Title: Message Mode Operations for Spacecraft: A Proposal for Operating Spacecraft during Cruise and Solving the Network Loading Crunch

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Abstract:

The current system of scheduling spacecraft during cruise for multiple 8 hour tracking sessions per week currently leads to an overcommitted Deep Space Network (DSN). Studies indicate that future projected mission demands upon the Network will only make the network loading problem worse. Therefore, a more efficient scheduling of DSN resources is necessary in order to support the additional network loading envisioned in the next few years: The number of missions is projected to increase from 25 in 1998 to 34 by 2001. In fact, given the challenge of the NASA administrator, Dan Goldin of launching 12 spacecraft per year, the DSN would be tracking approximately 90 spacecraft by 2010. Currently a large amount of antenna time and network resources are subscribed by a project in order to have their mission supported during the cruise phase. The recently completed Mars Pathfinder mission was tracked continuously (24 hours/day) during cruise to Mars.

This paper proposes an innovative approach called Message Mode Operations (MMO) for solving the Network loading problem while continuing to meet the tracking, reporting, time management, and scheduling requirements of these missions during Cruise while occupying very short tracking times. MMO satisfies these requirements by providing the following services:

• Spacecraft Health and Welfare Monitoring Service
• Command Delivery Service
• Adaptive Spacecraft Scheduling Service ("Meet Me Scheduling")
• Orbit Determination Service
• Time Calibration Service

Utilizing more efficient engineering telemetry summarization and filtering techniques on-board the spacecraft and collapsing the navigation requirements for Doppler and Range into shorter tracks, we believe spacecraft can be adequately serviced using short 10 minute tracking sessions. This claim assumes that certain changes would have to be made in the way the Network traditionally services missions in cruise. Furthermore, limiting spacecraft to short

sessions will free up larger blocks of time in the tracking schedule to help accommodate future tracking demands soon to be placed upon the Network.

This paper describes the key characteristics and benefits of MMO, the operational scenarios for its use, the required changes to the ground system in order to make this approach feasible and the results of a simulation to determine the effects of MMO on projected mission loading on the DSN.