

## Design and Architecture of Planning and Sequence System for Mars Exploration Rover (MER) Operations

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We propose to adapt and deploy a Planning and Sequence System for Mars Exploration Rover (MER) operation. This system is based upon a multi-mission planning and sequence software tool suite (SEQ), developed by Deep Space Mission System. The multi-mission SEQ system has been used and operated by many existing JPL deep space missions, such as Cassini, Mars Odyssey, MGS, and SIRTf. Even though SEQ has been deployed to many missions previously, this is a first time use of a surface mission.

The MER Planning and Sequence System will allow users from science community to spacecraft and mission operation engineers, to design a science and engineering plan; to formulate the spacecraft, resources, and environment models; to expand and translate from science intent from the mission plans to the rover's commands; to validate mission plan and command sequence prior to its uplink. The new challenges to adapt and deploy SEQ for surface operation are timely responsiveness to plan, validate, and uplink daily, model a mixture of timed and non-timed event sequence so-called "event driven / conditional" sequence, modeling consistency between different fidelity levels (i.e., mission planning and command generation), on-board sequence and communication window execution modeling, using discreet event and multi-threading simulation techniques, and multiple spacecraft delta dor events with respect to its flight and ground behaviours.

The essence of the MER Planning and Sequence System architecture is based on multiple years of JPL's mission operation and uplink system development experiences. It is focus to satisfy the MER mission operational concept requirements throughout different mission phases, from cruise, entry landing and descent (EDL), to surface operations, from strategic planning, tactical planning, to uplink command sequence generation and validation. The spacecraft models used by this system architecture vary from a simple mathematical algorithm to a complicated software component, scalable by user's selection. From mission planning to command uplink, it captures mission information and perform spacecraft health and safety and mission resources and constraints checking at a different level of abstractions, but yet maintains the mission plan consistence from each different level. It also interfaces with number of different software programs within the system, using XML and dynamic software library technologies. The system design and architecture has been fully prior to launch and continue to be validated and verified by numerous mission operational readiness tests prior to support MER's surface operations.