Model Based System Engineering Tools and Reliability – A Case Study

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Abstract

Systems are the functional parts of our world, consists of its own boundary, components, and interconnections. Systems can be natural or human-made. Systems engineering is a transdisciplinary and integrative approach to enable the successful realization, use, and retirement of engineered systems, using systems principles and concepts and scientific, technological, and management methods (Vincoli, 2014). Aviation is one of the most complex systems, adapting Model Based Systems Engineering tools and methodologies in aviation research and operations can assist in streamlining key workflows, simulate and analyze potential loopholes and risks, and make updates to the model for future improvements. This research investigated some MBSE tools and assessed their potential application in aviation (sysml.org, n.d.)

Background

System Markup Language (SysML) based models are prevalent in Model-Based System Engineering. These models are system relationship models and help show relationships among system functions, requirements, developers, and users. These models support three aspects of systems engineering: **System Functional Flows (i.e., System Architecture), System Requirements Traceability, System and Organizational Process Flows (**mbseworks, n.d.**)**

There are software as a service (SasS) companies providing industry standard solutions for Model Based Systems Engineering, and System lifecycle management. In this research some of the leading software solutions for Model Based Systems Engineering are used to perform demonstration systems models (Bocciarelli et. al., 2013).

An engineered system is a system designed or adapted to interact with an anticipated operational environment to achieve one or more intended purposes while complying with applicable constraints. A systems engineer focuses on designing a system to meet stakeholder objectives (Ericson, 2005). Model-based systems engineering (MBSE) is the formalized application of modeling to support system requirements, design, analysis, verification and validation activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases (sysml.org, n.d.).

Research Deliverables

To show:

1. *How MBSE assists in decision making?*
2. *How MBSE helps aviation industry in relation to safety operations?*

Methodology

There are several modeling approaches, the Traditional, Top-Down Systems Engineering approach's diagrams such as Block diagram, N2 diagrams, Functional flow block diagram, Data flow diagram, IDEF0, etc.
A software from Vitech corporation called CORE was used to construct an elevator system (Vitechcorp, n.d)

The schema for engineering the system is shown in the figure 1 & 2, to engineer the **airport escalator system**, a metasystem is first constructed using a case diagram, followed by sequence diagrams constructed for systems interaction and reliability calculation.
There are a continuous list of relationships used for the interactions in a CORE, these are shown in the figure 1 & 2, the diverse relationships captures the complexity of the system for constructing analytical models.

Figure 1
CORE Metasystem – case system

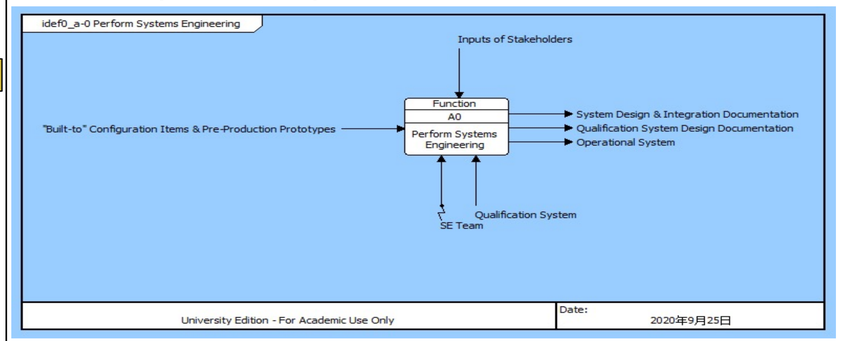
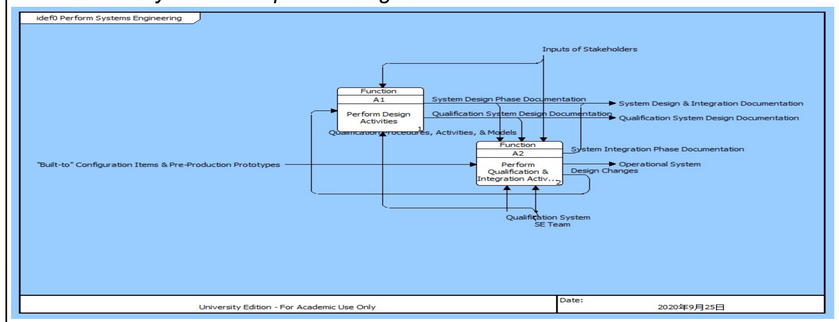


Figure 2
CORE Metasystem – sequence diagram



Finding

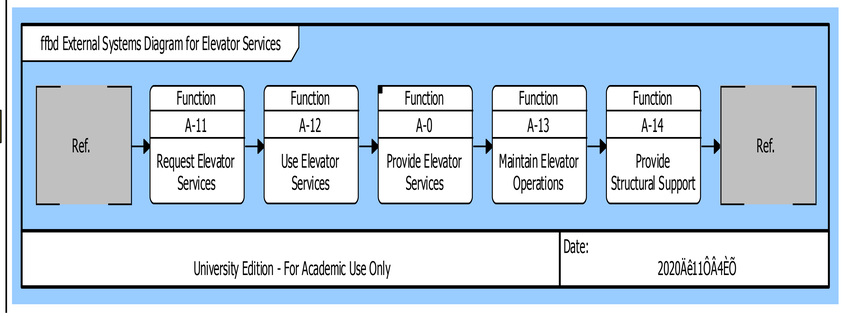
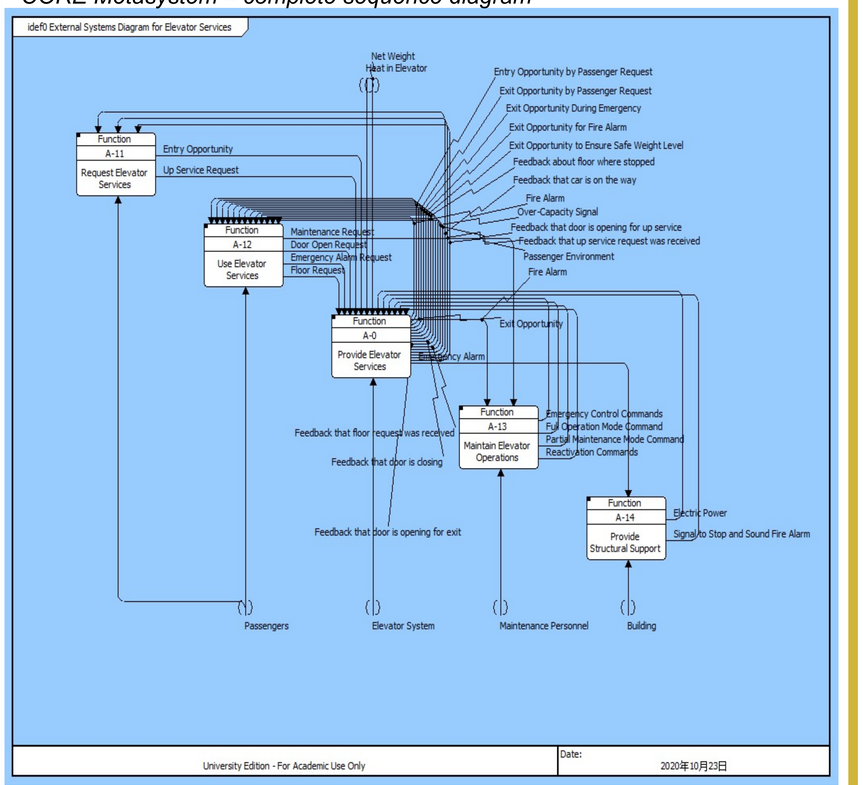


Figure 3
CORE Metasystem – complete sequence diagram



Conclusion

Based on the modeling experience using interactive CORE, Model-Based System Engineering is helpful for engineering success, helping decision-making early in the lifecycle. High return on investment and prove for future improvements are all properties of model-based systems engineering. Aviation can utilize this practical methodology of model-based system engineering to improve safety and operation efficiency.

References

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