

*Abstract*

## **Small Deep Space Mission Telecommunications**

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Unique requirements imposed on deep space telecommunications, such as operation at extreme ranges, have historically led to high cost, one-of-a-kind spacecraft telecommunications systems. Yet future deep space missions must fit within severe cost, mass and power constraints.

JPL recently completed a study to find ways of reducing telecommunications cost for future deep space missions. Study team members surveyed designers of proposed deep space missions to characterize their telecommunications needs and design constraints. They identified and evaluated alternative telecommunications systems architectures capable of satisfying these needs and constraints. They traded spacecraft capabilities against DSN capabilities to determine optimal flight/ground combinations. The task culminated in a final report identifying needed telecommunications technology development.

The survey demonstrated that future deep space missions will have requirements that are relatively modest compared to those of most other deep space missions launched over the past 17 years. Future missions are expected to occur more frequently than in the past. As a result, the study recommends that a standard deep space transponder be developed and that transponder procurement be coordinated between missions to minimize NASA's costs. It also recommences spacecraft power amplifier and antenna development efforts.

This paper summarizes survey results. It then presents key system analysis results of interest to the designers of future deep space missions. It concludes with a review of telecommunications technology development recommendations and plans.