

IAF SPACE SYSTEMS SYMPOSIUM (D1)
Space Systems Engineering - Methods, Processes and Tools (2) (4B)

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DEFINITION OF ARCHITECTURES & TECHNOLOGIES FOR SUSTAINABLE HUMAN
EXPLORATION OF THE MOON**Abstract**

The Moon is the next step in creating a human outpost in deep space. As anticipated by the global exploration roadmaps, different entities, both companies and space agencies, are working together to accomplish this vision. Different systems and mission architectures can provide the operational capabilities to extend the human presence on the Moon. However, constraints related to time, cost and technological maturity may drive the choice of the best mission architecture for a given stakeholder. To help fasten the feasibility assessment of different mission architectures, this study proposes a methodology for the preliminary design of complex aerospace products based on model-based systems engineering and knowledge graphs. More in detail, the study links a Knowledge Graph (KG) that collects implicit (i.e. experience) and explicit knowledge (i.e. research activities or projects or instances of an MBSE model) with a decision-making engine. The KG is capable of representing a network of entities, focusing at the same time on the relationship between them and allowing also to visualize all the information contained in a graph structure. It is composed of three main components: (i) schema, (ii) rules, and (iii) population. The decision-making engine provides a series of feasible mission concepts and linked building blocks keeping into account the stakeholder's needs expressed in terms of requirements and constraints. The approach is concretized in a tool that links two different software: (i) Capella, an Open-source MBSE tool that implements the Arcadia method, and (ii) TypeDB, a strongly-typed database that uses TypeQL as its query language. Beyond the links with the aforementioned software, the tool integrates Technology Roadmapping methodologies meant to support the identification of enabling technologies linked to the defined building blocks in the identified mission concept. Eventually, the capabilities of this methodology and related integrated toolset are tested for the design of a human landing mission targeting the Moon.