Science Opportunity Analyzer – A Multi-Mission Approach to Science Planning

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ABSTRACT

Mission operations is comprised of diverse teams competing for the limited resources of a spacecraft. Each team has its goals and its "own language". Flight teams talk about spacecraft commands and command parameters. They're involved with hardware components and computer transactions. Science teams are concerned with science objectives, physical phenomena, celestial bodies and their instruments on the spacecraft. What has been missing is a software tool that allows scientists to plan and develop their observations using the terms that are meaningful to them. At the same time this tool must communicate with project software in terms of commands and command parameters. Finally, the tool must be able to support a wide-variety of missions. Science Opportunity Analyzer (SOA), a Java-based application, has been built to meet these needs.

One typical scenario that describes scientist's use of SOA to build an observation is as follows:

1. The user runs an SOA configuration file to select the spacecraft and spacecraft trajectory data to be used.
2. The user finds one or more windows of opportunity for an observation based on geometry criteria using SOA's Opportunity Search capability.
3. The user displays a picture of the target at the desired time using the Visualization capability in SOA, and then selects a time for a candidate observation.
4. The user designs the observation using the SOA Observation Design capability. At this point the user will often want updated Visualization displays as well. The user may even want an animation of the observation.
5. The user can also check to see if any constraints have been violated with this observation using the SOA Constraint Checking capability. The constraints are checked at the observation level against either geometric (i.e., Sun exclusion zones) or dynamic (i.e., spacecraft rates) rules.
6. At any point in this process the user can view associated data such as a phase angle using the Data Output capability. Data can be viewed in a tabular format, graphically or both.
7. Once the observation meets the science criteria and doesn't violate constraints, it can be saved for further recall and sent downstream to planning software and command-level geometric checking software using SOA's communication capability.

Each of the above areas of SOA can be adapted to meet the needs of a specific project.

From the very beginning SOA was designed with the user in mind. Extensive surveys of the potential user community were conducted in order to develop the software requirements. Throughout the development period, close ties have been maintained with the science community to insure that the tool maintains its user focus. Although development is still in its early stages, SOA is already developing a user community on the Cassini project that is depending on this tool for their science planning. There are other tools at JPL that do various pieces of what SOA can do; however, there is no other tool which combines all these functions and presents them to the user in such a convenient, cohesive, and easy to use fashion.