Reduce Planning Costs with a Multimission Operations System

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For The Fifth International Symposium on Reducing the Cost of Spacecraft Ground Systems and Operations (RCSGSO)
July 8-12, 2003

ABSTRACT

Mission planning costs can be greatly reduced with multimission Mission Operations System (MOS) development. A generalized set of MOS components (ie, requirements, operations concepts, plans, processes, procedures, flight rules, mission rules and constraints, operational interface agreements (OIAs), and software interface specifications (SISs)) would provide a multimission development baseline. This baseline could then be adapted to incorporate the unique mission characteristics. Database technology would assign MOS components to mission teams. MOS component assignments would vary based upon mission complexity (for simpler missions, only a subset of components would be needed compared to that for complex missions). Following component assignments, a set of multimission costing algorithms would be employed to quickly establish baseline MOS costs. Mission teams would use the database technology to update MOS components to accommodate unique mission characteristics. Costs would then be modified to incorporate unique mission characteristics.

Existence of a generalized MOS system is analogous to some corporations' use of a standard, baseline spacecraft which can be "pulled off the shelf" and modified according to unique mission characteristics. This paper presents a proposal for a standardized, multimission MOS system which which can be modified to accommodate spacecraft mission operations.

MOS complexity is driven by spacecraft pointing requirements, navigation requirements, unique observing requirements, spacecraft landing requirements (if any), payload data acquisition capability, environmental constraints, spacecraft downlink capability, and new spacecraft technology. Depending on the presence of these factors within a mission, MOS complexity can be classified as standard, involved, or complex.

1) **Standard missions** do not have strict and tight pointing requirements. They do not employ new technology on critical subsystems. Operations are repetitive (such as a mapping mission). Standard missions have no lander or "target contact" aspects to the mission. For standard missions, teams (such as science integration and sequencing), can be combined and the number

of required MOS components can be reduced. Remaining MOS components can be employed with relatively small adaptations. Initial costing estimates would be performed based upon the reduced set of MOS components used and then adjusted according to the number of small adaptations.

2) **Involved missions** can have precise pointing requirements but not motion compensation. They can have new technology on one critical subsystem which is well-tested and well-modeled. Involved missions can have non-repetitive operations. Involved missions can involve "distant" target contact such as firing at a target to analyze ejecta or touching a target surface with a sample arm. For involved missions, teams (such as science integration and sequencing), can be combined and the number of required MOS components can be reduced. Required MOS components can be employed with moderate adaptations. Initial costing estimates would be performed based upon the number of MOS components used and then adjusted according to the the number of moderate adaptations.

3) **Complex missions** have precise pointing requirements with motion compensation. They can have new technology on one or more critical subsystems. They can have multiple, unique observation designs. He main spacecraft body may be a lander. Complex missions most likely will require all MOS components. MOS components can be employed with extensive adaptations. Initial costing estimates would be performed based upon the complete set of MOS components used and then adjusted according to the number of extensive adaptations.

This paper will analyze MOS component similarities among past JPL missions of varying complexity and show how these similarities enable the creation of a baseline MOS design.