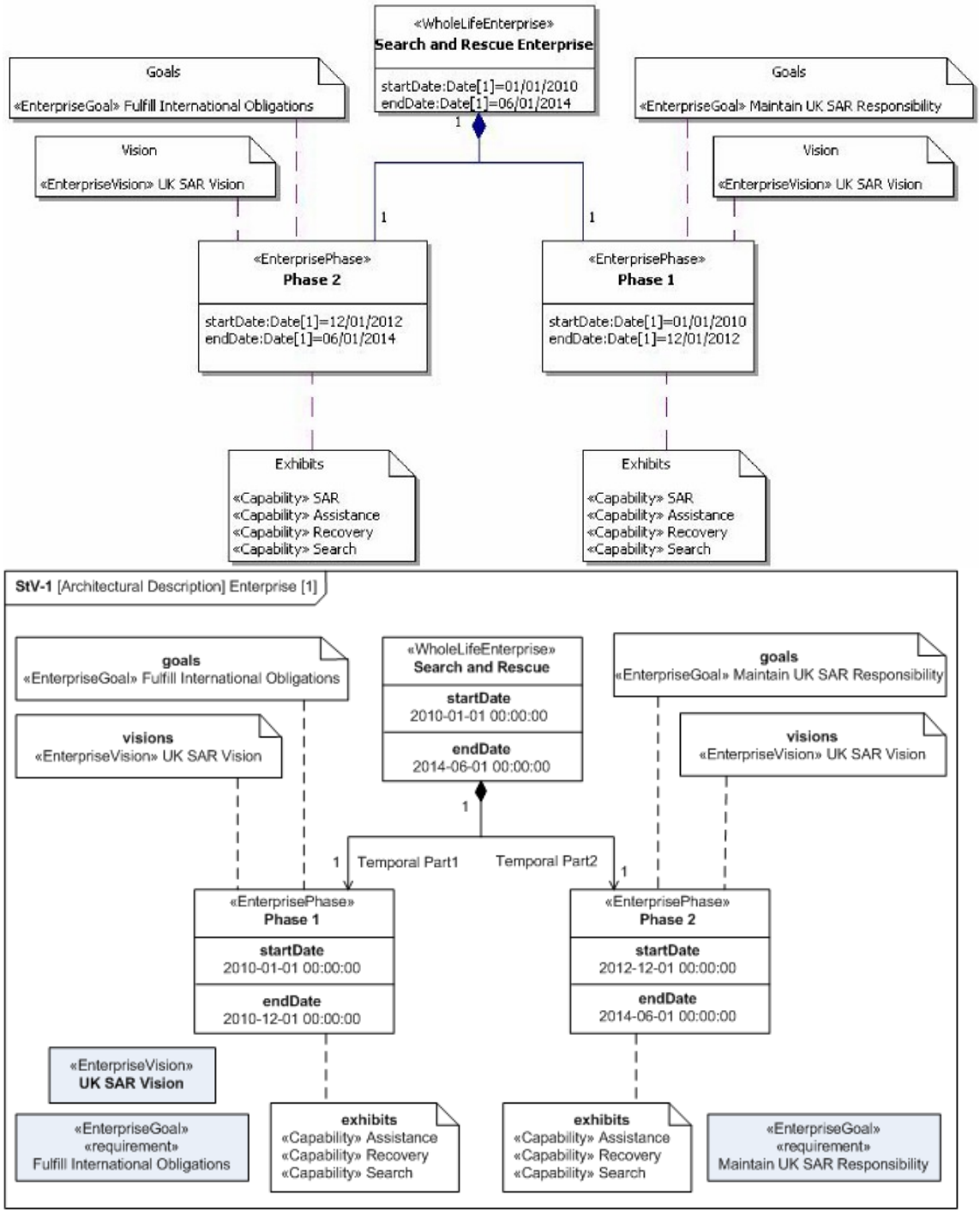


Figure C.64 - StV-1

C.6.2 StV-2 Capability Taxonomy

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. In Figure C.75 we have characterized Maritime SAR in terms of required values. These are defined in Figure C.5 and include ~~of~~ 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.

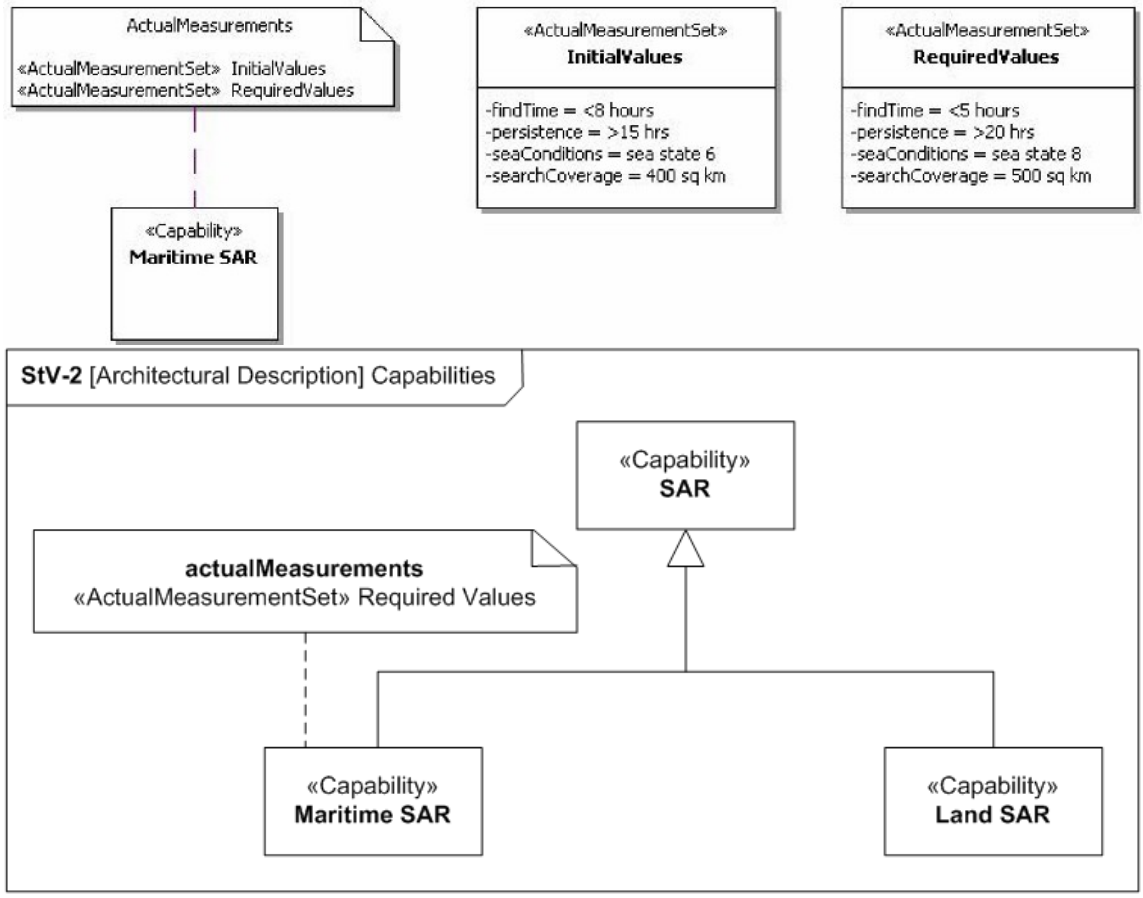


Figure C.75 - StV-2 Capability Taxonomy

~~As shown in Figure C.6, the StV-2 can also show a hierarchy of capabilities.~~

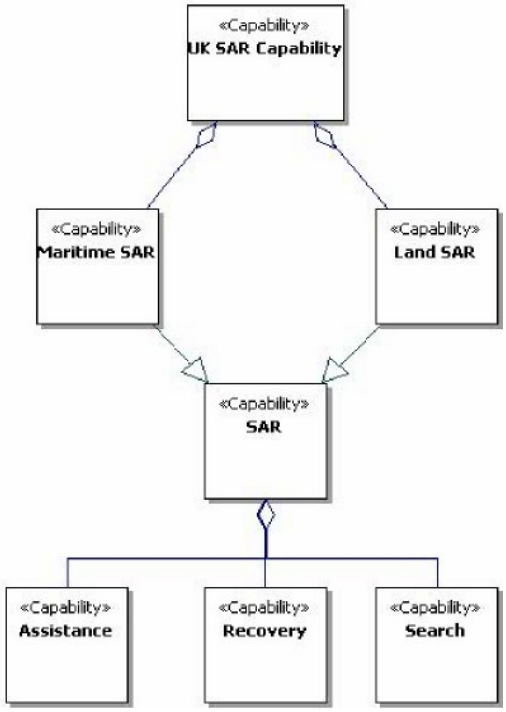
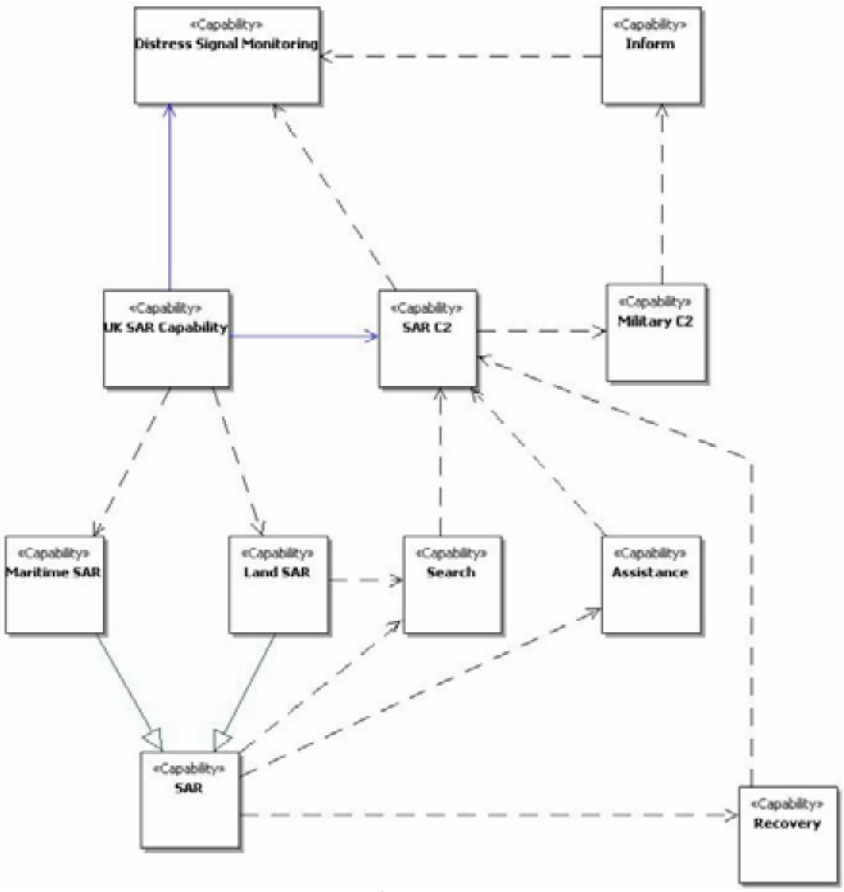


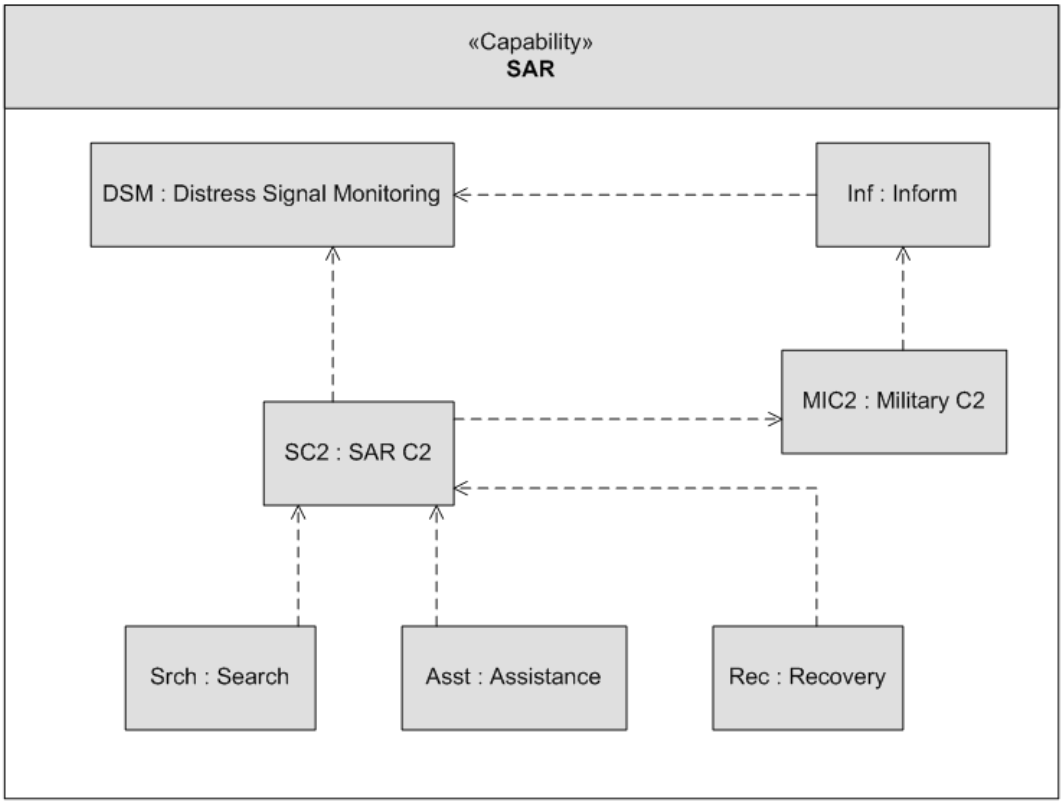
Figure C.6 – Alternate StV-2

C.6.3 StV-4 Capability Clusters

This view, Figure C.87, addresses the logical grouping of capabilities and the dependencies between them. In many circumstances, SAR Command and Control depends on the Military C2 Capability. Similarly, the Assistance, Search and Recovery Capabilities are dependent upon the SAR C2~~earch~~ Capability, which in turn is dependent upon the Distress Signal Monitoring~~SAR C2~~ Capability.



StV-4 [Capability] SAR Capability



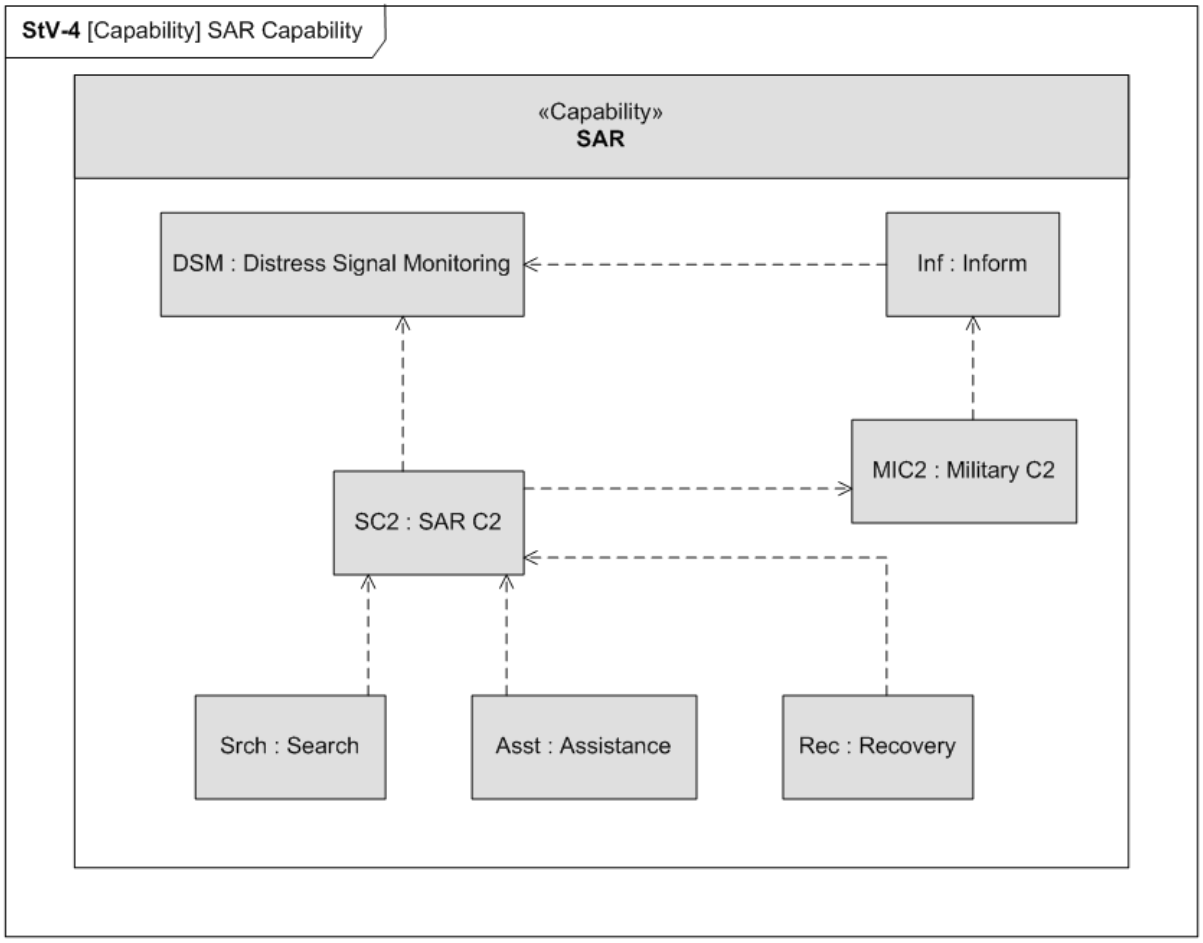


Figure C.87 - StV-4

C.6.4 StV-4 Capability Clusters Class Diagram

Figure C.9 shows the class diagram version of the capability clusters.

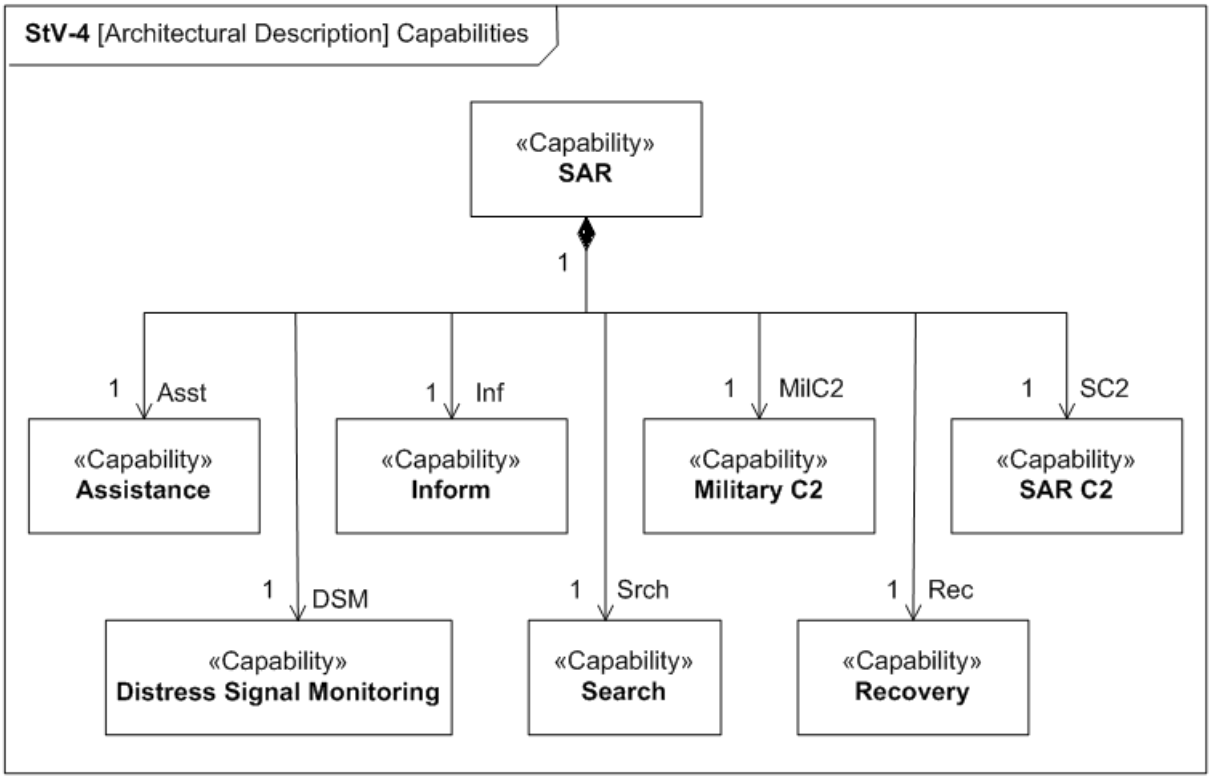


Figure C.9 – StV-4 Alternative View

C.6.5 StV-5 Capability to Organization Deployment

Figure C.10 shows the generated StV-5 table. The StV-5 defines Capability to Organization Deployment Mapping. It shows the planned capability deployment for a resource and the responsible organization. The StV-5 View is used to support the capability management process and, in particular, assist the planning of fielding. For example, the Assistance Capability is supported by the Maritime Rescue Unit. The RNLI and Maritime and Coastguard Agency are responsible for them.

[Architectural Description] Capabilities [StV-5]

Organizational Resources	Capabilities			
	«Capability» Assistance	«Capability» Inform	«Capability» Recovery	«Capability» Search
«ActualOrganization» RNLI	Maritime Rescue Unit Maritime Rescue Unit V2	Maritime Rescue Unit Maritime Rescue Unit V2	Maritime Rescue Unit Maritime Rescue Unit V2	Maritime Rescue Unit Maritime Rescue Unit V2
«ActualOrganization» Maritime & Coastguard Agency	Maritime Rescue Unit Maritime Rescue Unit V2	Maritime Rescue Unit Maritime Rescue Unit V2	Maritime Rescue Unit Maritime Rescue Unit V2	Maritime Rescue Unit Maritime Rescue Unit V2

Figure C.10 - StV-5

C.6.64 StV-6 Operational Activity to Capability Mapping

This view, Figure C.118, identifies how operational activities can be performed using various available capability elements. Figure 118 shows that in order to achieve Search and Assistance Capabilities, certain Standard Operational Activities must be performed, including Monitor Health and Provide Medical Assistance.

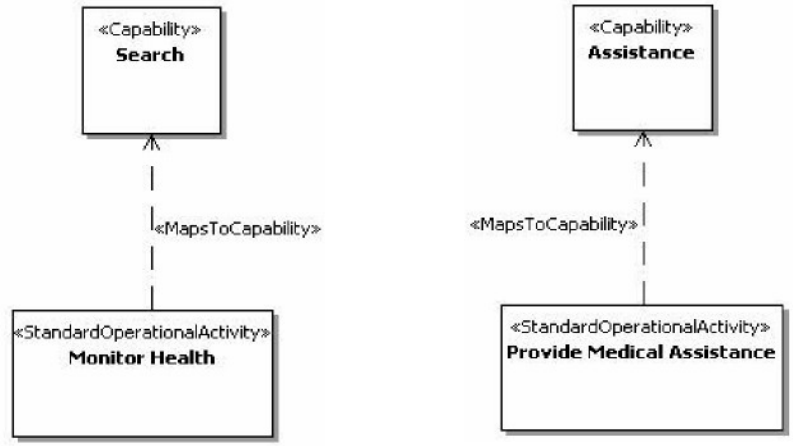


Figure C.8 - StV-6

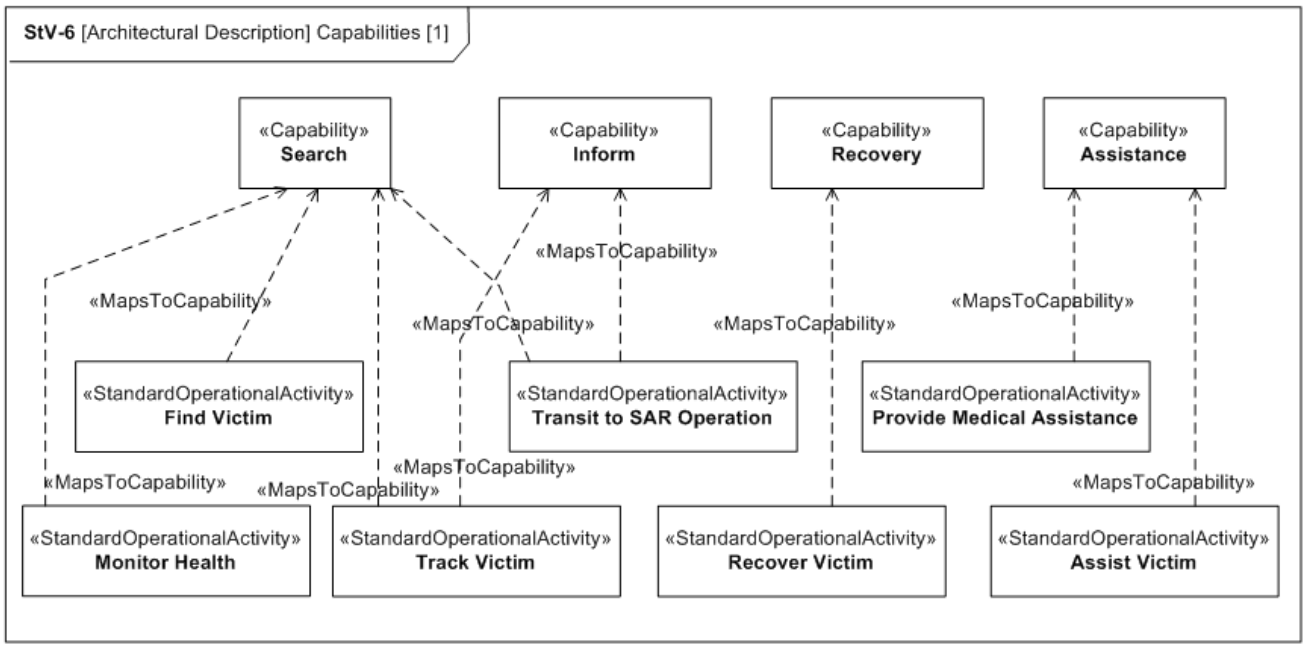


Figure C.11 - StV-6

C.7 Operational Views

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 that are required to conduct the operation.

C.7.1 OV-1 Operational Context Graphic

This diagram, Figure C.129, of the Maritime rescue sets the context 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 RNLI lifeboat.

In the OV- 1, 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.

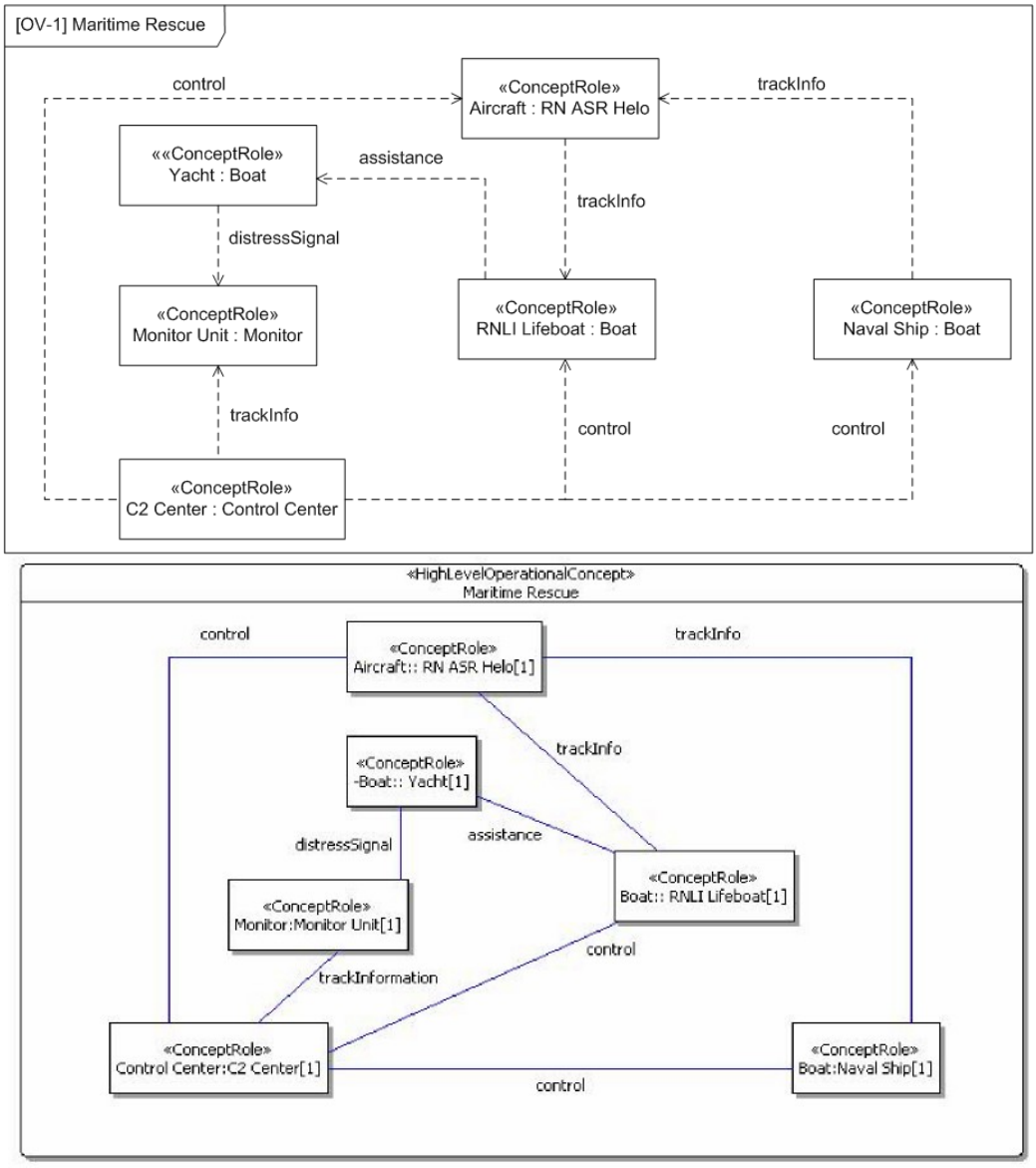


Figure C.129 - OV-1

As shown below, a pictorial background can be included to provide additional context.

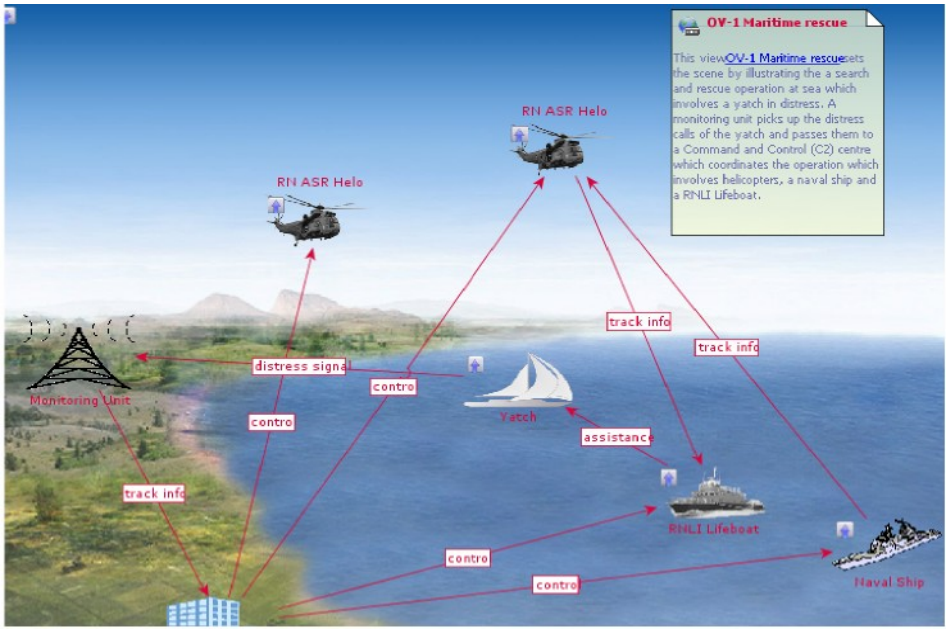


Figure C.130 - Alternate OV-1

C.7.2 OV-2 Operational Node Connectivity Description

Figure C. 141 depicts the key players in the SAR operation and the interactions for information exchange. It identifies the different types of nodes 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 nodes and also shows the interactions between these nodes. The OV-5 view shows the operational activities undertaken by a few select nodes. Figure C.14 is the class diagram version of the OV-2.

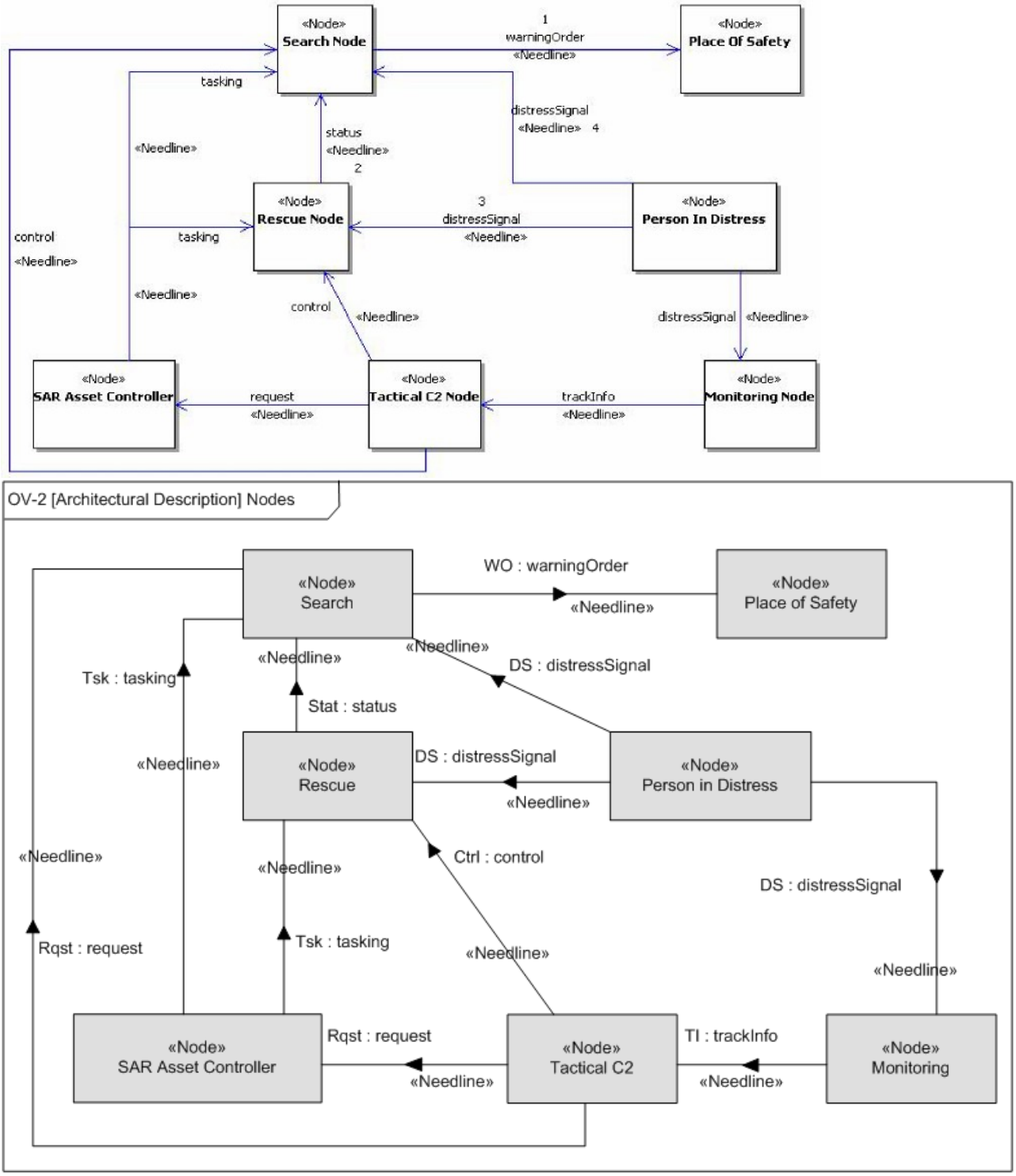
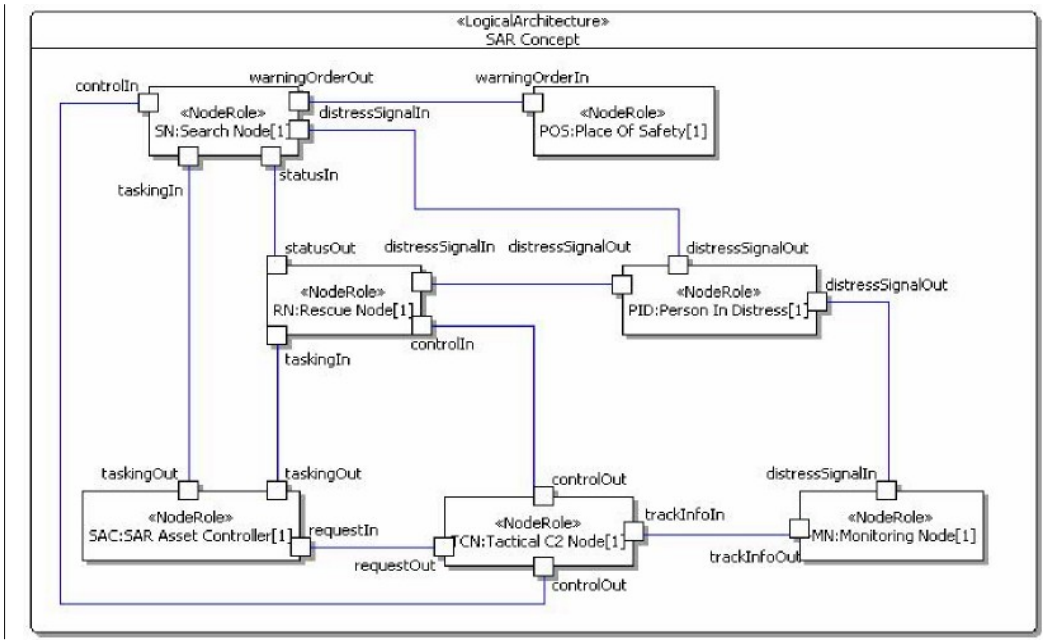


Figure C.1~~4~~4 - OV-2

Figure C. 1~~5~~2 shows an alternate way to display the OV-2. It can be illustrated as above with IO Flows~~directed relationships~~ or as below using connectors and SysML Item Flows ~~with or~~ without flow ports as in Figure C.15 or with flow ports as in Figure C.16.



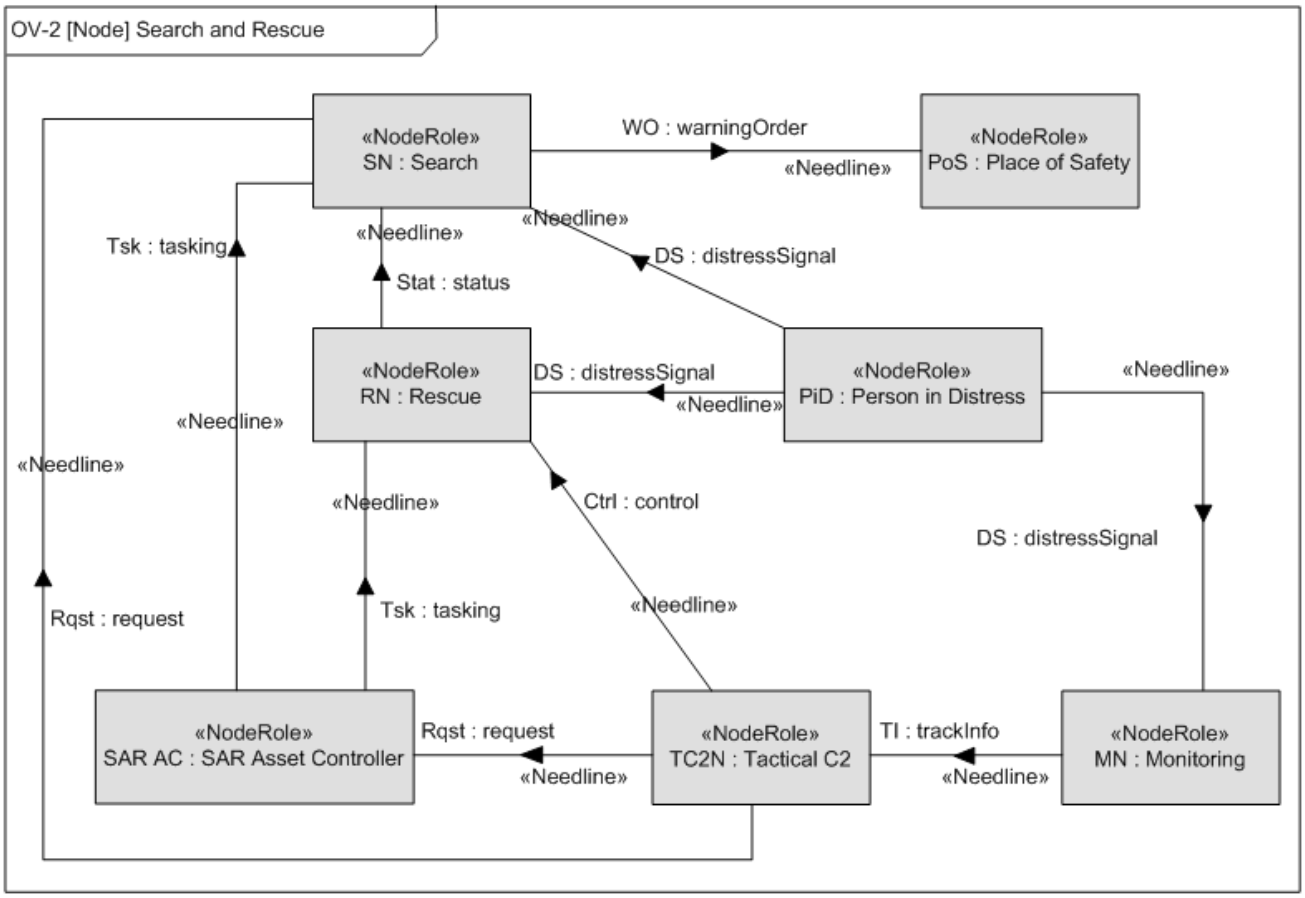


Figure C.152 - Alternate OV-2 SysML Version Without Flow Ports

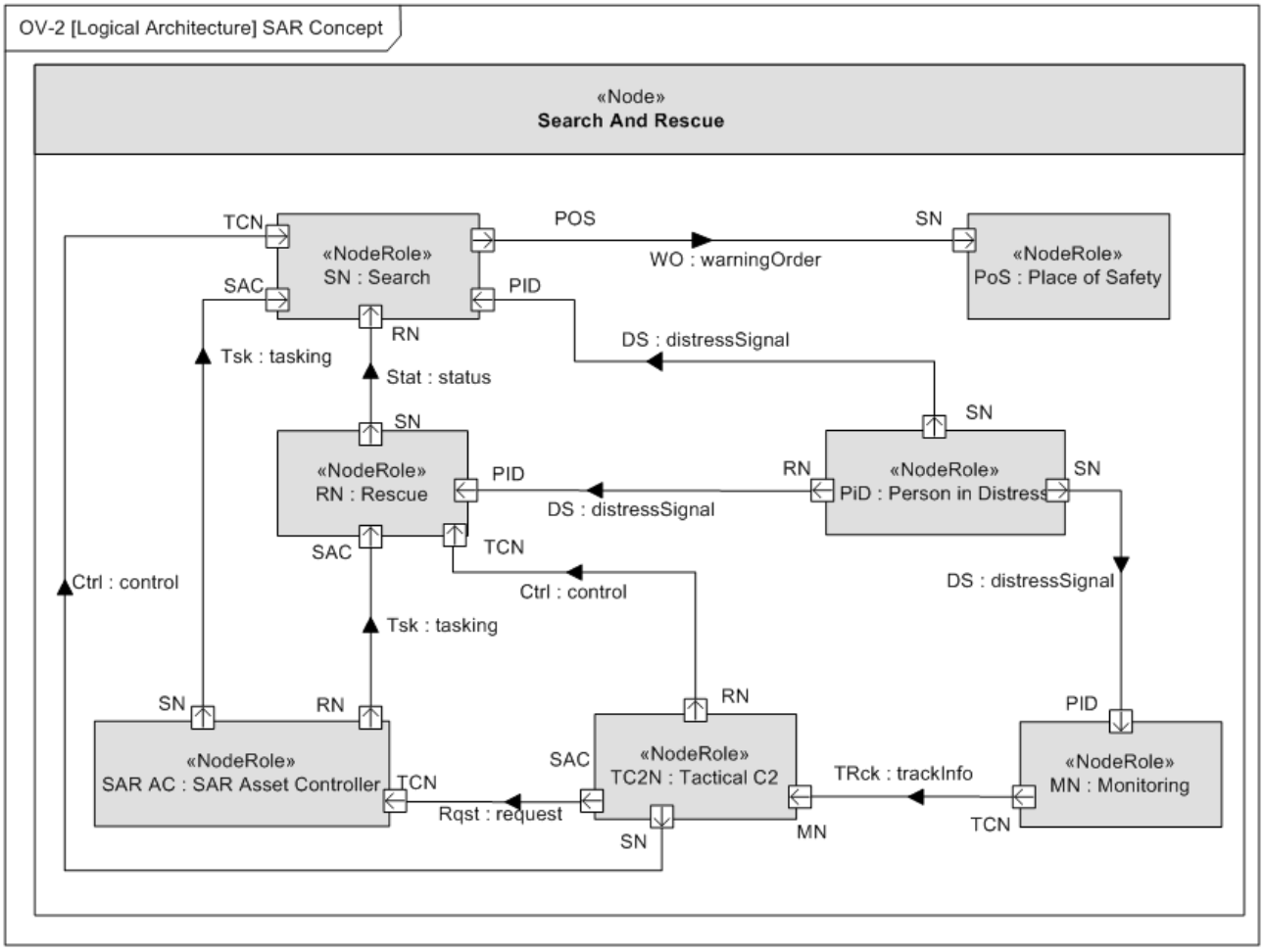


Figure C.16 - Alternate OV-2 with SysML Flow Ports

Figure C. 16 shows the SysML version with Flow Ports and Item Flows. The typed ports mean that the user can constrain the elements that can flow in and out of the port. This means that consistency checks can be performed on the ports to ensure that the flows correspond to the allowed elements. The stereotypes have also been removed to aid readability.

C.7.3 OV-3 Operational Information Exchange

Table C.2 shows the operational information exchanges between nodes. The OV-3 can include Information Exchanges associated with a Needline as well as Information Elements carried by one or more Information Exchange.

Table C.2 - OV-3

Needline Identifier	Information Exchange Identifier	Information Element Name	Content	Language	Sending Op Node	Sending Op Activity	Receiving Op Node	Receiving Op Activity
1	1	Warning Order	Information about what is needed for the SAR operation	English	Search Node	Send Warning Order	Place of Safety	Process Warning Order
2	2	Medical Condition	Information about victim's medical condition	English	Search Node	Monitor Health	Rescue Node	Provide Medical Assistance
2	3	Location	Location of Victim	English	Search Node	Find Victim	Rescue Node	Recover Victim
3	5	Distress Signal	GPS coordinates and vessel information	English	Person in Distress	Receive Signal	Rescue Node	Find Victim
4	6	Distress Signal	GPS coordinates and vessel information	English	Person in Distress	Receive Signal	Search Node	Find Victim

[Architectural Description] Structure [OV-3]

Information Exchange		Producer		Needline	Consumer	
Name	Conveyed	Node	Operational Activity	Name	Node	Operational Activity
Ctrl	«Information Element» control	«Node» Tactical C2		TC2N - RN	«Node» Rescue	
Ctrl	«Information Element» control	«Node» Tactical C2		TC2N - SN	«Node» Search	
DS	«Information Element» distressSignal	«Node» Person in Distress	Send Distress Signal	PiD – MN	«Node» Monitoring	Receive Distress Signal
DS	«Information Element» distressSignal	«Node» Person in Distress	Send Distress Signal	PiD – SN	«Node» Search	Receive Distress Signal
DS	«Information Element» distressSignal	«Node» Person in Distress	Send Distress Signal	PiD - RN	«Node» Rescue	Receive Distress Signal
Rqst	«Information Element» request	«Node» Tactical C2		TC2N - SAR AC	«Node» SAR Asset Controller	
Stat	«Information Element» status	«Node» Search	Monitor Health	SN - RN	«Node» Rescue	Provide Medical Assistance
TI	«Information Element» trackInfo	«Node» Monitoring		MN - TC2N	«Node» Tactical C2	
Tsk	«Information Element» tasking	«Node» SAR Asset Controller		SAR AC - RN	«Node» Rescue	
Tsk	«Information Element» tasking	«Node» SAR Asset Controller		SAR AC - SN	«Node» Search	
WO	«Information Element» warningOrder	«Node» Search	Send Warning Order	SN - PoS	«Node» Place of Safety	Process Warning Order

C.7.4 OV-4 Organizational Relationships Chart

Figure C. 173 illustrates the command structure or relationships (as opposed to relationships with respect to a business process flow) among human roles, organizations, or organization types that are the key players in the SAR operation.

The OV-4 exists in two forms - typical (typical command structure) and actual (organization chart for a department or agency).Figure C.173, the typical OV-4, shows the possible relationships between organizations and posts. It is also possible to define types of people who are capable of filling these posts. For example, a Qualified Lifeguard could become an MRT Swimmer.

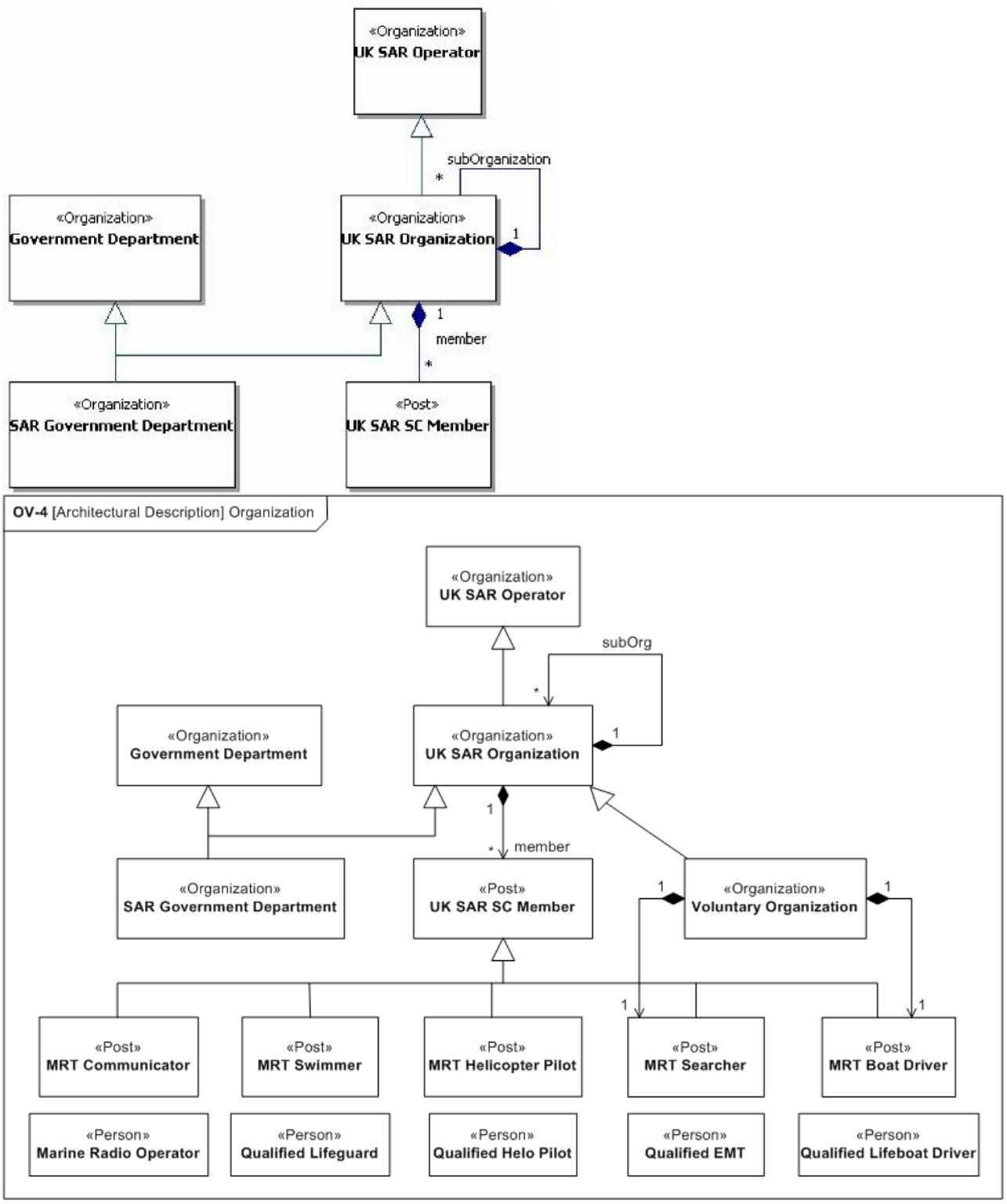
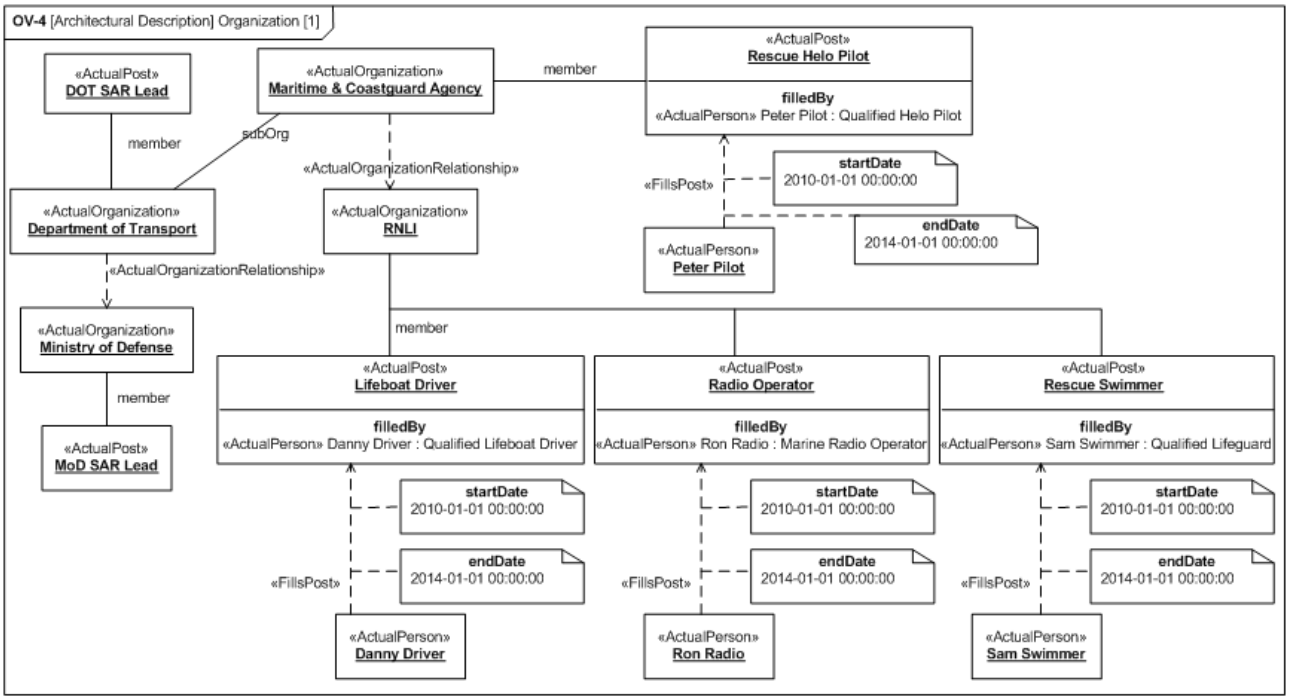


Figure C.173 - OV-4 Typical

The actual OV-4, shown in Figure C. 184, depicts the structure of the organization, the actual posts and the actual persons who fill those posts. The diagram can also be annotated with the start and end dates for this.


OV-4 [Architectural Description] Organization [1]
«ActualPost»
DOT SAR Lead
«ActualOrganization»
Maritime & Coastguard Agency
member
«ActualPost»
Rescue Helo Pilot
filledBy
«ActualPerson» Peter Pilot : Qualified Helo Pilot
member
subOrg
«ActualOrganizationRelationship»
«FillsPost»
startDate
2010-01-01 00:00:00
endDate
2014-01-01 00:00:00
«ActualOrganization»
Department of Transport
«ActualOrganization»
RNLI
«ActualPerson»
Peter Pilot
«ActualOrganizationRelationship»
«ActualOrganization»
Ministry of Defense
member
member
«ActualPost»
Lifeboat Driver
«ActualPost»
Radio Operator
«ActualPost»
Rescue Swimmer
filledBy
«ActualPerson» Danny Driver : Qualified Lifeboat Driver
filledBy
«ActualPerson» Ron Radio : Marine Radio Operator
filledBy
«ActualPerson» Sam Swimmer : Qualified Lifeguard
«ActualPost»
MoD SAR Lead
startDate
2010-01-01 00:00:00
endDate
2014-01-01 00:00:00
«FillsPost»
«ActualPerson»
Danny Driver
«ActualPerson»
Ron Radio
«ActualPerson»
Sam Swimmer

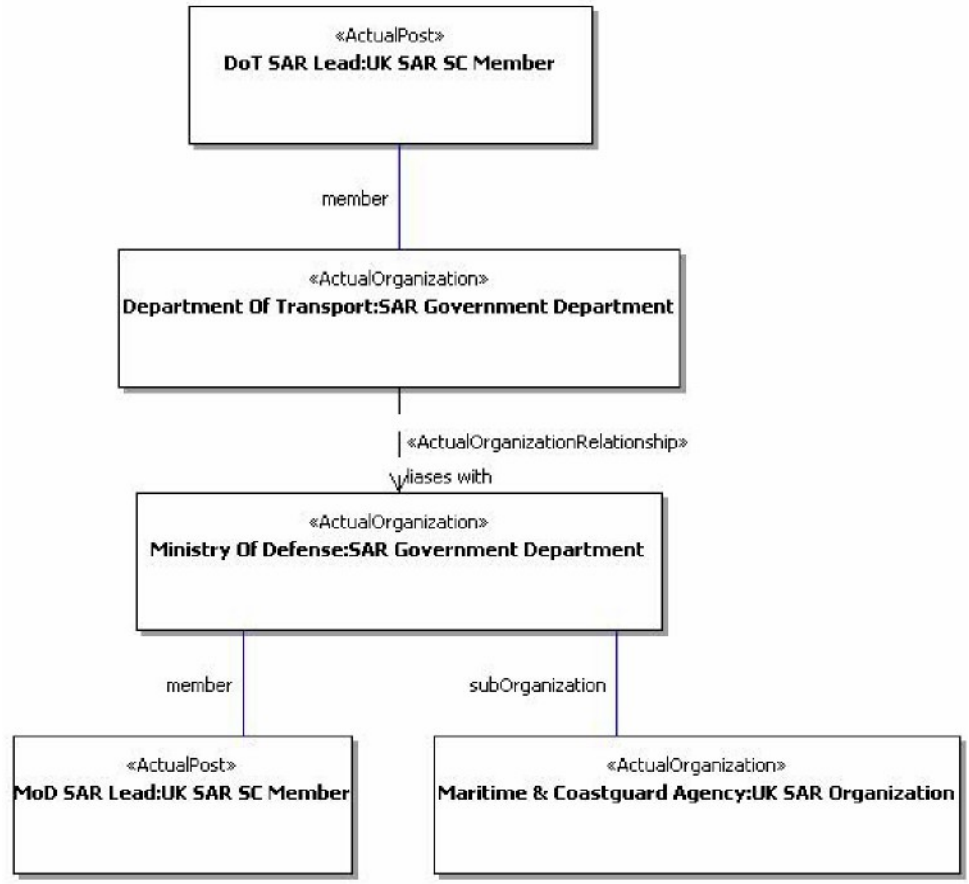

«ActualPost»
DoT SAR Lead:UK SAR SC Member
member
«ActualOrganization»
Department Of Transport:SAR Government Department
«ActualOrganizationRelationship»
liases with
«ActualOrganization»
Ministry Of Defense:SAR Government Department
member
subOrganization
«ActualPost»
MoD SAR Lead:UK SAR SC Member
«ActualOrganization»
Maritime & Coastguard Agency:UK SAR Organization

Figure C.184 - OV-4 Actual

C.7.5 OV-5 Operational Activity Model

Figure C.1-95 describes the operations that are normally conducted in the different nodes of a Search and Rescue operation. This view shows the operational activities which are performed in the Search Node and Rescue Node. This view shows which nodes undertake the operations.

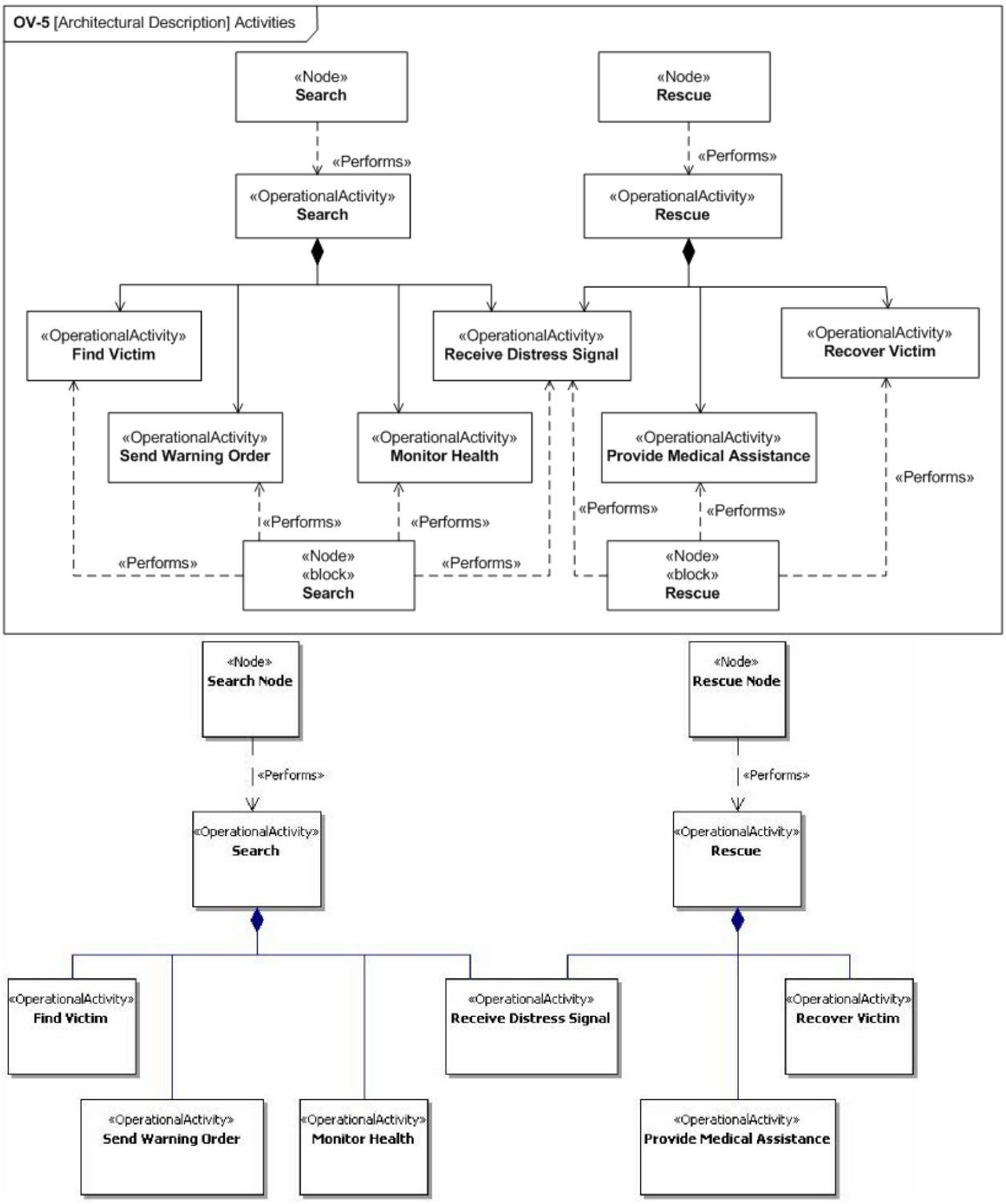


Figure C.195 - OV-5

Figure C. 2016 shows the OV-5 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 Architecture.

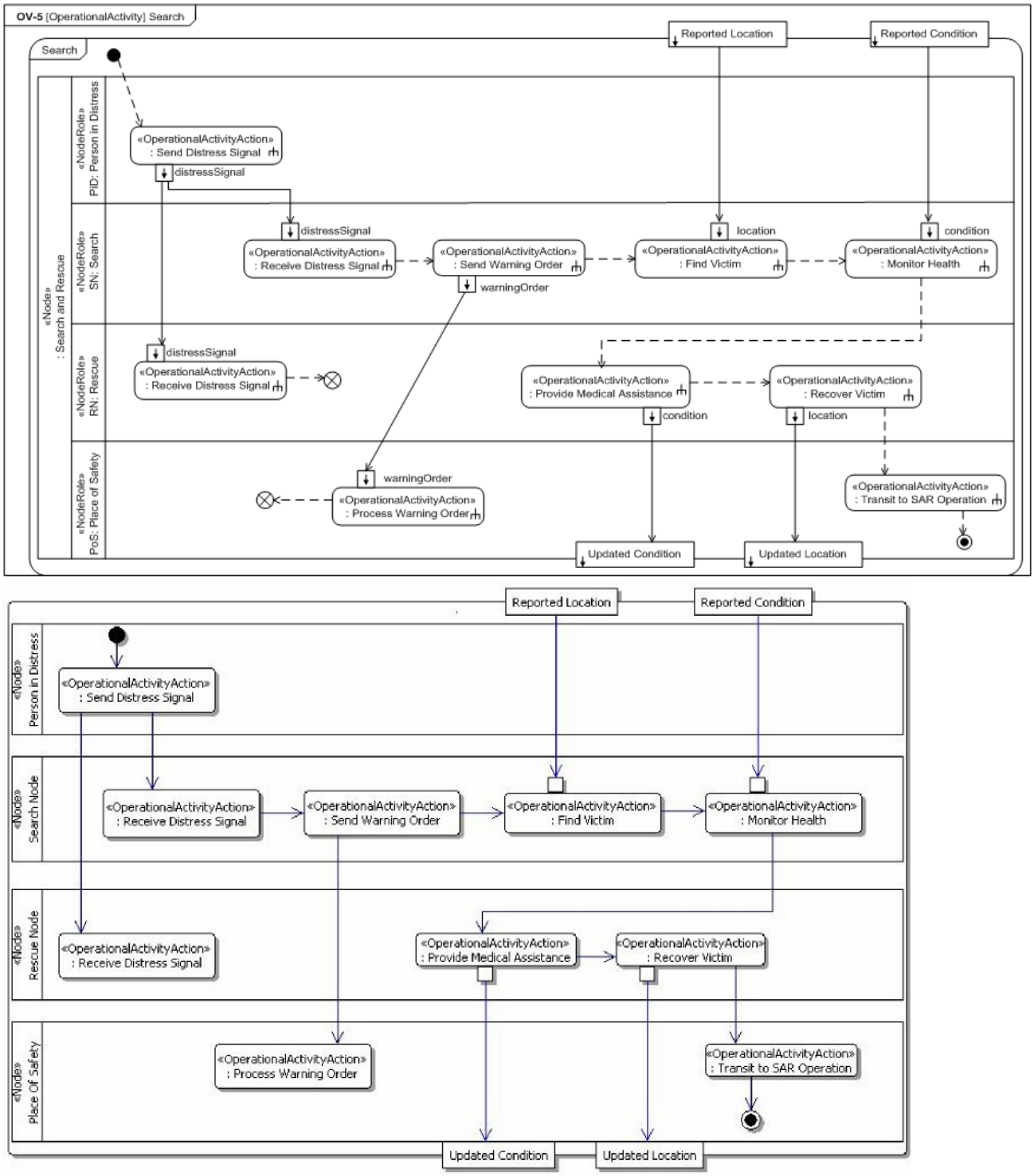


Figure C.2016 - Alternate OV-5

C.7.6 OV-6 Operational States

Figure C.21 describes the operational states of the Search Node, 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. When one is received, the warning order is sent out and the search node transitions to searching for victim.

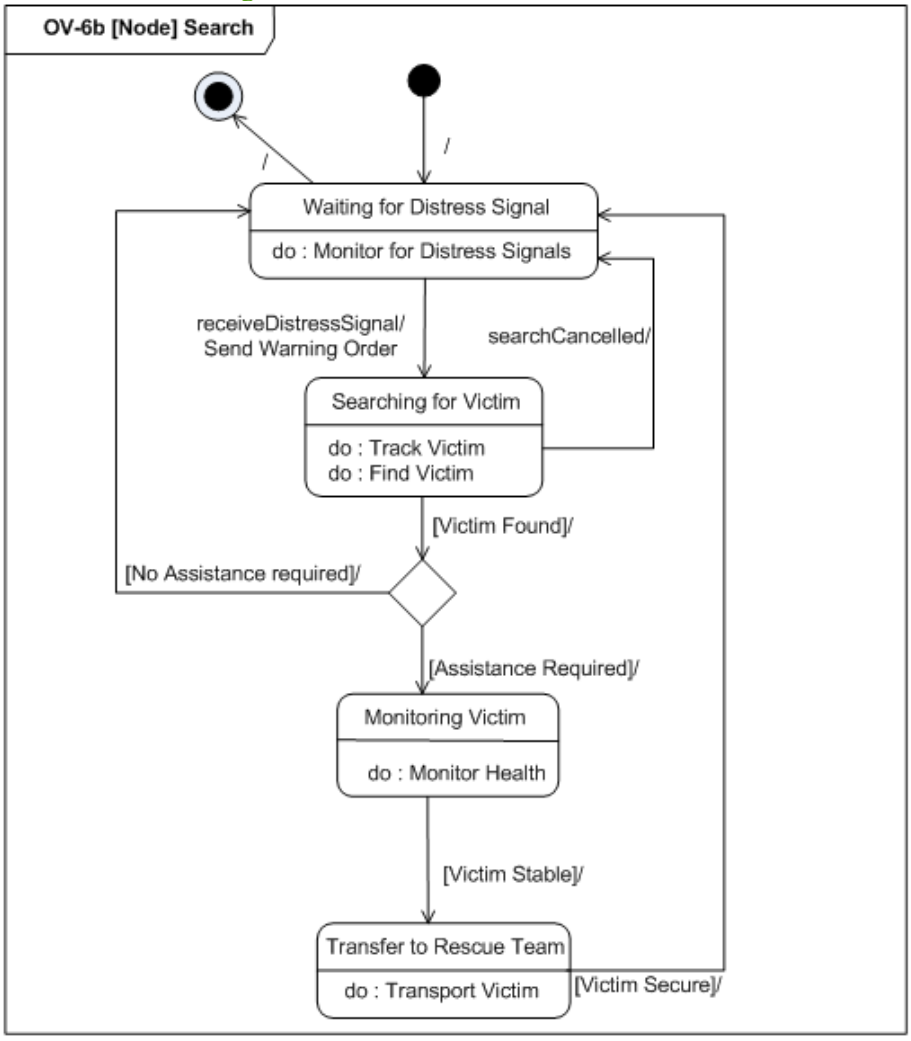
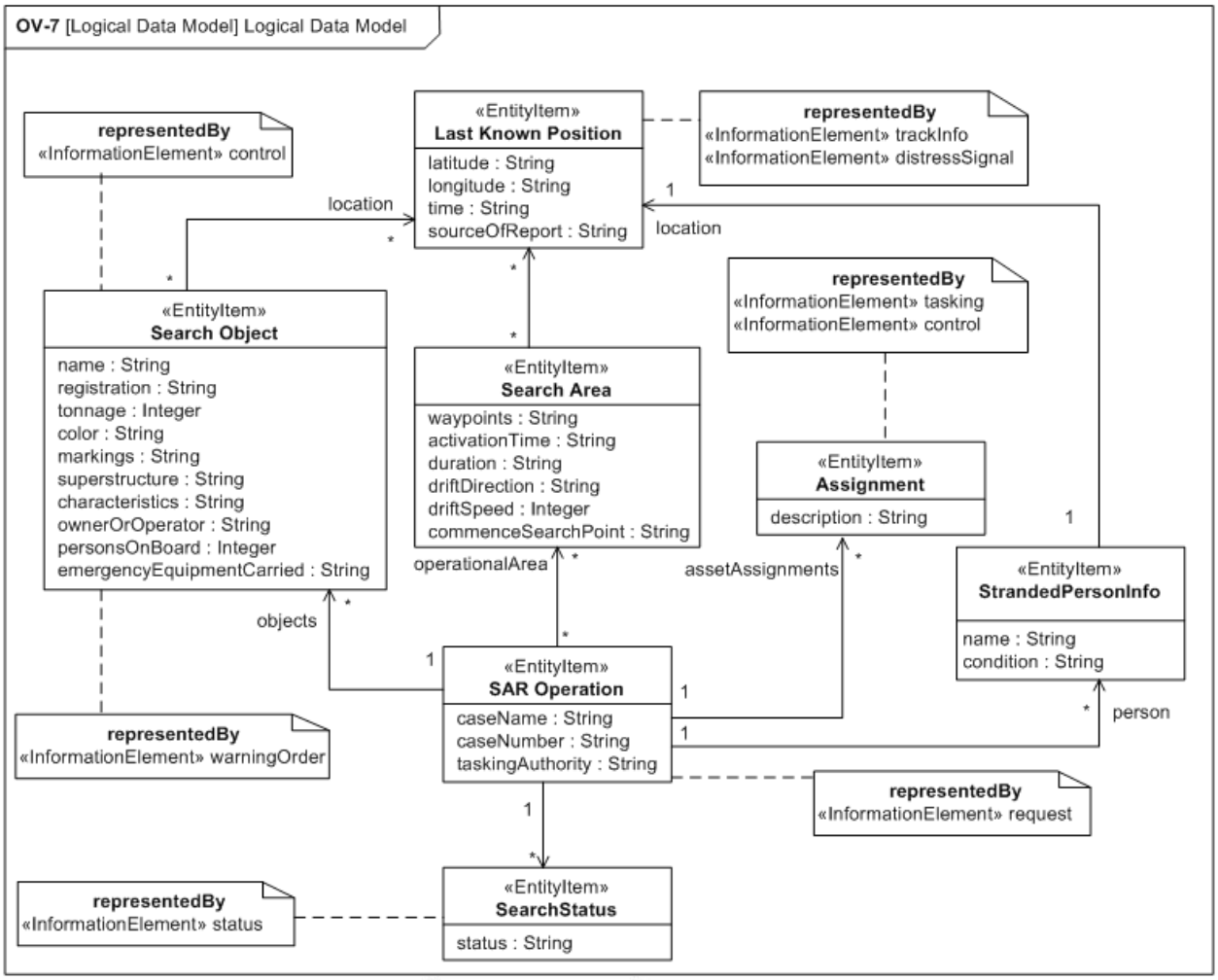
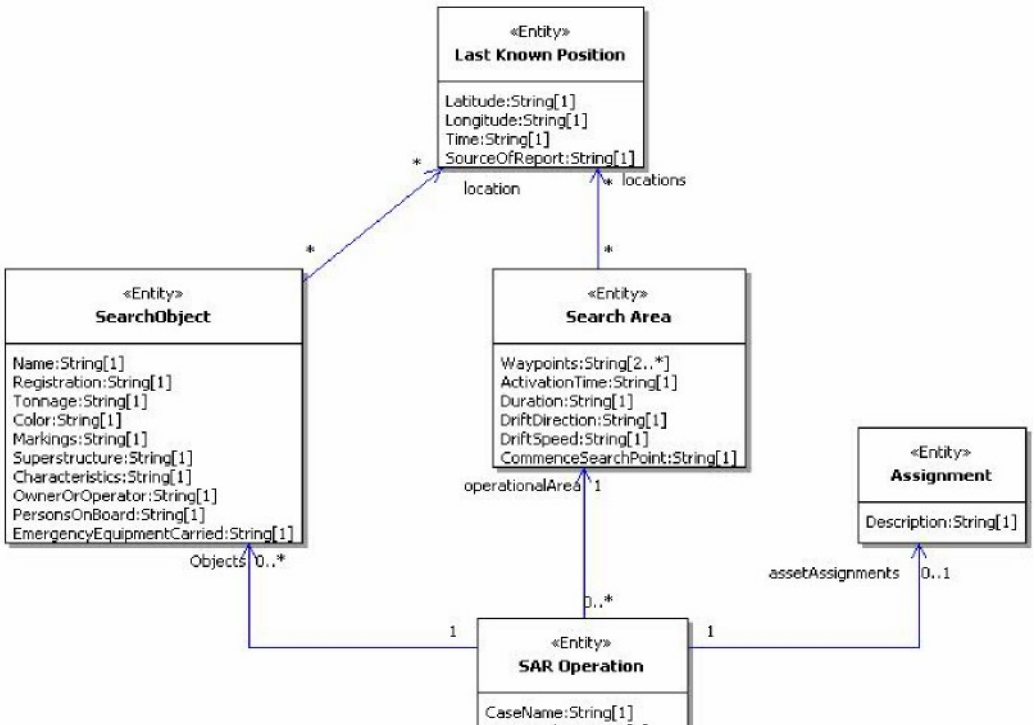


Figure C.21 - OV-6b

C.7.76 OV-7 Logical Data Model

This view describes the information that is associated with the Warning Order information element. 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. The call-out notes show the information elements that represent the entity items. These are used on the OV-2 and other diagrams.


OV-7 [Logical Data Model] Logical Data Model
«EntityItem»
Last Known Position
latitude : String
longitude : String
time : String
sourceOfReport : String
representedBy
«InformationElement» control
representedBy
«InformationElement» trackInfo
«InformationElement» distressSignal
location
location
«EntityItem»
Search Object
name : String
registration : String
tonnage : Integer
color : String
markings : String
superstructure : String
characteristics : String
ownerOrOperator : String
personsOnBoard : Integer
emergencyEquipmentCarried : String
«EntityItem»
Search Area
waypoints : String
activationTime : String
duration : String
driftDirection : String
driftSpeed : Integer
commenceSearchPoint : String
representedBy
«InformationElement» tasking
«InformationElement» control
«EntityItem»
Assignment
description : String
operationalArea
assetAssignments
«EntityItem»
StrandedPersonInfo
name : String
condition : String
objects
person
«EntityItem»
SAR Operation
caseName : String
caseNumber : String
taskingAuthority : String
representedBy
«InformationElement» warningOrder
representedBy
«InformationElement» request
representedBy
«InformationElement» status
«EntityItem»
SearchStatus
status : String


«Entity»
Last Known Position
Latitude:String[1]
Longitude:String[1]
Time:String[1]
SourceOfReport:String[1]
location
locations
«Entity»
SearchObject
Name:String[1]
Registration:String[1]
Tonnage:String[1]
Color:String[1]
Markings:String[1]
Superstructure:String[1]
Characteristics:String[1]
OwnerOrOperator:String[1]
PersonsOnBoard:String[1]
EmergencyEquipmentCarried:String[1]
«Entity»
Search Area
Waypoints:String[2..*]
ActivationTime:String[1]
Duration:String[1]
DriftDirection:String[1]
DriftSpeed:String[1]
CommenceSearchPoint:String[1]
«Entity»
Assignment
Description:String[1]
Objects
operationalArea
assetAssignments
«Entity»
SAR Operation
CaseName:String[1]

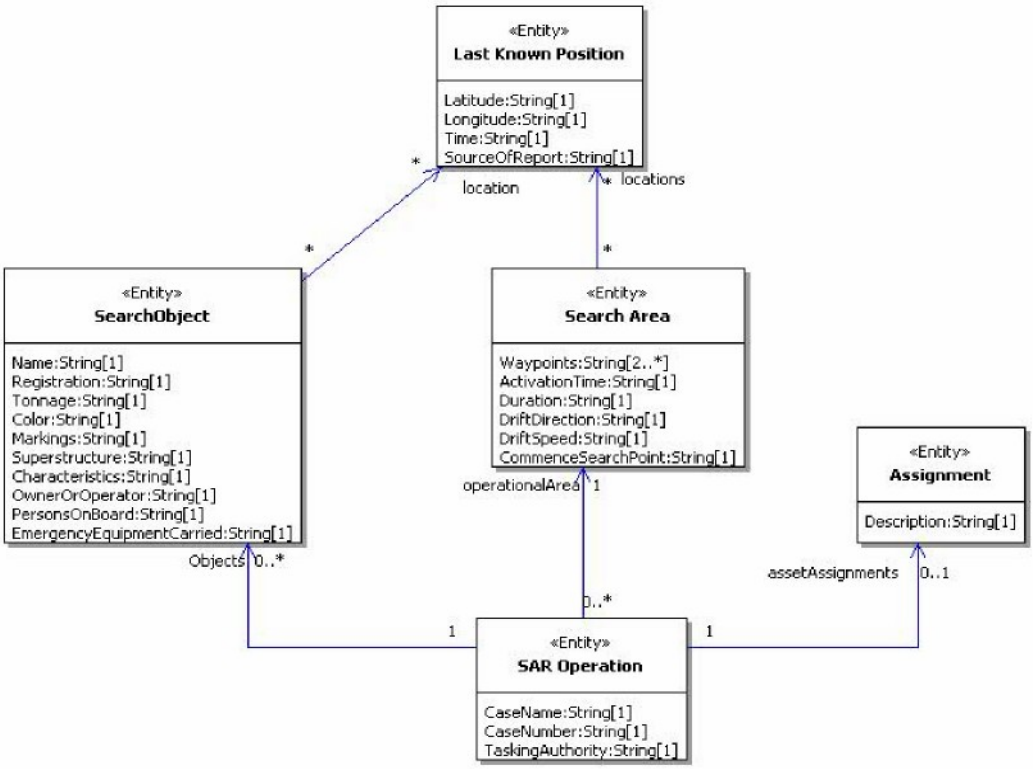


Figure C.22~~17~~ - OV-7

C.8 Service Oriented Views

The Service Oriented views describe the services needed to directly support the Search and Rescue operations described in the Operational View. The role of the services is to support the Operational Activities.

C.8.1 SOV-1 Service Taxonomy

This view specifies the hierarchy of services as well as the relationships between them. Figure C. 23~~18~~ 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.

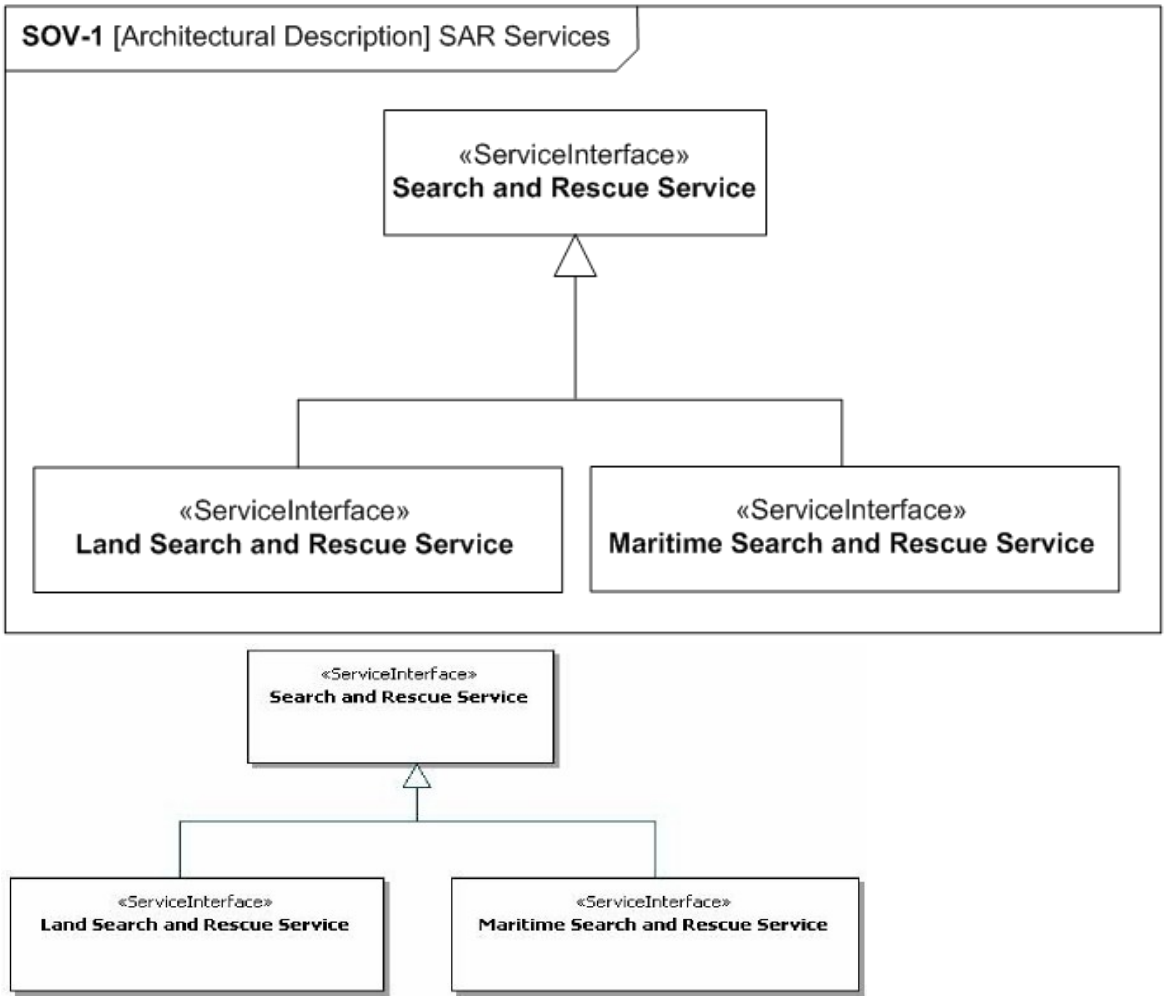


Figure C.2318 - SOV-1

C.8.2 SOV-2 Service Interface Specification

Figure C.24295 defines the interfaces that will provide access to the services.

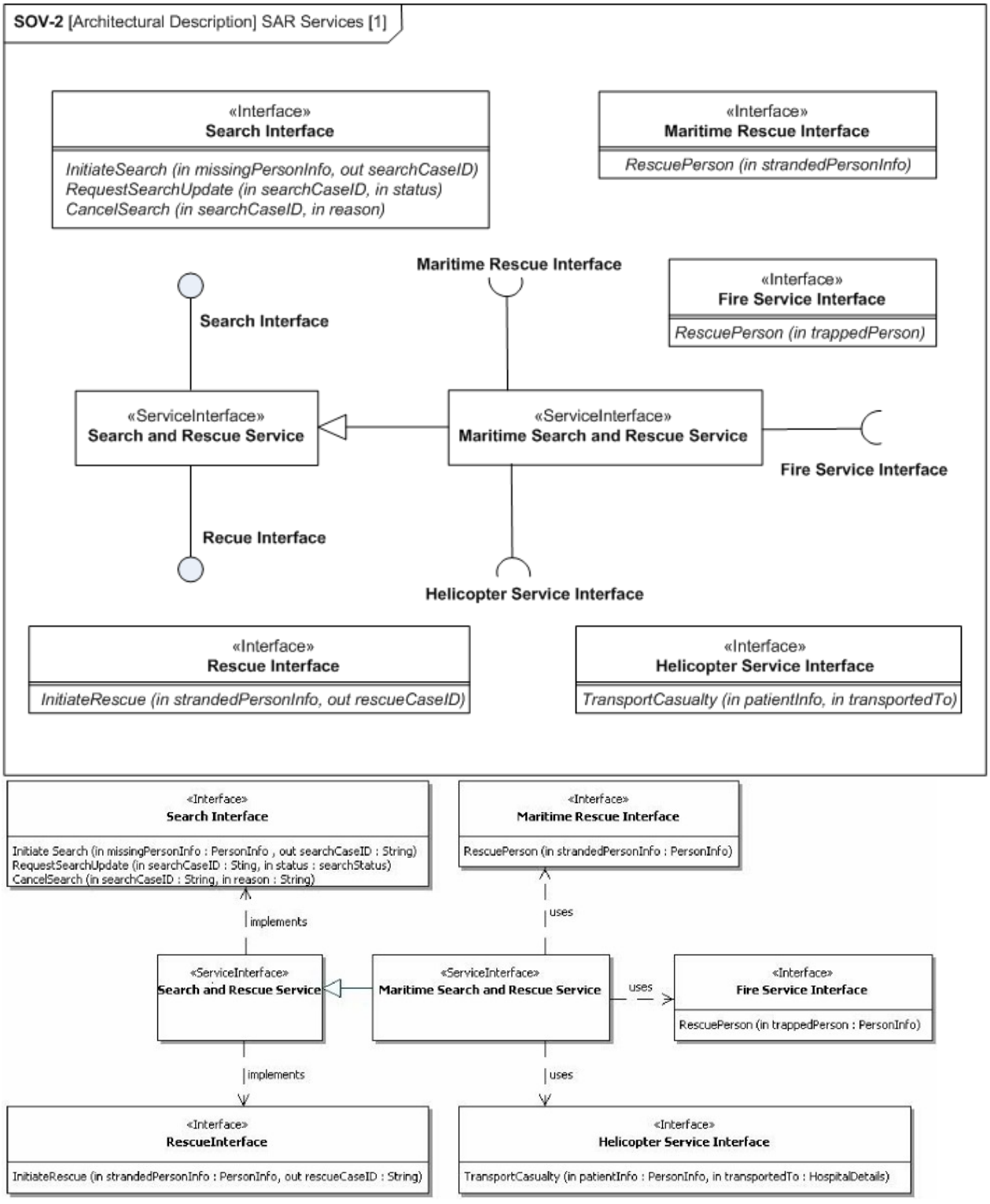


Figure C.2419 - SOV-2

C.8.3 SOV-3 Capability to Service Mapping

Figure C.25~~0~~ shows which services contribute to the achievement of a capability. In this example, the Land Search and Rescue Service aims to achieve the Land SAR Capability. Likewise, the Maritime Search and Rescue Service aims to achieve the Maritime SAR.

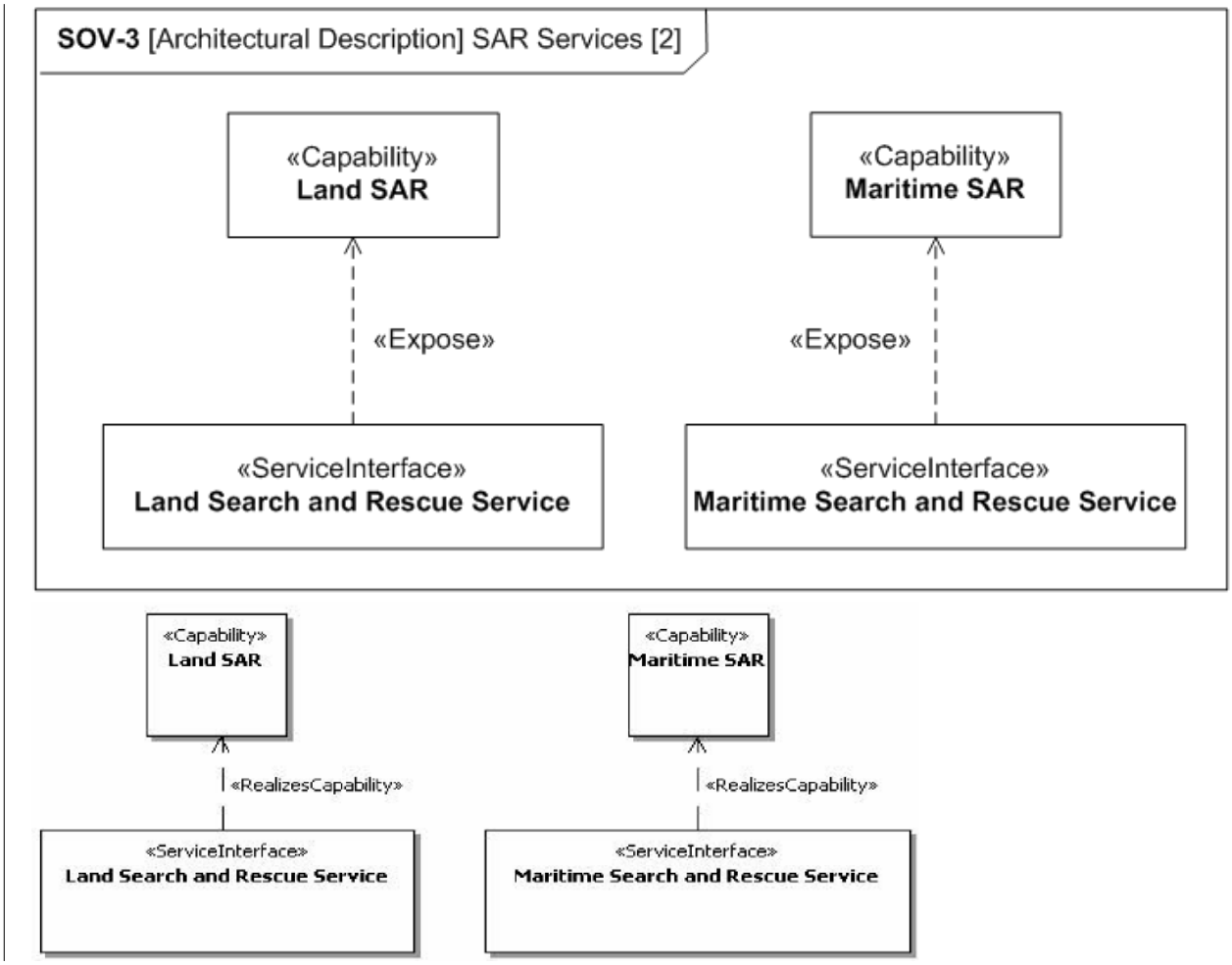


Figure C.250 - SOV-3

As shown below, the SOV-3 can also be presented as a matrix with capabilities on one axis and services on the other

Table C.3 - Alternate SOV-3

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

C.8.4 SOV-4 Service Behaviors and Constraints

Figure C.26 defines constraints that must be adhered to by Consumers and Providers of the Services via Service Policies.

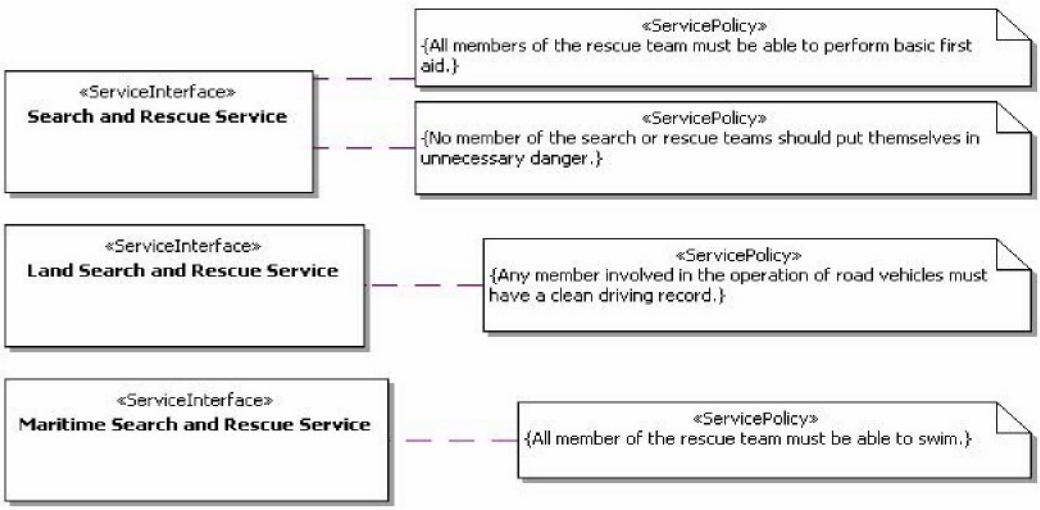


Figure C.21 - SOV-4

Table C.4 - Alternate SOV-4a

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

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

Table C.4 is an alternate representation.

C.8.5 SOV-5 Service Functionality

Figure C.272 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.

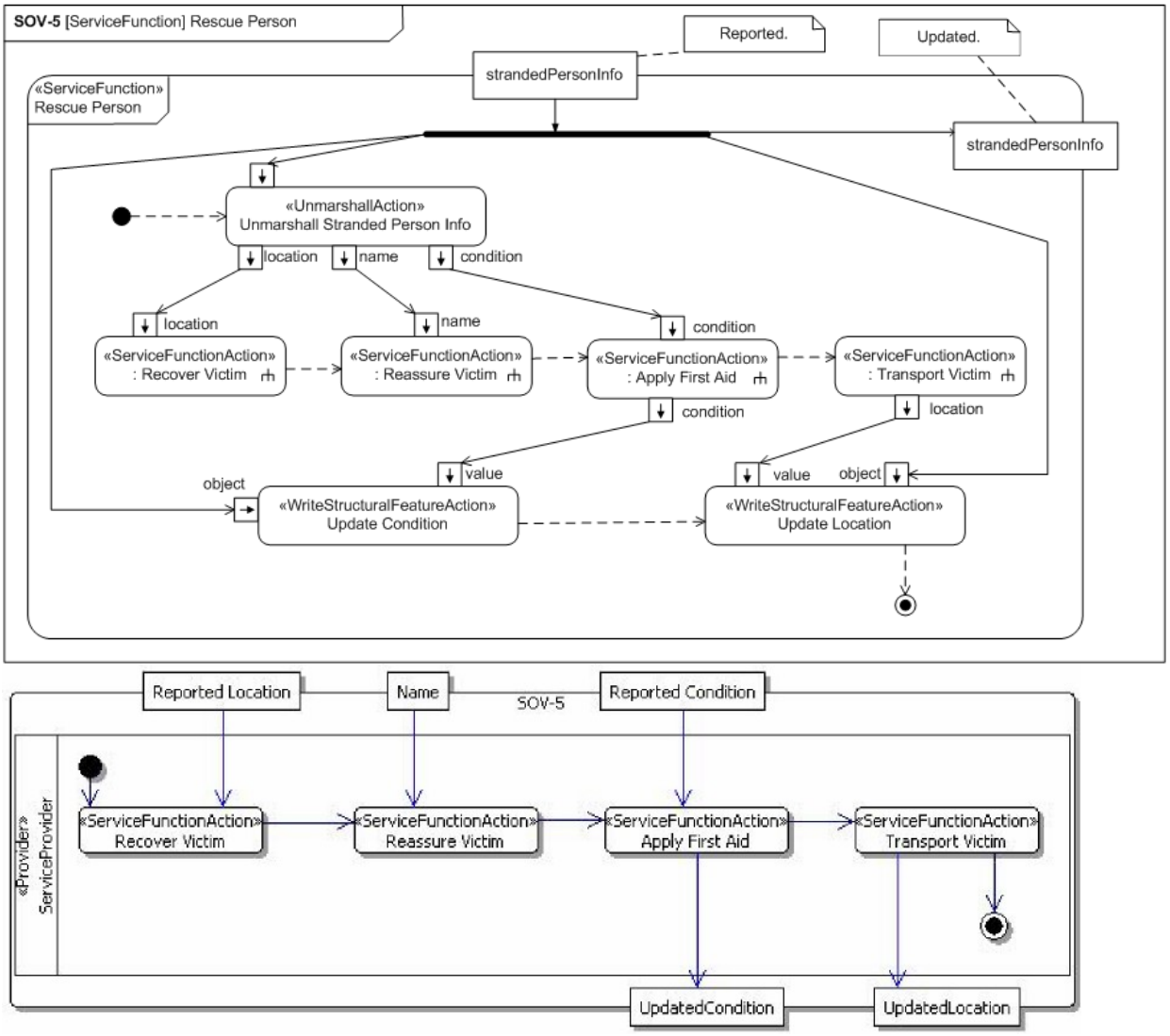


Figure C.272 - SOV-5

C.9 Systems Views

These views describe the resources that realize the SAR capabilities. They describe resource functions, interactions between resources, and can provide detailed system interface models.

C.9.1 SV-1 Resource Interaction Specification

This view defines the structure and internal flows of the Capability Configuration. Figure C.2~~3~~8 shows the Capability Configuration of a Maritime Rescue Unit. The Maritime Rescue Unit is comprised of the Maritime Rescue Team (MRT), and the roles that make up the MRT, as well as the components that enable them to fulfill their role. This example shows that the Role of Driver is filled by a MRT Member who must interact with a MR Boat.

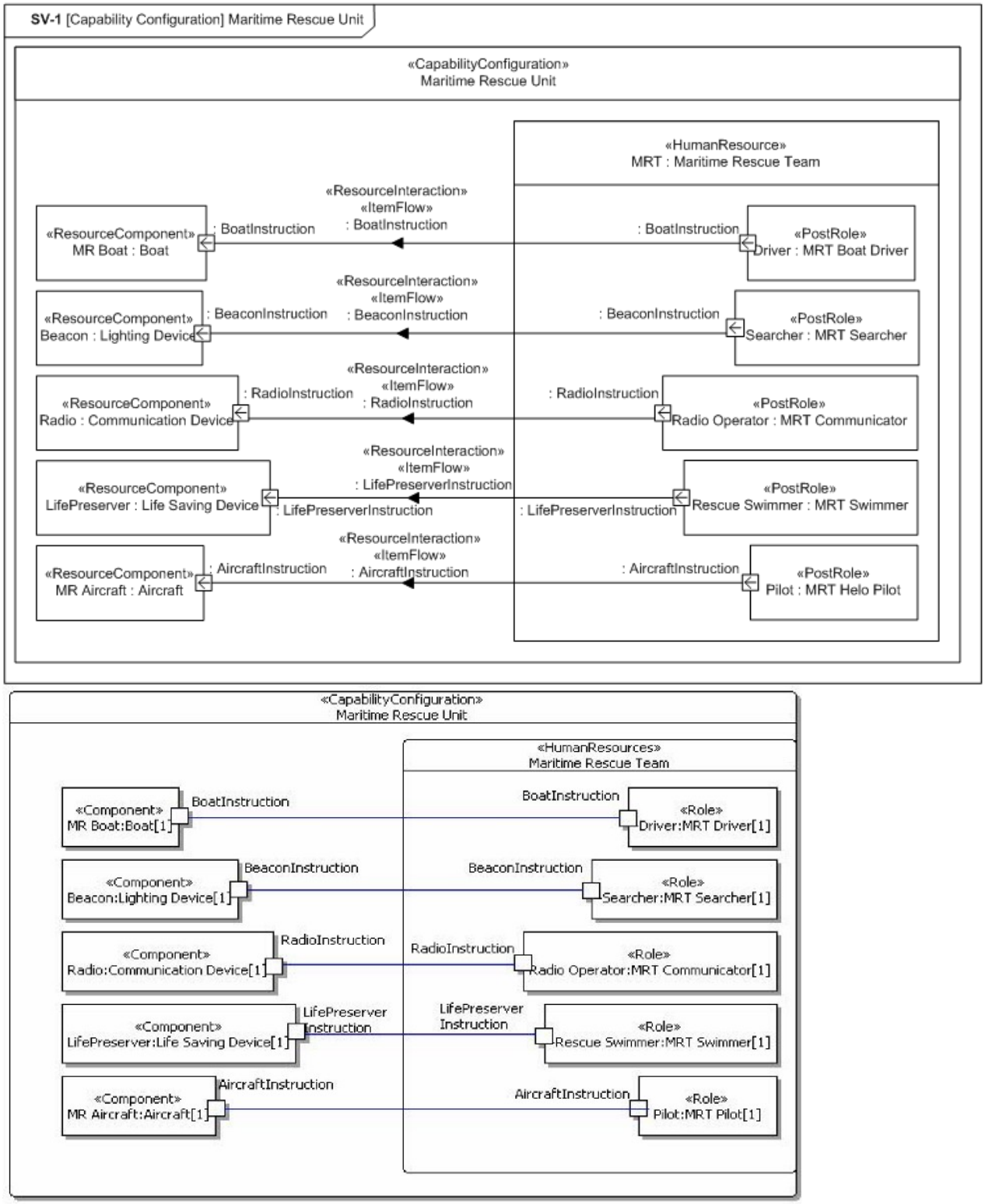


Figure C.283 - SV-1

C.9.2 SV-2 Systems Communications Description

Figure C.294 shows systems interconnections for a number of entities in a maritime search and rescue scenario.

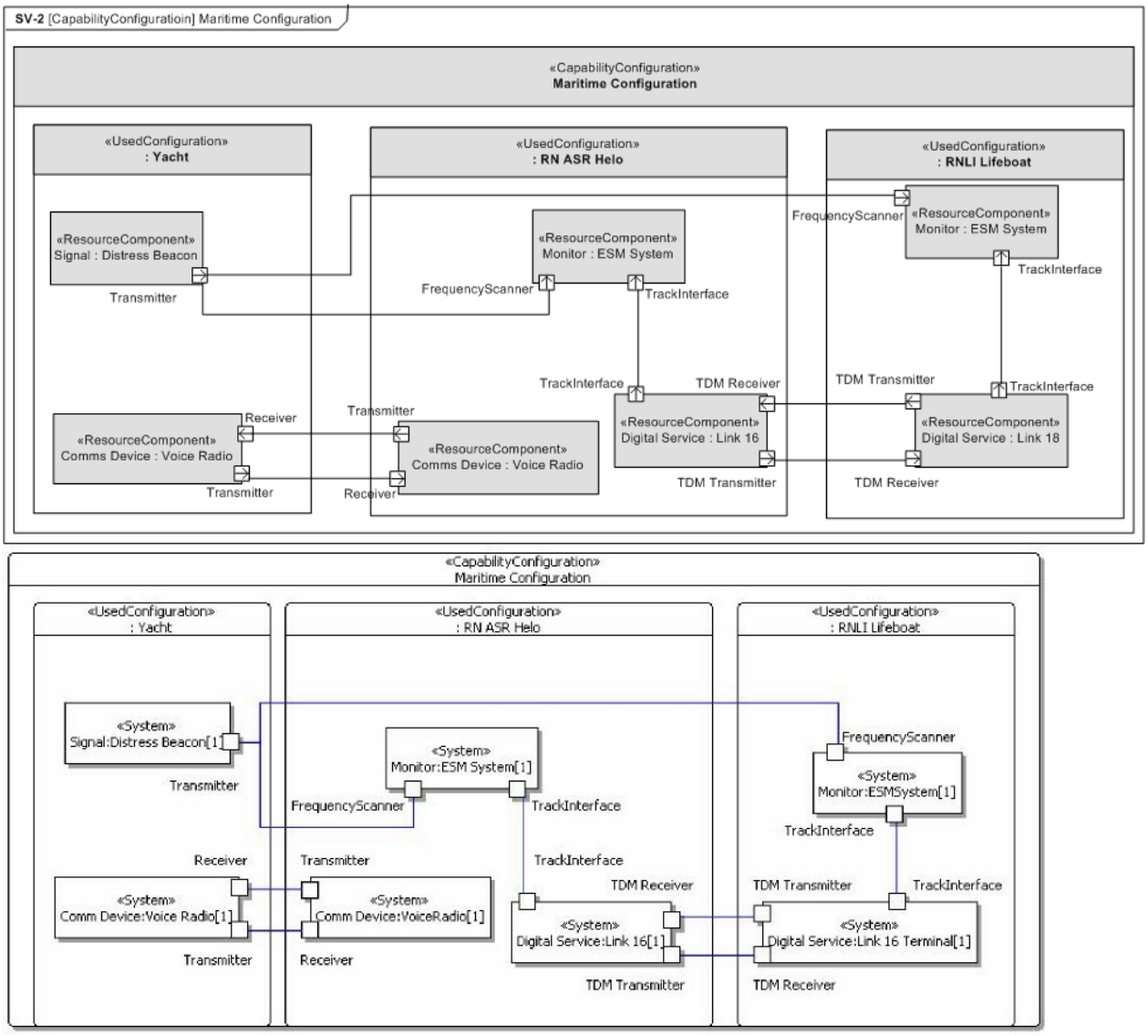
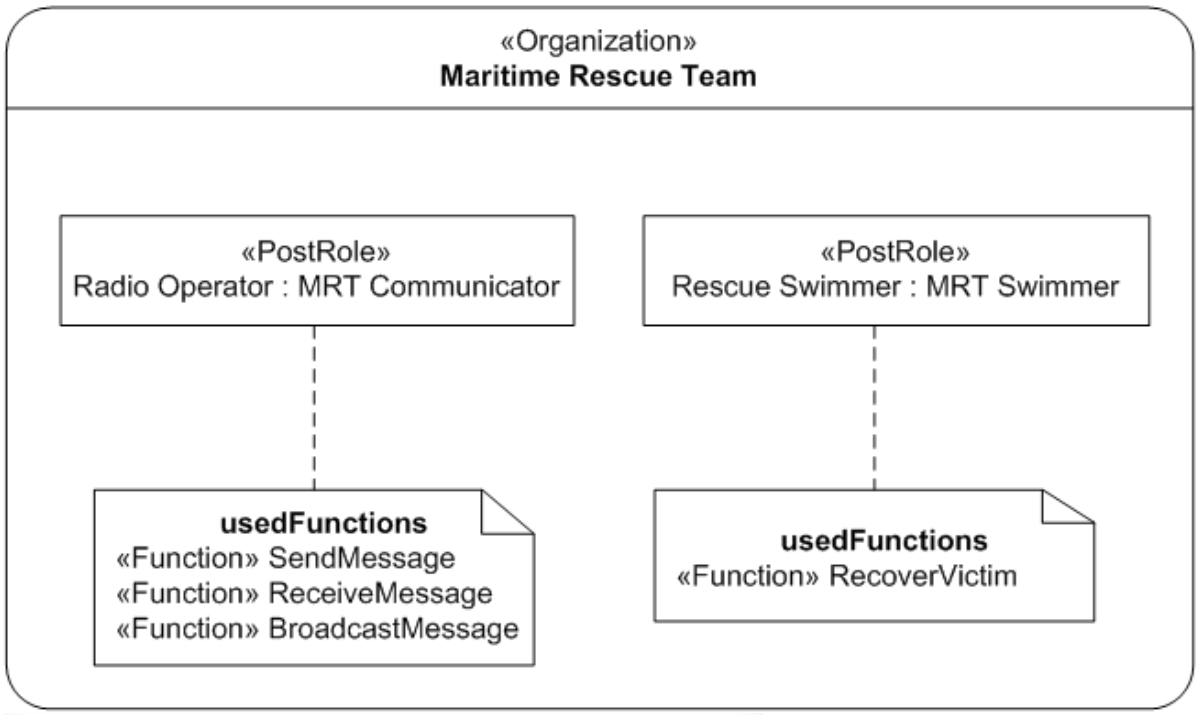


Figure C.294 - SV-2

C.9.3 SV-4 Functionality Description

This view uses Functions to describe Resources. Figure C.3025 is a mapping of resource usage to function. It shows that the Maritime Rescue Team, which is part of the Maritime Rescue Unit, consists of two Roles - Radio Operator and Rescue Swimmer, both of which are filled by MRT Members. The Rescue Swimmer performs the Function of Recover Victim. The Radio Operator performs the functions of Send Message, Receive Message and Broadcast Message.



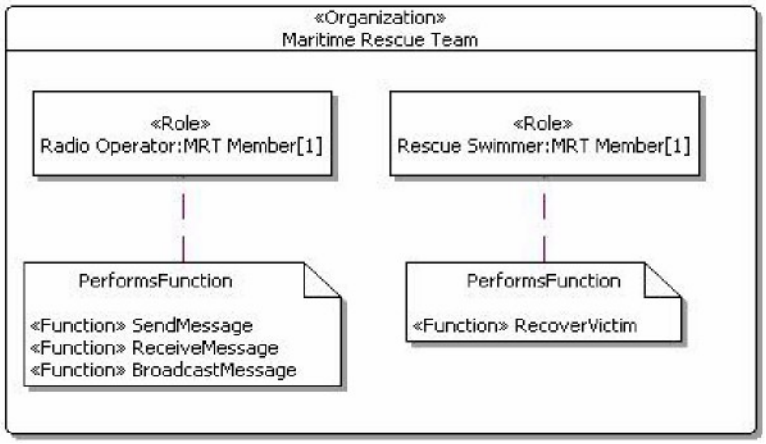


Figure C.3025 - SV-4

The below diagram describes the Resources using Functions. It shows the operational step-by-step workflows and the overall flow of control

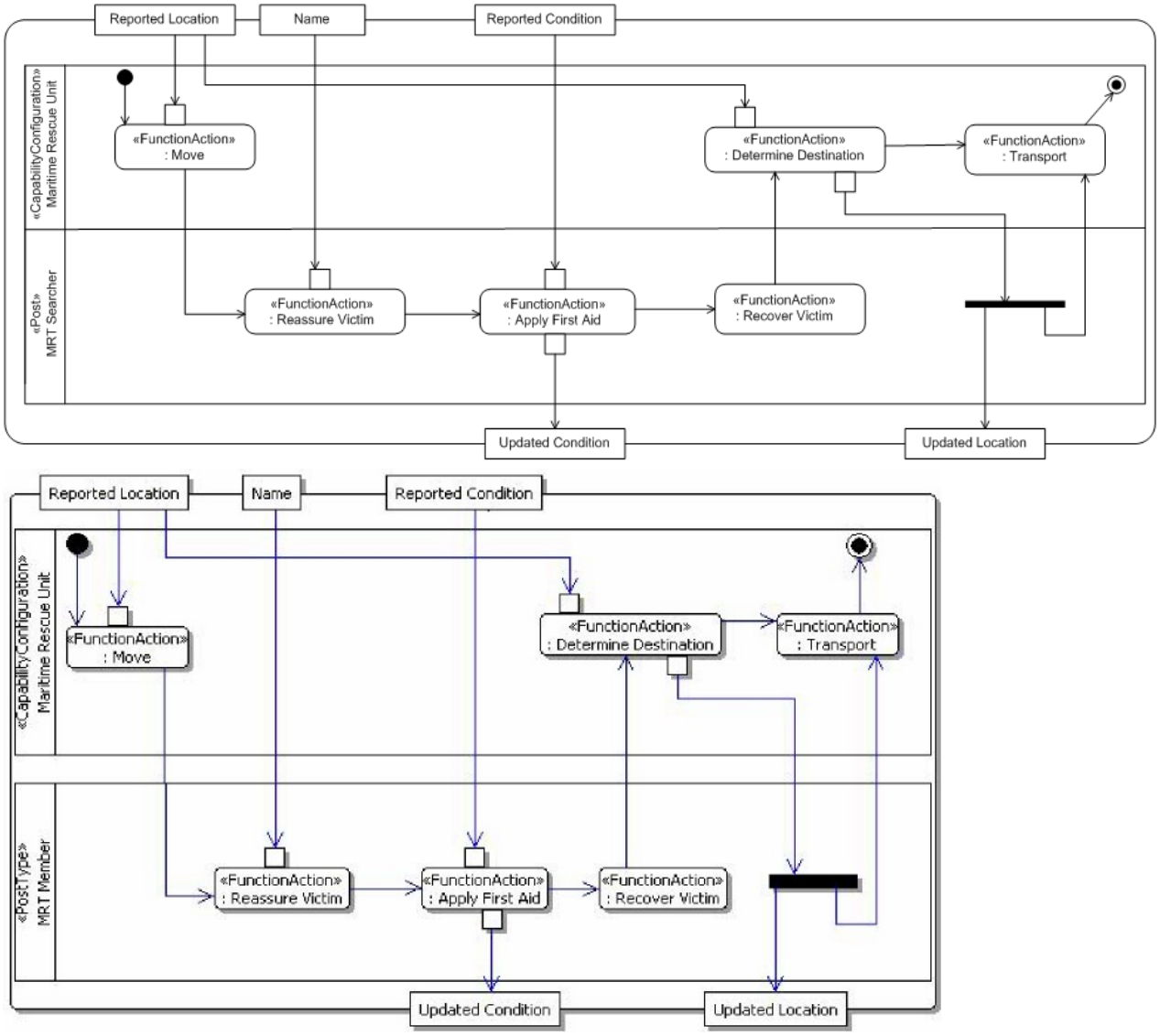


Figure C.3126 - SV-4 Activity Diagram

C.9.4 SV-7 Resource Performance Parameters

This view defines the types of measurements that are important to the Capabilities. It consists of measurable, qualitative properties. Figure C32 shows the Capability Configurations that are linked to the various measurements.

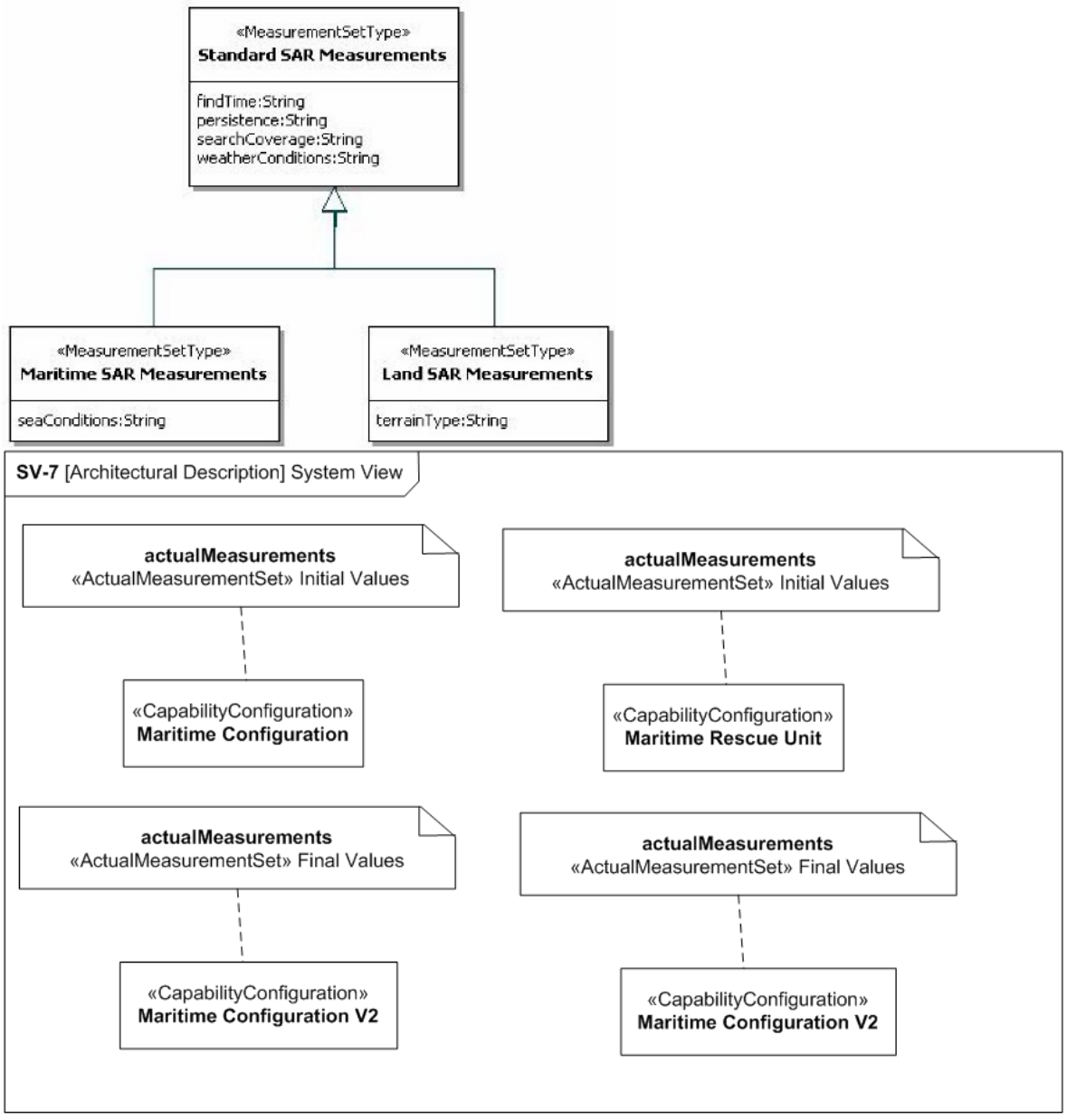


Figure C.32~~27~~ - SV-7

As shown below, the SV-7 can also be in tabular format, specifying qualitative and quantitative characteristics of resources.

Table C.54 - Alternate SV-7

Parameter ID	System/Element	Performance Requirement	Metric	Measure
				Hardware
H 1.1	Voice Radio Transmitter	Transmission rate	2	GB
H 2.1	Voice Radio Receiver	Gain	60	dB
H 2.2		Signal to Noise Ratio	20	dB
H 3.1	Signal Processor	Comms Channel Bandwidth Support	2	GB
				Software
S 1.2	Status Alerting	Min. status change alert accuracy	500	meters
S 1.3		Min. alert response time	30	seconds

[Architectural Description] System View [SV-7]

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

C.10 Acquisition Views

The Acquisition 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.

C.10.1 AcV-1 System of Systems Acquisition Clusters

The AcV- 1 represents an organizational perspective of the program. It allows the user to model the organizational structures needed to manage a portfolio of projects. The below diagram shows who is responsible for the SAR ~~Satellite Aid Tracking System~~ Project, as well as the project type.

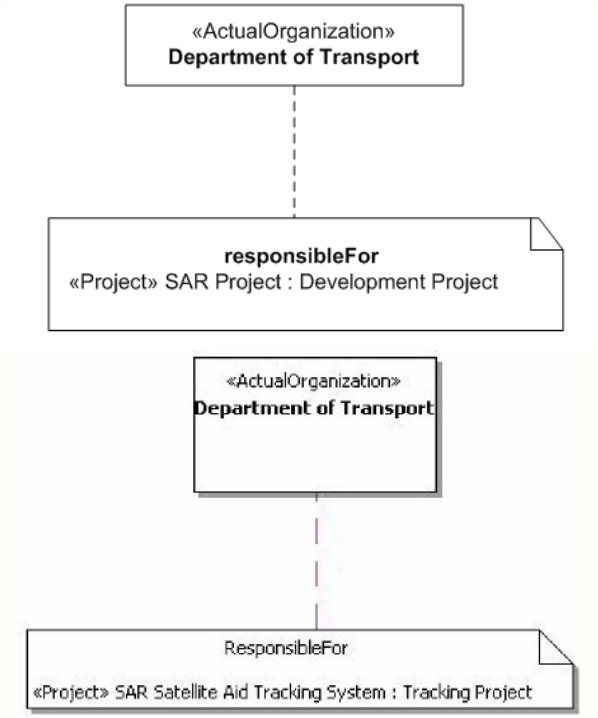


Figure C.3328 - AcV-1

C.10.2 AcV-1 Project Definitions

The AcV-1 class diagram provides a means of defining projects and project types. In this case, the development project can contain c
Development projects contain milestones containing project themes corresponding to DOTMLPF themes.

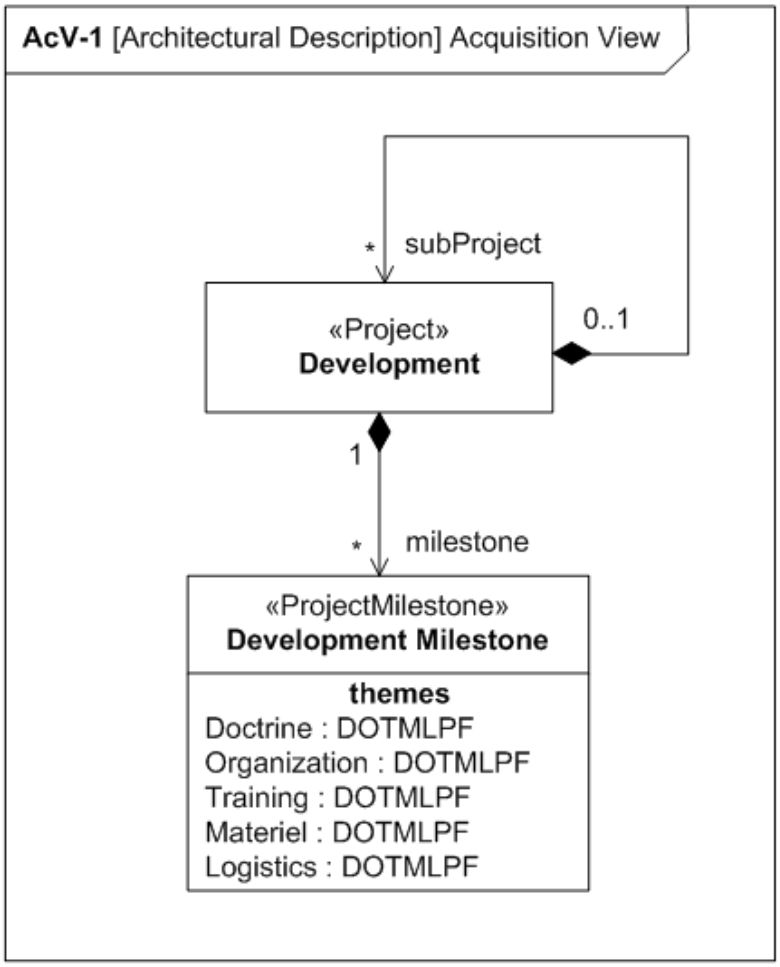


Figure C.34 - AcV-1 Class Diagram

C.10.3 AcV-1 Project Instance

The AcV-1 provides a means of defining actual projects and actual project milestones. The SAR project and Flood Response projects are both part of an Emergency Response Enhancement project. The SAR project milestones are also shown.

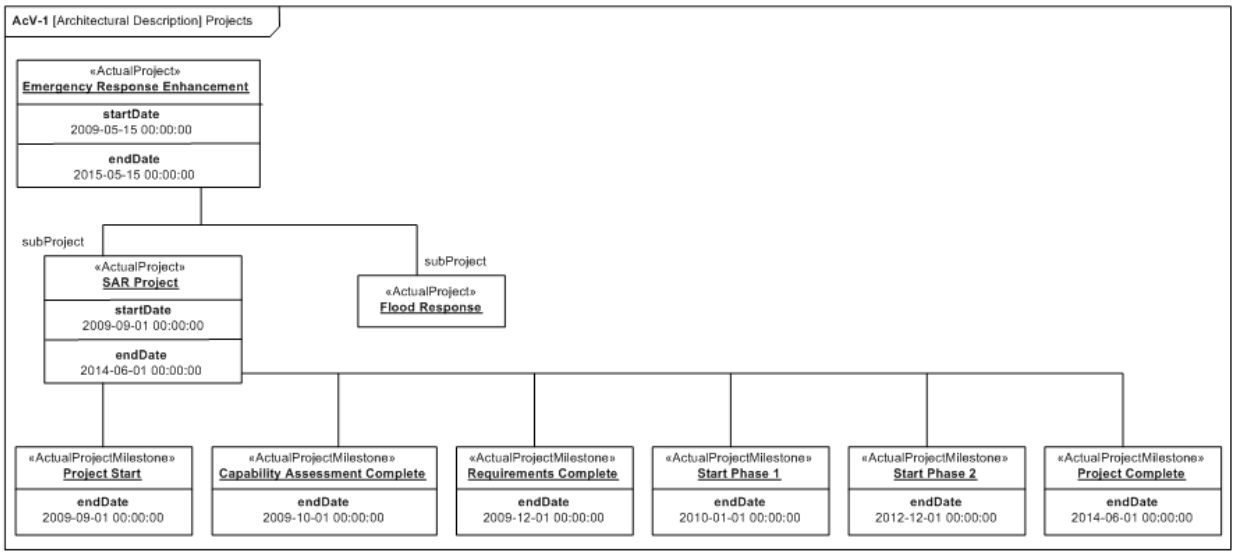


Figure C.35 - AcV-1 Typical

The project also contains increment and deployment milestones that provide a means of showing when resources are deployed and rendered out of service as well as capability increments, as shown in Figure C.36.

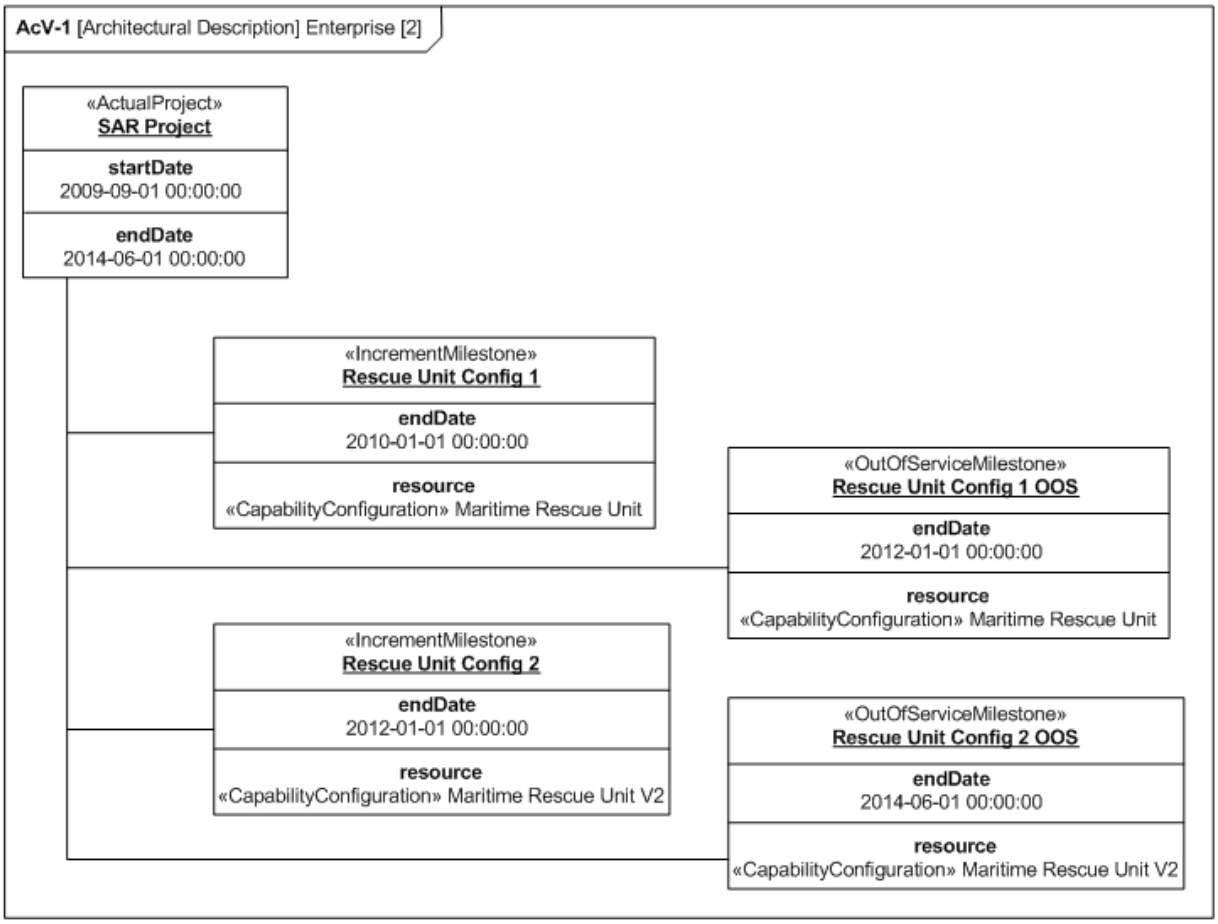


Figure C.36 – AcV-1 Additional Milestone Types

C.11 A Simple Example of SysML Parametrics

C.11.1 Definition of SysML Typedefs

The SysML Block Definition Diagram (BDD) provides a means of defining value types, units and dimensions, as shown below. The value types are the types for the measurements in Figure C.4. The units and dimensions are displayed in Table 5. This provides a clearer definition of different values being measured as opposed to real or float definitions.

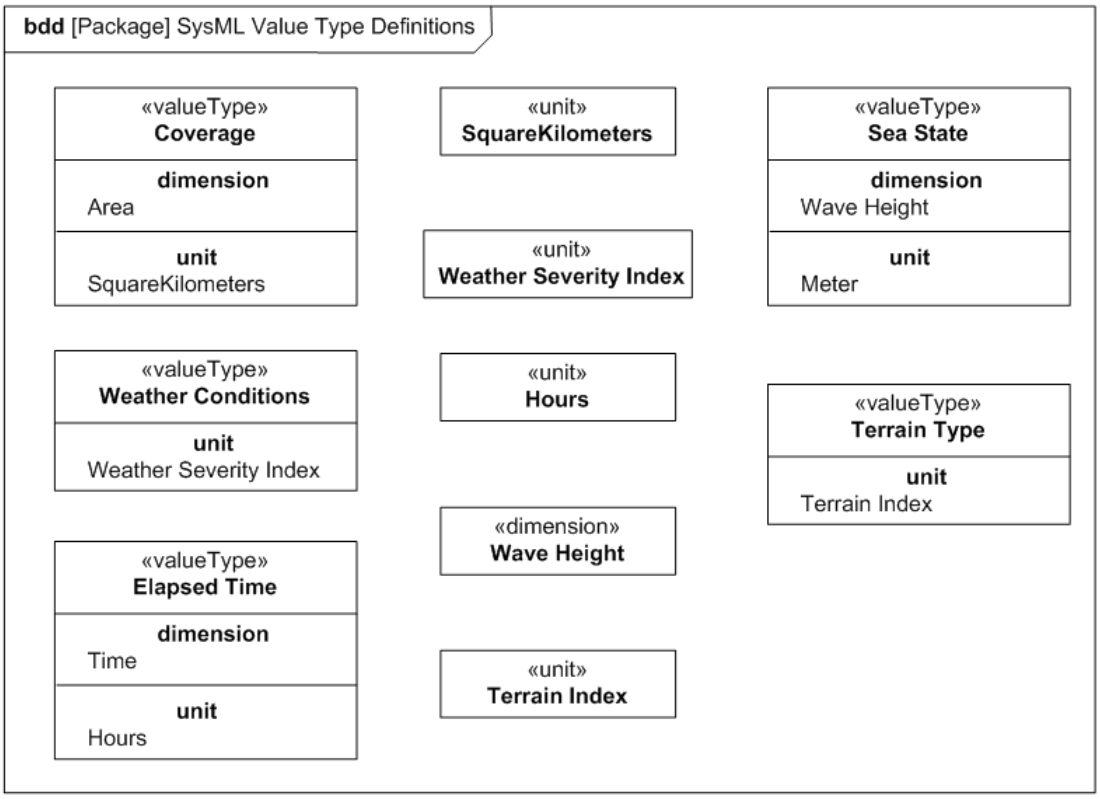


Figure C.37 – Block Definition Diagram

C.11.2 SysML Parametrics

The parametric diagram represents constraints on system parameter values such as performance, reliability and mass properties to support engineering analysis. The Parametric Diagram is a specialized variant of an internal block diagram that restricts diagram elements to represent constraint blocks, their parameters and the block properties that they bind to. An example of the parametric diagram is shown in Figure C.38.

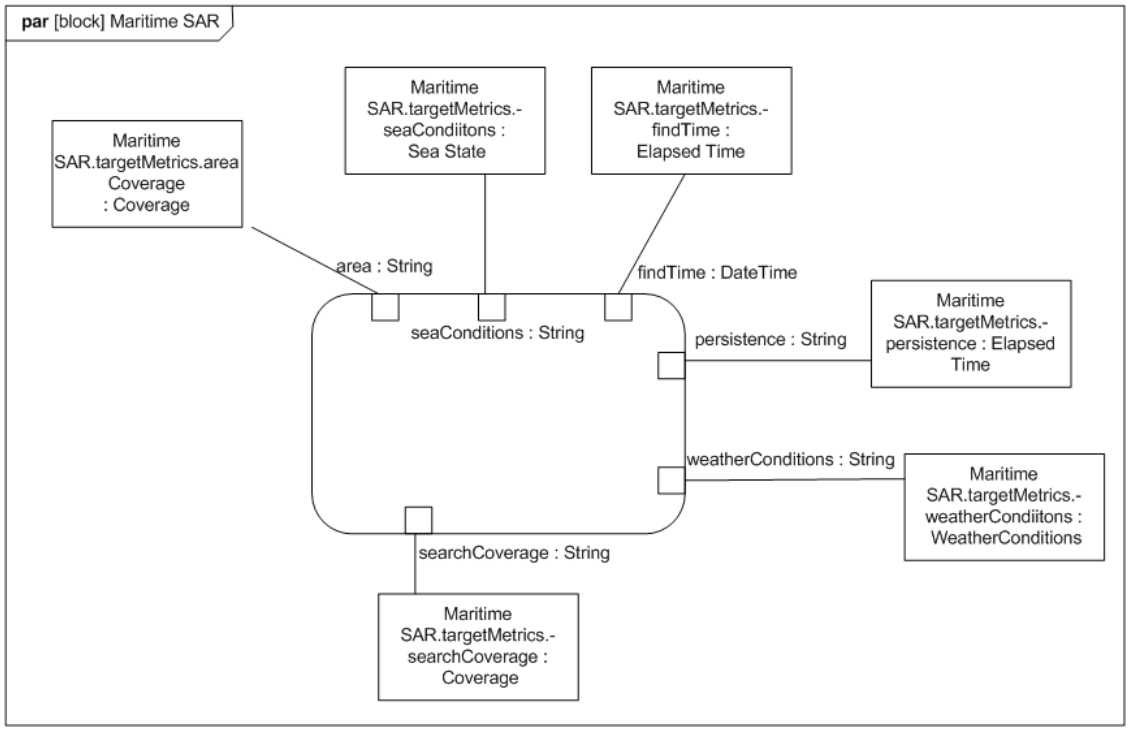


Figure C.38 – SysML Parametric Diagram