MBSE

VERTIPORT AUTOMATION SOFTWARE ARCHITECTURE AND REQUIREMENTS

CIWG Presentation on 9/2/2021

NUAIR
MAKING FUTURE SKIES SAFER

AGENDA

1 | Overview

2 | Modeling Approach

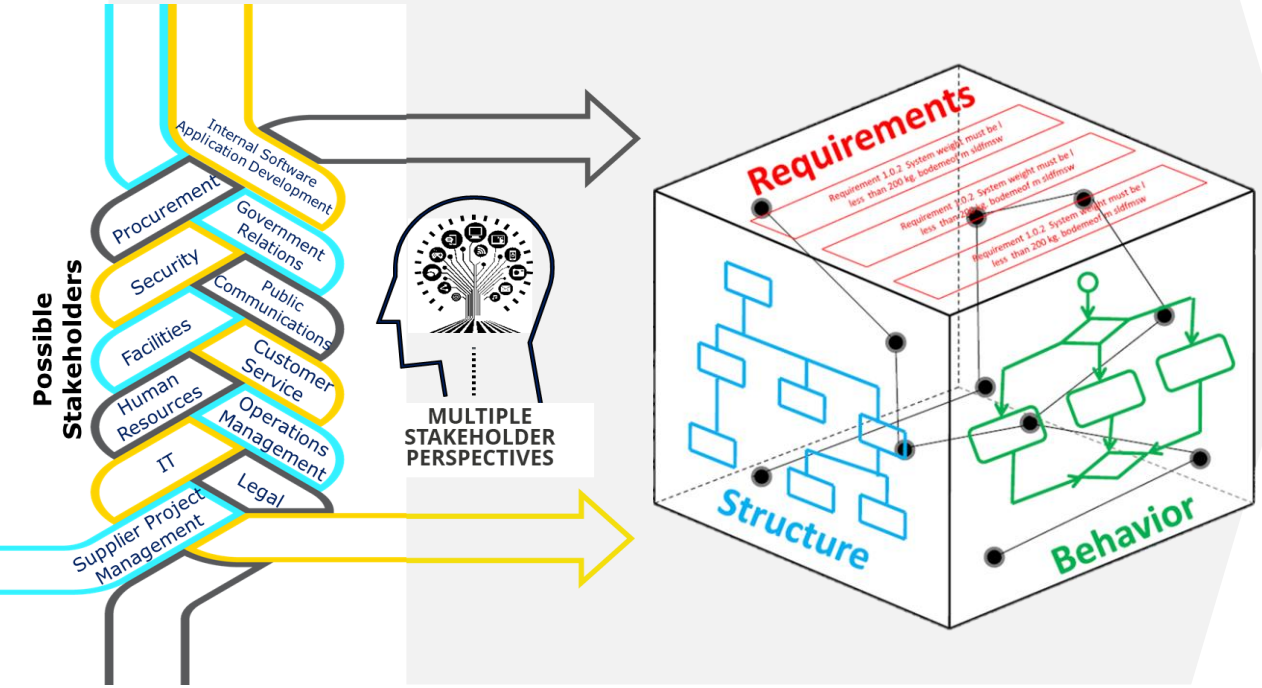
3 | Modeling Activities

4 | Model Packages & Diagram Views

5 | Model Demo

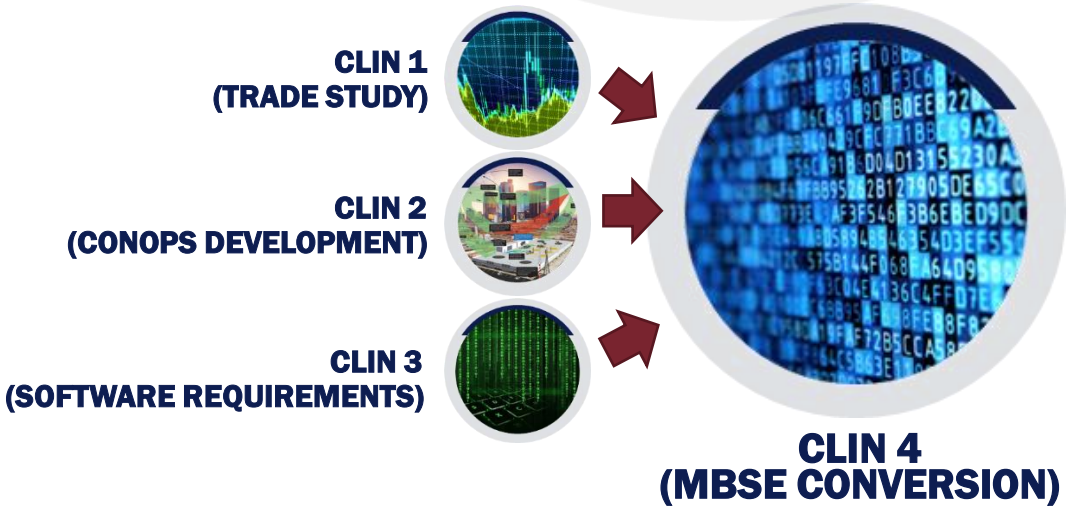
OVERVIEW

Model-based Systems Engineering (MBSE) Forges a Common Vision



Model of VAS Architecture and Requirements

Translation of VAS software architecture definitions and requirements (outputs of CLIN 1, 2, and 3) into an integrated model describing the VAS operational and functional architecture in Cameo Enterprise Architecture using Unified Architecture Framework (UAF)



MODEL APPROACH

Modeling activities leveraged outputs from CLIN 1 - 3

HDAutomatedVertiportConOps_April5th2021_Clean.docx (CLIN 2)

- This document primarily feeds the operational-level model
- Sections 4.1-4.5 provide the operational description and operational performers
- Sections 5.1-5.2 provide the operational scenarios
- Operational information captured while building the operational scenarios

CLIN 3 Final Report - Final.docx (CLIN 3)

- This document primarily feeds the systems-level model
- Services / systems hierarchy and system-to-system interfaces articulated in the model
- System / service data captured and loaded to appropriate system interfaces

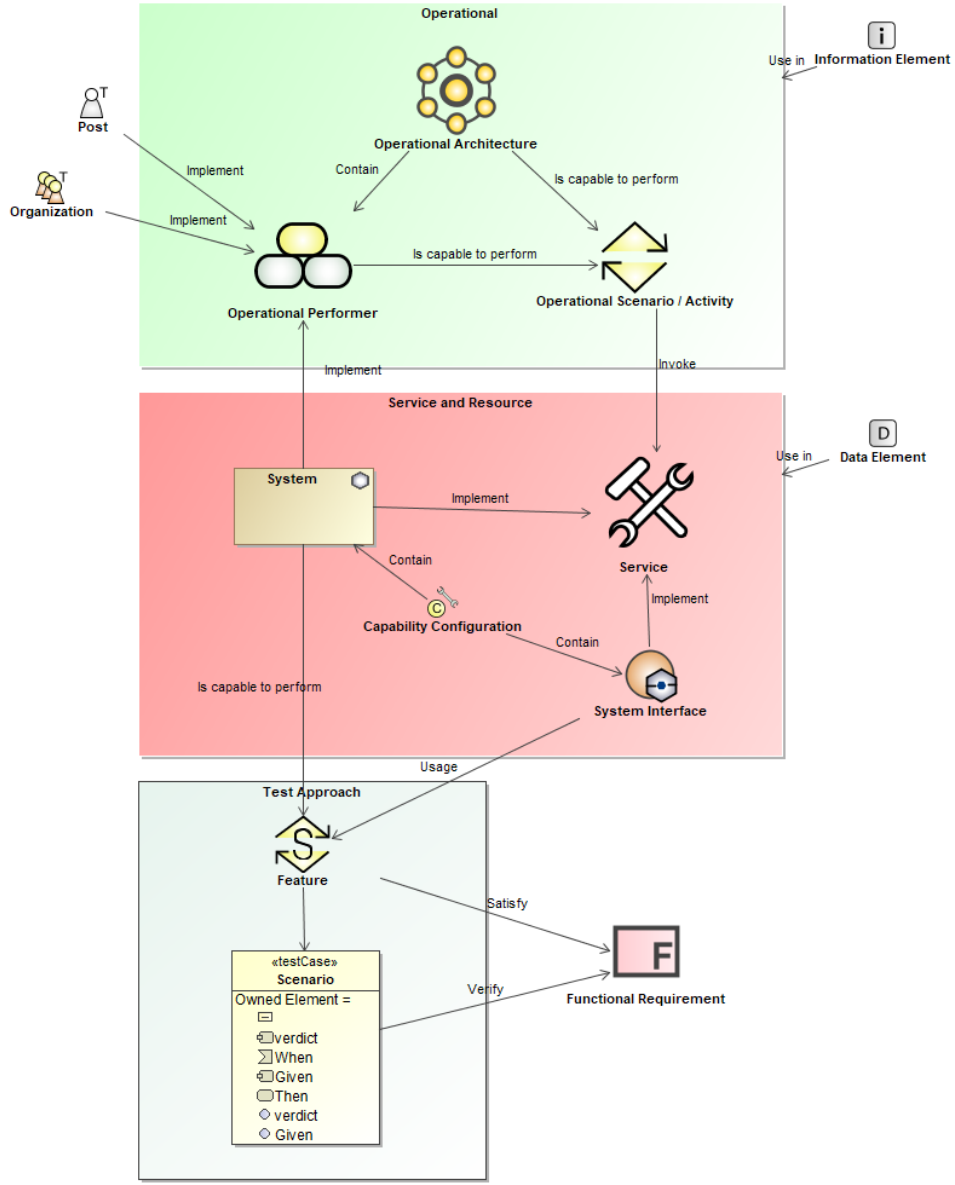
VAS Functional Requirements - Final.docx (CLIN 3)

- This document primarily feeds the Functional Requirement modeling
- Functional Requirements hierarchy and dependencies are captured
- Mapping to VAS will achieve through the Function element

VAS Software Test Approaches - Final.docx (CLIN 3)

- This document primarily feeds the modeling of Test Approaches

Model Schema



MODELING ACTIVITIES

CLIN 1-3

Inform overall structure and content of model

Package	Modeling Activities Performed
Operational	Modeled an **OV-1 and OV-2** and included OV-1 graphics Modeled **51 OV-6cs** to articulate the operational interchanges and interactions Modeled operational elements (stakeholders, services, information, and activities) and their relationships and allocations
Services and Systems	Modeled services and systems hierarchy using Service and System modeling elements Modeled **system-to-system interfaces and generated 2 SV-2s and an SV-6** Created/generated relevant diagrams (taxonomy and structure) and tables
Requirements	Modeled **289 functional requirements** and their dependencies Generated diagrams and tables to describe requirements and dependencies
Test Approach	Described **49 Features, 226 Scenarios, 405 Givens, 285 Whens, 318 Thens,** and their dependencies and allocations Modeled **226 activity flows**, and required elements (Given, When, Then), to describe the test Scenarios Created/generated **at least 9 diagrams and tables** to describe relationships with other modeling elements
Acronyms and Glossary	Included compilations from source documents (**177 acronyms and 17 glossary terms**)
Model Schema	Created to describe model elements and their relationships in this modeling effort
Model Guide	Provide a high-level guide to the model structure and modeling notation to assist in model consumption and utilization

CLIN 2

Major input into

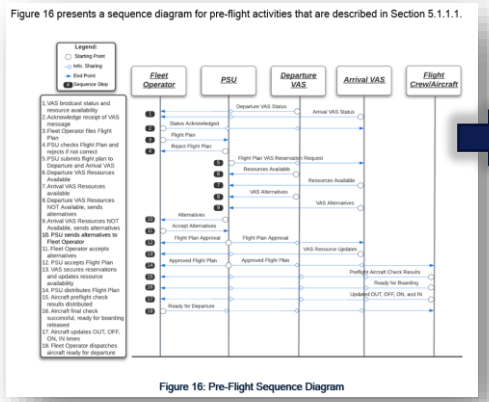
CLIN 3

Major inputs into

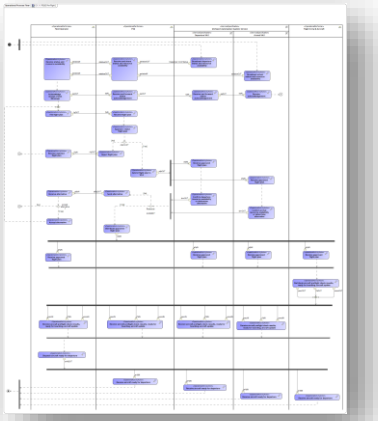
MODEL BASED REPRESENTATION EXAMPLES

Operational and functional architecture artifacts & properties from CLIN 1-3 content are translated into the appropriate model elements and diagrams

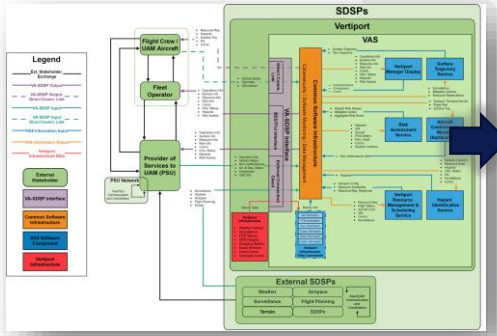
HD Automated Vertiport ConOps Document - Operational Scenario (CLIN 2)



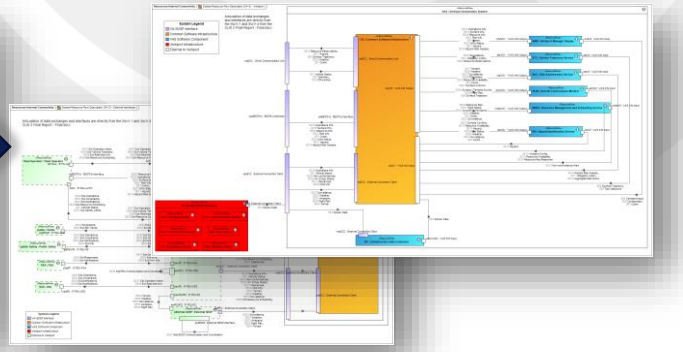
VAS Operational Scenario in Model



CLIN 3 Final Document - SvcV-4 (CLIN 3)



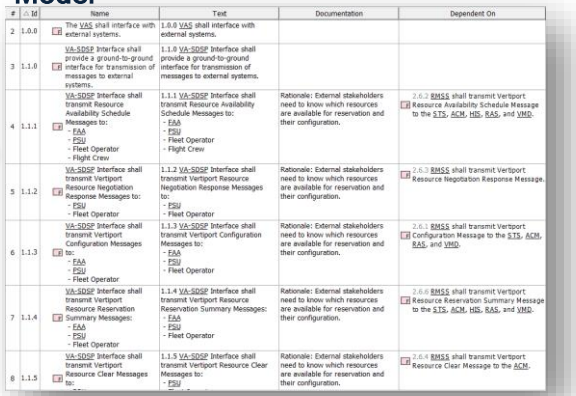
VAS Software Architecture - SV-2s in Model



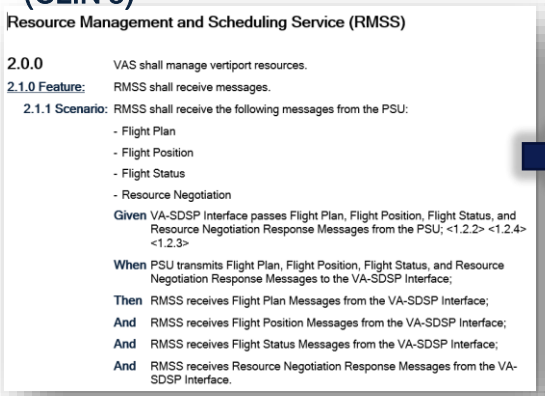
VAS Functional Requirements Document (CLIN 3)

ID #	Requirement	Dependencies	Rationale
VAS 1.0 Vertiport Automation VAS shall interface with external systems.			
1.1.0	VA-SDSP Interface shall provide a ground-to-ground interface for transmission of messages to external systems.		
1.1.1	VA-SDSP Interface shall transmit Resource Availability Schedule Messages to: - FAA - PSU - Fleet Operator - Flight Crew	2.6.2	External stakeholders need to know which resources are available for reservation and their configuration.
1.1.2	VA-SDSP Interface shall transmit Vertiport Resource Negotiation Response Messages to: - PSU - Fleet Operator	2.6.3	External stakeholders need to know if their reservation request has been confirmed or denied.
1.1.3	VA-SDSP Interface shall transmit Vertiport Configuration Messages to: - FAA - PSU - Fleet Operator	2.6.1	External stakeholders need to know the vertiport configuration.
1.1.4	VA-SDSP Interface shall transmit Vertiport Resource Reservation Summary Messages: - FAA - PSU - Fleet Operator	2.6.6	External stakeholders benefit from metrics regarding the number of resource request and the subsequent approval and denial metrics.
1.1.5	VA-SDSP Interface shall transmit Vertiport Resource Clear Messages to: - PSU - Fleet O	2.6.4	External stakeholders are notified that the landing pad is clear of obstacles just prior to the aircraft landing as an additional layer of safety.

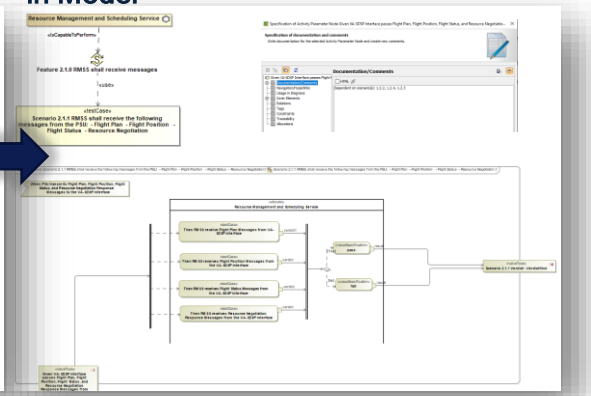
VAS Functional Requirements Table in Model



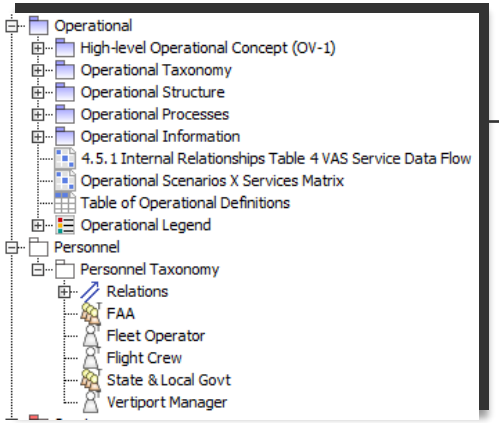
VAS Test Approach Document (CLIN 3)

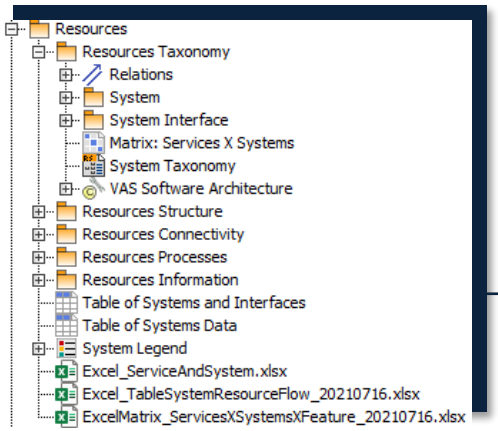


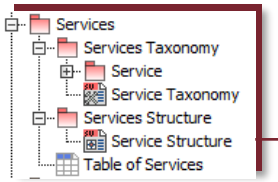
VAS Test Approach as SysML Activity Flow in Model

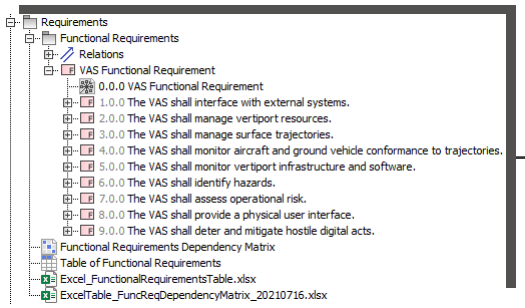


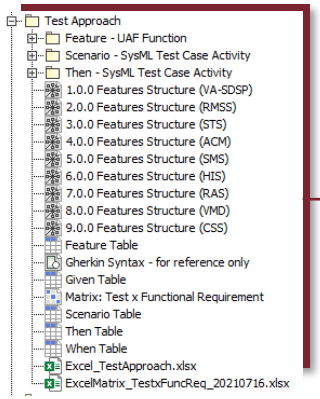
MODEL PACKAGE & DIAGRAM VIEWS





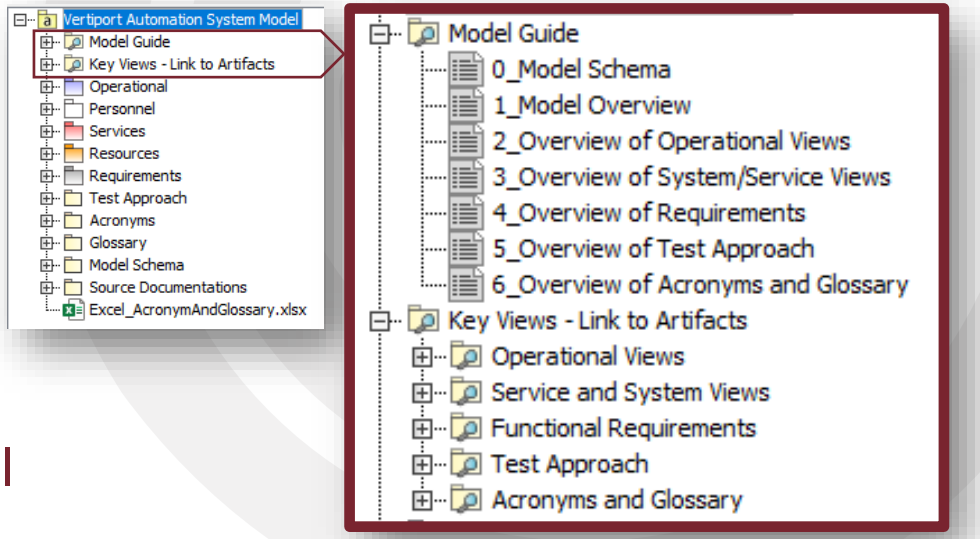






UAF Diagram Types	Intended Use of Diagram
Operational High-level Taxonomy	To demonstrate high-level operational context (from DoDAF OV-1)
Operational Structure	To define operational architecture and operational performers
Operational Connectivity	To demonstrate logical exchanges between the operational performers (from DoDAF OV-2)
Operational Processes	To demonstrate the operational scenarios as defined in the ConOps
Service Taxonomy and Structure	To define services (from DoDAF SvcV-1)
Resource Structure	To define hierarchy decomposition of services as systems
Resource Connectivity	To demonstrate message exchanges between the resources (from DoDAF SvcV-4)
Requirements Diagrams	To align functional requirements to resources using the “Satisfy” relationship
Requirements Table and Matrix	To demonstrate hierarchy of functional requirements and their dependencies (from VAS Functional Requirements)
System Functions and Test Case Activities	To define the test approach (from Gherkin Syntax)

MODEL DEMO OVERVIEW



The objective is to show:

the model elements and diagrams capturing the VAS operational, service and system architectures, functional requirements, and test approaches in Cameo EA,

while demonstrating how the integrated VAS architecture model can further mature through these modeling use cases:

- ✓ Add a new element or change an existing one
- ✓ Use export to and sync with MS Excel functionality to add / change a lot of info
- ✓ Use Dependency Matrix to add / change associations to other modeling elements

- ✓ Show how change in element definitions / properties / allocations are automatically reflected across all diagrams that uses it
- ✓ Show how modeling tool actively validates changes to model

- ✓ Show reports that are readily available for use through tool
- ✓ Show how reports can be customized for creation and maintenance of required deliverables / artifacts

QUESTIONS?

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