

# **MBSE in an SME Context**

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## **1 Introduction**

The directorate of Telecommunications and Integrated Applications (TIA) work with a number of small satellite companies. Most of these companies use document-based methods to perform systems engineering activities. Due to intense commercial pressures, fast development with shorter lead times and lower costs is becoming important for small satellite companies. This paper presents the evaluation of MBSE in an SME context. Particular attention will be paid to the needs of an SME and assessing whether MBSE aligns well with those needs.

## **2 Context**

Increasing competitiveness within the space industry drives companies to constantly want to improve their service; whether that's improving the quality of their product or improving development times. SMEs face many challenges from their fast-paced environment to communicating with colleagues and stakeholders. MBSE could be a solution by providing a source of truth, enabling reusability and providing strong traceability between the design work created. However, MBSE comes with many challenges. Adoption of MBSE is not an easy process with factors such as procuring and cost of licenses, training your workforce on how to use the tool and integrating MBSE into the existing development process needing to be considered.

The aim of this investigation is to explore the potential benefits of MBSE to support new space in the rapid development of new missions with reduced lead times and at lower associated costs. In order to assess the effectiveness of MBSE in the satellite design process; literature reviews, modelling within the tools and interviewing SMEs about their systems engineering practises were performed.

## **3 Methodology**

To evaluate the research question, three main approaches were used to gather information on the benefits and drawbacks of MBSE and the systems engineering practices of SMEs. The following describes each approach:

### **3.1 Literature Reviews**

Literature reviews were performed on a number of journal articles. The articles reviewed touched on many topics such as the adoption and implementation of MBSE, attitudes of MBSE after deployment and the maturity of MBSE.

### **3.2 Case Study**

A TIA mission has been modelled using Vitech's GENESYS. Operational analysis, functional analysis and requirements management have been performed for layers 1 and 2 of the system. The tool has been used to collaborate with colleagues and technical reports have been created within the tool to be exchanged with colleagues. This exercise has helped to understand what benefits MBSE can provide to the systems engineering process.

### **3.3 SME Interviews**

To investigate the key challenges SMEs face concerning systems engineering, interviews were conducted. The purpose of these interviews was to investigate an SMEs attitude towards

systems engineering, common challenges they face when developing a mission and tools used to support their systems engineering. A conversational interviewing approach was used to collect the qualitative data provided by each SME. Qualitative coding was used to analyse the interviews. For each line in the transcript a word was given to represent the content within the line. Each coded word was cross-referenced with each other to look for common themes. This analysis helped to define the needs of an SME by finding themes and patterns within the interviews.

#### **4 Results**

Results collected from the investigation, indicated that the day to day to life on an SME is fast-paced due to the large commercial pressures faced. A variety of challenges were recorded ranging from defining an appropriate systems engineering process to dealing with the challenges faced from having a small workforce. Work performed within GENESYS indicated the large learning curve needed to use the tool successfully. However, modelling within GENESYS did highlight the advantages MBSE can provide such as ensuring that the system is well defined with consistent outputs and providing traceability between all entities modelled.

#### **5 Conclusion**

MBSE provides many advantageous characteristics in the development of a space mission. It provides a single source of truth and provides consistency to the systems engineering work among with many more qualities. However, the large learning curve and limited time SMEs can offer to the adoption are big factors as to why SMEs have not adopted MBSE. Can SMEs afford not only the license of the tool but the training that will be needed for? Is MBSE mature enough for an SME to adopt at this point in time?

From the research conducted, it has been concluded that MBSE can provide benefits to SME's systems engineering practice. However, the introduction of MBSE could be too time consuming for what an SME can offer. Therefore, the recommendation to adopt MBSE is dependent on the SME. The presentation will go through 3 different scenarios that an SME may fit into and provide certain recommendation with regards to the adoption and implementation of MBSE for each scenario.