Multi-Mission Sequencing Software

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Sequencing software for deep space missions has historically been one of the most critical parts of the ground software used to communicate with and control the spacecraft. At JPL, the sequencing software is responsible for planning and creation of science and engineering activities, checking command syntax, checking mission and flight rules, and translating the commands into packets which can be uplinked to the spacecraft. Significant effort has been spent by earlier missions to ensure the integrity of this software since errors in this area could cause the spacecraft to enter fault protection or cause the loss of the spacecraft.

Over the last several years, in an effort to reduce the costs associated with sequencing software, a multi-mission form of sequencing software has been developed. The sequencing software is now developed as two separate components. The multi-mission "core" software provides, in a generic sense, the capability to perform the functions needed in the sequencing software: planning and scheduling events, checking flight rules, and packetizing commands. The "core" software is then "adapted" to a project specific mission. The "adaptation" part of the software task involves providing the models for activities needed for planning and scheduling, converting the Command List for the project into models that can be used for sequence checking, coding project and mission flight rules and the modeling needed to support them, and developing project blocks for repetitive activities.

By partitioning the sequencing software into a "core" component and an "adaptation" component, JPL has been able to reduce costs. The core component of the software is verified once, by a central group, rather than by multiple projects. Projects can then focus on verification of just the adaptation part of the software. An additional cost saving with this methodology has been that it has allowed JPL to staff a multi-mission adaptation team where personnel can move from one project to another with minimal start-up and training time.

This paper describes the architecture of the JPL multi-mission sequencing system and demonstrates many of the benefits of the core/adaptation format of the sequencing software.