Collaborating with OpenMBEE as an Authoritative Source of Truth Environment

Benjamin Kruse, Sc.D.
Systems Engineering Research Center
Systems Engineering Research Center (SERC)

Collaborating with OpenMBEE as an Authoritative Source of Truth Environment

By:
Benjamin Kruse, Sc.D.
Mark Blackburn, Ph.D.
Certain commercial software products are identified in this material. These products were used only for demonstration purposes. This use does not imply approval or endorsement by Stevens, SERC, or ARDEC, NAVAIR, nor does it imply these products are necessarily the best available for the purpose. Other product names, company names, images, or names of platforms referenced herein may be trademarks or registered trademarks of their respective companies, and they are used for identification purposes only.
• Authoritative Source of Truth & Surrogate Pilot

• OpenMBEE Overview
  — Model Development Kit (MDK) & DocGen
  — Model Management System (MMS)
  — View Editor

• Results
  — Digital Signoff Mechanism
  — Guidelines and Findings
    o Project Usage & User Permissions Example
  — Issues & Suggested Improvements
• Authoritative Source of Truth (AST)
  — To provide consistent data in the format necessary for the given task
  — Implemented by OpenMBEE = Open Model Based Engineering Environment, developed by NASA/JPL

• Surrogate Pilot
  — Execution of NAVAIR’s Systems Engineering Transformation (SET) Framework
  — To simulate collaboration in an AST
  — To support new operational paradigm between government and industry
    o By elimination of paper artifacts and large-scale design reviews in favor of continuous insight/oversight via the digital collaborative environment
Surrogate Pilot Scenario: Skyzer UAS

Graphical CONOPS Scenario: Search & Rescue

Skyzer System & Mission Models developed using SysML

Airfoil designation for a similar Bell tilt-rotor (BA609)
OpenMBEE: MDK, MMS & View Editor

MDK in Magicdraw: DocGen with View and Viewpoint Hierarchy

Model Management System (MMS)

Visualization in View Editor
What is MDK?

Plugin for Magicdraw, to support building system assemblies through modeling augmentation and validation, enable syncing with MMS and using the DocGen language for model-based document creation using views and viewpoints

Content
- Systems Reasoner
- MMS Sync
- DocGen
DocGen

- For model-based document creation based on Views and Viewpoints
  - To generate views for View Editor or PDFs
  - To guide modeling and development

**Chapter 2: View 2**

- Block 1
- Block 2
Model Management System (MMS)

• What is MMS?
  — A version control system for structured data, including versioning, workflow management, and controlled access through RESTful web services
  — Used as central data hub to facilitate multi-tool and multi-repository integration across engineering, computing, and management disciplines

• To store SysML model data
  — Capturing all model elements (e.g., classes, instances, relations, but not: diagram layout), including their change history and views for View Editor

MDK: View and Viewpoint Hierarchy

View Editor: Provides Rich Web Interface
• What is the View Editor?
  — A web app to provide consistent DocGen views on live SysML data, to allow interaction with model elements outside of the case tool

• To communicate through and edit model-derived documents
  — Provide AST data access to non-modelers
  — Editing of exposed model elements (e.g. placeholders for new elements) and addition of presentation elements (e.g. text, videos, etc.) and comments

MDK: View and Viewpoint Hierarchy

View Editor: Provides Rich Web Interface
View Editor: Commenting & Cross-Reference

Exposed Diagram

Request for Information (RFI) with Views/Chapters

Documentation of Diagram

Cross-Reference to UAV term
View Editor: History Comparison

Statement of Work (SOW), Section C

Comparison towards read-only RFP Tag

Cross-Reference to following View/Chapter

Government Computer Models
- Skyzer IM20 Mission Model (v.15) with Views in IM90-20 model (v.29)
- Skyzer IM30 System Model with own Views (v.39) and Views in IM90-30 model (v.35)
- Skyzer IM30 Evaluation Model with own Views (v.35) and Views in IM90-30 model (v.35)

Used tools:
- Magicdraw 18.5 SP3 or Cameo System Modeler 18.5 SP3
- MDK plugin v. 3.3.6
- MMS v.3.2.2
- View Editor v.3.2.1
- Teamwork Cloud 18.5 SP

3. Requirements
3.1 General

The work required by this contract shall be performed in accordance with System Requirements contained in Skyzer System Model (SM) and this Statement of Work (SOW). The contractor shall design, develop, fabricate, test and deploy the complete Skyzer Maritime SAR system in accordance with the detailed tasking in paragraph 3.2 Detail Tasks below. All contract activities are to be completed within 48 months after contract award.
Digital Signoff

Digital Signoff for cross-referenced elements in View Editor, to support transition from document-based to model-based documents

<table>
<thead>
<tr>
<th>Approved Elements</th>
<th>Risk</th>
<th>Approval Status</th>
<th>Approved By</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Performance in Evaluation Context</td>
<td>high</td>
<td>Value:</td>
<td></td>
<td>Criteria SRR-II 1.b - KPP are achievable</td>
</tr>
</tbody>
</table>

Signoff target: General…
Approval status: undefined
Last changed by: Admin
Last changed at: 02/22/2019, 10:43:51

Captured signoff & model information in AST (including who and when)
• View Editor offering views on consistent data from AST, improving communication between modelers and other stakeholders
  — Through access on consistent AST data without SysML or tool knowledge
    o Enabling transition from document-based to model-based development
  — Through central model-based data representation
    o Improving traceability by searching, comparing and cross-referencing of elements in MMS in the View Editor
  — Adopted GitFlow\(^1\) workflow for collaboration and reviews with branches and tags
  — Implemented Digital Signoff mechanism
    o Supporting transition from static documents to live model-based views, by referencing model elements to be approved
  — Implemented Issue Tracking with AST access, referencing model elements and comments in the View Editor

\(^1\) https://www.atlassian.com/git/tutorials/comparing-workflows/gitflow-workflow
• Use of DocGen & Viewpoint Library
  — Model-based document generation using DocGen, enabling fast and useful design iterations
  — Providing standardized viewpoints to quickly create consistent documents
    o Most viewpoint needs covered by the provided elements and OCL\(^1\) constraints
    o Few modelers need to be familiar with DocGen
    o Allowing pre-planned view hierarchies to guide modeling by defining model structure and required content

• Required Modeling Considerations
  — Consistent model structure to ensure viewpoints finding model elements
  — Keeping document creation in mind while modeling
    o E.g. limiting diagram size and adding documentation
  — Project usage mechanism for modularization, reuse, partitioning, traceability and user access

---

1) OCL = Object Constraint Language
Project Usage & User Permissions: Example

- Editing & commenting in the Mission View Model, without permission to directly change exposed requirements from Mission Model
- Creating issues in Issue Tracking Model, e.g. using prior comments
• Issues
  — Errors preventing project usages in Teamwork Cloud
  — Inconsistent document representation between SysML tool and View Editor
  — View Editor creating names for elements unable to have a name in SysML (fixed)

• Suggested Improvements
  — Utilizing open access to AST data, e.g. for ontological reasoning
  — Augmented cross referencing in View Editor, e.g. for SysML term elements
  — Improved creation of model elements in View Editor, e.g. using MapleMBSE
  — Improved reviewing in View Editor, e.g. with a change request process involving tracked issues and signoffs that may prevent changes without an reversed approval status and notifications
  — GitHub: [https://github.com/Open-MBEE](https://github.com/Open-MBEE)
  — OpenMBEE Public Server Information:

• Surrogate Pilot
  — Apan SET Surrogate Pilot Group:
  — View Editor: [http://ime.sercuar.org/alfresco/mmsapp/mms.html](http://ime.sercuar.org/alfresco/mmsapp/mms.html)
    (Login instructions available on Apan)
Thank you!

Dr. Benjamin Kruse
Research Assistant Professor
School of Systems & Enterprises
Systems Engineering Research Center
Stevens Institute of Technology