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# Space Architecture Assessment Using System-of-Systems Methodologies

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## ABSTRACT

As technologies in the space exploration community are further developed, mission complexity and the associated risks have become greater. Dozens of complicated system interactions may result in unexpected, potentially dangerous emergent behaviors. Early efforts are underway by NASA to map potential system architectures (collections of systems which fulfill design requirements) for future human space exploration missions. However, current mission complexity requires the determination of emergent behaviors, as well as time requirements, and safety levels of complicated space exploration architectures, which current analysis methods in use cannot address. To that end, a newer technique has been developed—System Operability Dependency Analysis (SODA). This technique uses a combination of expert input and past data analysis to create a model of system interactions, to properly complete the required study. By gathering a broad variety of data and opinion through literature survey and interaction with subject matter experts, and modeling interactions between systems, obtaining estimations for the feasibility and features of a variety of architectural variations becomes possible. This study compares a small set of architectures/variations to determine which best meet the requirement metrics designated by the user. The resultant data includes sets of feasibility data and specialized data plots which denote the relative feasibility of each architecture. The knowledge learned from this study is intended as an initial guide for the development of future human space exploration missions.

## KEYWORDS

System of Systems, Space Exploration, Operability, System Dependency, SLS, Orion, SODA, SDDA