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PROTOTYPING CASSINI MISSION OPERATIONS

ABSTRACT

The Cassini Mission to Saturn plans to employ several new operations concepts to decrease the complexity of Mission Operations and to maximizes science return in a cost constrained environment, These concepts have been proposed to reduce cost, increase productivity, and eliminate duplication of knowledge and effort. Two of these concepts are referred to as Operational Modes and the Sequence Virtual Team. A proof of concept study has been performed to validate these two concepts. The basic idea of the study is to prototype these new operations concepts by performing the actual operations tasks, using software similar to what will be used for operations and using the expertise of appropriate team members. In the past this effort is performed late in the Mission Development Phase as part of System Integration. At that point changes to Mission Operati ons are either difficult or impossible. The study identifies software and operations requirements at a time when they can be implemented in a cost efficient manner, and suggests changes to existing concepts and software.

The first operational concept, Operational Modes, is based on the idea of defining a set of instrument and engineering resource envelopes. These envelopes allow spacecraft activities to be checked for resource usage (such as power and data rate) against the envelope boundaries. Operational Modes allow scientists the flexibility to schedule any observation as long as the observation stays within these envelopes. Checking at the Operational Mode level reduces the expended effort because there is less detail to check.

The second concept is the Sequence Virtual Team, The Sequence Virtual Team is comprised of a full-time core of sequence experts and a variable number of spacecraft and instrument experts. The number of spacecraft and instrument experts and the amount of time they must spend on the team is based on the contents of the sequence (a set of time ordered instrument and spacecraft commands). This team develops, reviews, approves, and monitors the sequence. In this concept, the requester (the person with the most detailed knowledge) has the responsibility for performing the most detailed checks. The Sequence Virtual Team exists from the planning stage to the end of sequence execution. This concept reduces team size (and cost) since people are used as needed,

The proof of concept study used existing multi-mission software, and a sample Cassini 16-day orbit. Sample science and engineering inputs were merged together to create a constraint-checked sequence. The Sequence Virtual Team tasks were to collect, merge, apply Operational Modes to constraint check the merged inputs, and create a complete sequence. Performing these tasks verified the feasibility of using the new design concepts.

This paper presents the results of the proof of concept study in detail and examines the software needs required to implement these concepts. The work described in this abstract was performed by the Jet Propulsion Laboratory, California Institute of Technology, under contract to the National Aeronautics and Space Administration.