Jet Propulsion Laboratory
Interoffice Memorandum
July 9, 2004

To: W. Tai and R. Miller

From: D. Morris

Subject: Lunar Reconnaissance Orbiter (LRO) Special Study

Mission and Requirements:
The LRO mission is planned to launch in August 2008 and with a planned duration of two years. It will have a 90-day post launch trajectory to the Sun-Earth L2 and then back to the moon. The goal of this study is to determine the impact to current DSN missions and assets from this mission under today's mission support scenario and three different support strategies. Today's mission support scenario assumes loading under the current approved mission set. The three support strategies were based on three hours of contact divided by 3, 2, or 1 passes per day at Ka-Band.

Summary:
The moon orbits the Earth and crosses nearly every deep space mission's viewperiod monthly. This ensures contention with nearly any mission that has high activity if they share the same antenna subnet as LRO. Launch and post launch support for Mars Telesat Orbiter (MTO) and Mars Science Laboratory (MSL) in late 2009 and Space Interferometry Mission (SIM) in March 2010 show contention for at least a week during these 30-day events. The 45-day approach support for Mars Telesat Orbiter and Mars Science Laboratory beginning in mid-2010 show contention for at least a week per month during these events.

The three support strategies while only cumulatively having three hours of daily spacecraft contact suffer a setup overhead time for increased number of contacts per day. Over the two-year period studied, this setup time inefficiency seems to outweigh the advantage of two to three shorter contacts per day.

Methodology:
This study used the following items to perform the study:

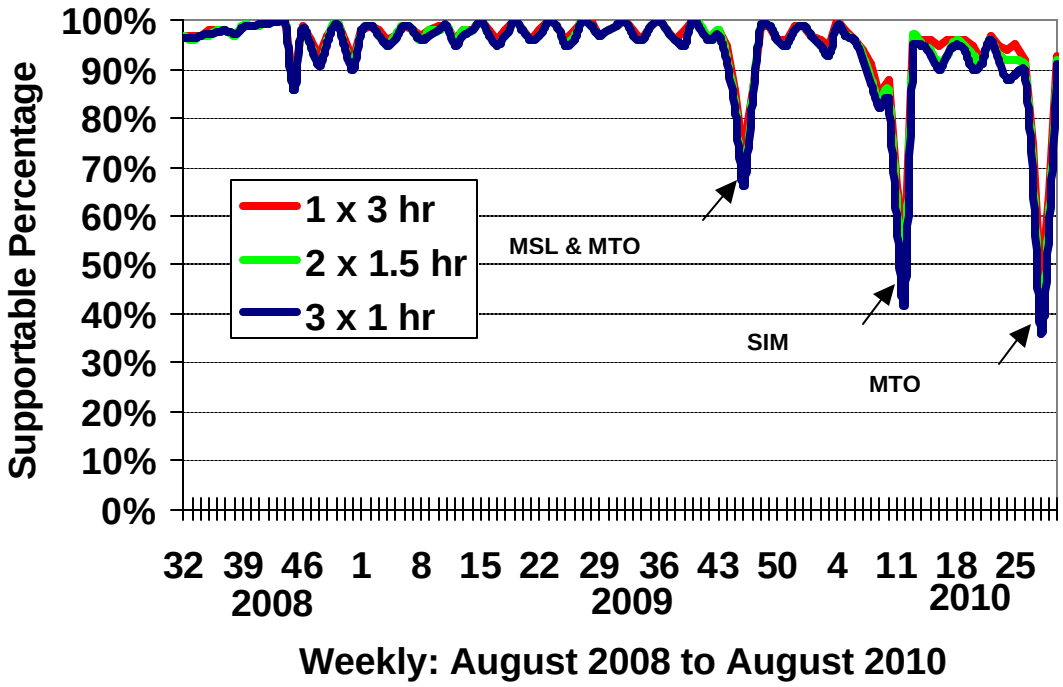
1. Only the 34m Beam Waveguide –1 (34BWG-1) subnet is expected to have the capability to support the Category A Mission Ka-band frequency. This subnet also supports Category A Mission S-band and X-band frequencies as well. Therefore, LRO support was shown here.
2. A Lunar viewperiod with a 6-degree horizon mask was used for analysis.
3. The data and mission set for the August 2004 Resource Allocation Review Board was used for this analysis.

Data Results and Analysis:

Average supportable percentage over two years for each of the three support strategies shows that:

Strategy	Support %
1 x 3 hour	95%
2 x 1.5 hour	94%
3 x 1 hour	93%

Forecasted Supportable for each of the three strategies for tracking support under the current scenario is shown in the following figure:



This figure shows both the slight decrease in support with the three separate support strategies as well as the impact from major support requirements for launches or planetary approaches. The figure shows that in late 2009, both MTO and MSL launch and will impact LRO support when the moon traverses their viewperiod. In early 2010, SIM launches and will impact LRO support. Later in 2010, the approach phase begins for MTO and this also is forecast to affect LRO support.

Conclusion:

Two conclusions can be drawn from this study. The first conclusion is that support strategies do matter and DSN setup overhead will affect forecasted support. It is better to have one 3-hour pass per day than two 1.5-hour passes per day. And it is better to have two 1.5-hour passes per day than three 1-hour passes per day. If setup time reduces, this may change this conclusion.

The second conclusion is that severe loading from post Launch support (30 days continuous support) or a planetary approach (pre-MOI for Mars missions) impacts a lunar mission for at least a week as the moon traverses that part of the sky.

Distribution:
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