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

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# COMPLEXITY AND NOVELTY AS RELATIVE MEASURES OF COST, RISK AND UNCERTAINTY IN LOW CONCEPT MATURITY MISSIONS

**Abstract**

Exploration of the trade space for mission architectures poses several challenges, particularly during the early stages of mission definition when little or no funding is available. Yet arbitrarily selecting a limited number of point designs for elaboration when more funding may be available for studies may inadvertently result in an under-optimized solution. In this case, optimized means with respect to science return (performance), cost, cost uncertainty, and mission risk. In order to characterize the hypersurface of the tradespace (thus allowing for optimal selections) with the limited information available in the early stages, it is necessary to recognize that absolute values cannot be computed in any meaningful fashion. However, as this paper will demonstrate, it is possible to determine relative values that allow for characterization of the trade space and therefore relatively optimal mission architectures can be identified that can then be candidates for more detailed analysis. This approach introduces the concepts of mission complexity and novelty as the basis for computation of relative measures of cost, risk, and uncertainty, as well as a simple technique for computing science value, based on the established science objectives provided by current science assessment groups and formal decadal surveys.