Project Trades Model for Complex Space Missions

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Traditional methods of exploring mission tradespaces during the concept phase often engender undesirably long trade study cycle times. In addition, decisions on performance issues are often made independently of their cost and risk effects. A Project Trades Model (PTM) addresses these shortcomings by tying models and tools together to rapidly perform integrated system trade studies of cost, risk, and performance.

A PTM was created for the Mars Science Laboratory (MSL) project, a capstone-class landed mission scheduled for launch in 2009. The PTM uses a distributed modeling approach to connect islands of excellence in simulation and modeling to leverage existing capability across the Jet Propulsion Laboratory. These best-of-practice tools range from instrument databases to rover simulators to detailed science scenario schedulers to orbit analyzers. To investigate a sample architecture, the PTM uses Web Services to send and receive information to, from, and between its distributed collection of models. The results are subsequently archived, tagged with rationale descriptions, and quantitatively compared against competing architectures in tradespace explorations. A large number of candidate architectures can be explored.

The PTM investigates an architecture by placing a candidate design into a candidate operational scenario to calculate the expected performance. The level of detail captures the couplings between physical design elements, allowing investigation of ripple effects. This enables design and operational margins to be scrutinized. A suite of cost/risk models provides estimations to accompany each performance evaluation.