SPACE SYSTEMS SYMPOSIUM (D1)
System Engineering Tools, Processes and Training (2) (6)

Author: Dr. Savan Chhaniyara
Surrey Space Centre, University of Surrey, United Kingdom, s.chhaniyara@surrey.ac.uk

Dr. Chakravarthini M. Saaj
Surrey Space Centre, University of Surrey, United Kingdom, c.saaj@surrey.ac.uk
Dr. Bernd Madiger
Astrium Space Transportation, Germany, Bernd.Maediger@airbus.com
Dr. Marianne Althoff-Kotzias
Astrium Space Transportation, Germany, Marianne.Althoff-Kotzias@airbus.com
Dr. Ingo Ahrns
Astrium Space Transportation, Germany, Ingo.Ahrns@airbus.com

SYSML BASED SYSTEM ENGINEERING: A CASE STUDY FOR SPACE ROBOTIC SYSTEMS

Abstract

Space systems are similar to their terrestrial counterparts in many respects but the main distinction that makes space system unique are due to the harsh and low gravity environment that space systems needs to survive, requirements of system redundancy due to lack of on orbit maintenance or parts replacement and costs associated with those. These put extra emphasis on systems and requirement engineering from the very early stage of systems development lifecycle. Typical space missions comprise of many interconnected systems and systems of systems. Each of these systems need to be satisfied or adhered to thousands of requirements.

Traditional system engineering approaches require to update and to track requirements against their functional or behavioural components manually. On top of that, during early design review stages, mission system engineers may also needs to carefully modify or delete requirements without compromising effects of that on other interconnected or sub systems. This is a very time consuming and complex procedure especially when multiple stakeholders and teams of engineers involved locally or globally. This paper introduces the implementation of Systems Modelling Language (SysML) for modelling complex space robotic systems in context of On-orbit Serving (OOS) missions. SysML supports the requirements, testing, design, verification, and validation of systems which helps to improve the ability to exchange systems engineering information amongst tools; it helps to bridge the semantic gap between systems, software, and other engineering disciplines.

The autonomous rendezvous and docking of uncooperative client is one of the most challenging and complex aspects of OOS missions. The main aim of this paper is to outline the use of SysML based system engineering approach for the **INVERITAS**^{i} system. It is the prototypic realization of a broad spectrum rendezvous and capture (RvC) system and the development of the necessary core technologies. The main driving technology behind this RvC system is autonomous multi-sensory data capture and analysis. This paper will present the internal block diagram of generic camera system and it's interaction with the image processing modules. These generic SysML building blocks then can be reused or adapted for other space applications. The results presented in this paper will also highlight the benefits of this new approach to modeling space systems using SysML.

^{i}**INVERITAS** stands for Innovative Technologies for Relative Navigation and Capture of Autonomous Systems. (project sponsored by the German Space Agency, 50RA0908)