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MODEL BASED SYSTEMS ENGINEERING (MBSE) APPLIED THROUGH A SYSML MODEL TO THE MASCOT ASTEROID LANDER

Abstract

Modern space systems engineering practices, such as the use of concurrent design and international and inter-organisational teams, require effective and reliable communication. A shift towards Model Based Systems Engineering (MBSE) may provide a more effective way for systems engineers to manage and document project progress, while also simplifying project handover. By constructing a Systems Modelling Language (SysML) model of the MASCOT asteroid lander system, the German Aerospace Centre (DLR) has demonstrated the applicability of MBSE to such a project.

SysML, developed by the International Council On Systems Engineering (INCOSE) and the Object Management Group (OMG), is a general purpose graphical modelling language that can be used to construct descriptive models of complex space systems and systems of systems. By providing a descriptive model, SysML can reduce ambiguity and the likelihood of misinterpreted information. The recursive nature of SysML models allows for a simple top down approach to modelling and quick access to the relevant model sections.

DLR applied SysML to a shadow study of MASCOT, which allowed access to the knowledge and key personnel of the MASCOT project without putting the MBSE approach on the critical path. The modelling followed a top-down approach and allowed for the building of model knowledge in parallel to the recursive nature of design evolution.

It was shown that widespread SysML literacy is required in order to ensure the greatest benefit towards project communication. DLR witnessed a difficult learning curve that required an investment of time and resources before MBSE could be implemented. Additionally, as SysML has no set methodology, a standard methodology needs to be addressed, either within individual organisations, or at the industry level, before it can be implemented . Of the existing methodologies, the Model-Based methodology to support Space System Engineering (MBSSE) showed great potential for early project phases.

The study also demonstrated the effectiveness of SysML for documenting a project throughout the phases. SysML was judged to be particularly effective for project handover in situations such as inter-Phase team change; particularly , for instances where the initial design team for the Phase-0/A study is different from the team taking the project forward into Phase B. A standardised model, as demonstrated here, would ease this transition.

The application of MBSE to MASCOT was successful and demonstrated the usefulness of the approach for project handover between different design phases. Nonetheless, critical issues remain regarding standardisation that must be addressed before wider application.