Proposed capabilities of the DSN in support of the MORE experiment

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Topics

➢ US Team Funding Status

➢ Current Capabilities

➢ Planned DSN Upgrades

➢ Proposed Ranging System Improvements

U.S. Team Funding Status

➢ Proposal to ***Discovery Mission Of Opportunity*** was not selected but rated high for science and considered low risk for implementation

➢ Team encouraged to apply to future opportunities, possibly the fundamental physics MIDEX in late 2008

Current Capabilities at DSS-25

➢ X-band uplink

- X-band Doppler link has excellent instrumental stability that meets BepiColombo MORE X-band requirements
- Ranging modulation is supported
  - Sequential tone ranging with 1 MHz clock
  - Current performance is about 1 m
- Downlink may be at both X-band and Ka-band
- Troposphere calibration is available
  - Advanced Media Calibration System

➢ Ka-band uplink

- Very good Doppler performance proven during the Cassini Gravity Wave experiments in 2001-2003
- Out of service at this time

Planned DSN Upgrades at DSS-25

- ➢ Ranging modulation
  - PN ranging with 1 MHz clock will be supported in mid 2007
  - Clock could be increased to 2 MHz with a minor effort
  - Supporting all proposed CCSDS standard ranging codes is under consideration
- ➢ Ka-band uplink
  - Carrier only will be returned to service for future missions
- ➢ Multiple frequency links will be supported
  - X-up/X-down
  - X-up/Ka-down
  - Ka-up/Ka-down
- ➢ End-to-end Doppler performance using multiple links expected to be much better than 1e-14 at 1000 sec

Proposed Upgrades for MORE

➢ Add modulation capability to Ka-band uplink

➢ Increase Ka-band ranging code clock frequency

- A single fixed tone at 20 MHz has been considered
- CCSDS PN ranging with 16 Mchip/s clock could also be considered, possibly via a general DSN upgrade

➢ Improved methodology for station delay calibration

- Account for frequency dependence and temporal change

➢ Measure downlink signal using open loop (Radio Science) receiver and software processing