1/21/2015

Abstract for ***Interplanetary Smalls Satellite Conference***

# Tools for Identifying OMSPA Opportunities in the DSN

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The Deep Space Network (DSN) provides communication and navigation services for many of NASA's missions. The Opportunistic Multi-Spacecraft per Antenna (OMSPA) method may be used to increase the number of spacecraft that can be downlinked by a single ground antenna. Using this method, a host spacecraft is identified that is regularly tracked by the DSN. Wide-band recordings are made of the signals received by the host aperture. Other signals from any spacecraft (opportunistically) in the host beam will also be recorded. These signals are later demodulated and decoded using software to recover downlinked data from the opportunistic spacecraft. In this way, a large number of spacecraft in the host beam can be serviced without increasing the number of (hardware) receivers.

In order to implement OMSPA, two separate events must coincide. First, the DSN must be actively tracking the host spacecraft; and second, one or more opportunistic spacecraft must reside in the host beam. Two tools were developed to determine when these coincidences occur.

The Beam Intercept Planning System (BIPS) tool uses ephemeris data files for potential opportunistic spacecraft to determine when they will be in the host beam. The BIPS tool assumes that the beam is always centered on the host spacecraft. It then determines when one or more of the opportunistic spacecraft will be within the half-power beam width of the host beam. Occultation by nearby bodies (e.g., Mars) is also taken into account.

The opportunistic view periods from BIPS are output as an EXCEL table to a second tool: the DSN 7-Day Schedule Cross-Comparison tool (7-DSC). Reliable tracking schedules are available from the DSN SPS database about one month before tracking takes place. 7-DSC compares the view periods with scheduled host tracking times from SPS. 7-DSC reads and compares SPS data with BIPS data to determine when the opportunistic spacecraft will be within the host beam at the same time the host is being tracked.

In a demonstration described in a companion presentation, the host spacecraft was taken to be NASA's Mars Reconnaissance Orbiter (MRO), while the opportunistic spacecraft was Mars Odyssey (MO). The tools were used successfully to predict times when the demonstration was feasible. The time when the MO signal was re-acquired after occultation was found to agree with the time predicted by BIPS to within a few seconds.

This work was sponsored by NASA.