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22nd IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Space Technology and System Management Practices and Tools (3)

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WHAT IS A SPACE PROGRAM? A SYSTEMATIC ANALYSIS

Abstract

What is a space program? Throughout the history of spaceflight, space programs have proven to be very large, typically long-term, extremely complex, and highly cost-intensive ventures, as exemplified by the 1960s-70s Apollo or the ongoing Artemis program. They may be understood as sets of related space projects, or as national strategic investments. They usually involve a significant number of individual missions that incrementally and systematically develop required capabilities to achieve the program's goals. Generally, these endeavours also include a large number of actors, be they public regulatory agencies, public not-for-profit organisations, privately owned space companies, or companies engaged in space-related or non-space-related business. Given their enormous size and scale in every considerable aspect, it is reasonable to say that space programs are extremely complex, and hence equally complex to design. There currently exists no systematic framework for space program architecture design to which the formulation of high-level space program objectives and their translation into concrete elements, such as missions, systems, technologies and actors, could adhere. Variability in design and traceability of design changes are currently not being addressed in a systematic manner.

This paper carries out a systematic analysis of past and present space programs in order to identify and clearly define common elements. This will be used for establishing a single definition of the space program concept. This will form the basis for such a systematic framework. This work is embedded in the Space program Architecture Modelling Platform (SAMP) project currently under development at the Interdisciplinary Centre for Security, Reliability and Trust (SnT). The SAMP project aims to enable informed decision-making in the design of space programs. This capability is to be provided through the use of a model-based systems engineering (MBSE) software tool in collaborative development sessions. The tool will follow a model-based system development method that guides the development process and draws upon stored information on space programs. It will output space program variants that can be quantitatively compared with respect to their impact on their context over time as a result of simulation. The common elements identified in the systematic analysis carried out in this paper will later be formalised into a metamodel and data model that will form the information foundation of the SAMP software tool.