

March 12, 2004

TO: A. Chang
FROM: S. Guduru, E. Hampton, D. Morris
SUBJECT: Preliminary SELENE Study
REFERENCE: 1) SELENE Draft DSA, received March 2004.
2) A. Chang to Distribution, "SELENE Launch slipped to August 06," dated 11 March 2004.

The purpose of this study is to report on a preliminary evaluation of the support request for SELENE, a mission to Earth's moon. Requirements for 20 days of continuous support on 34m antennas supporting Category A S-band frequency (Ref. 1) limits the set of antennas that would support this mission. With launch just announced to be in August 2004 (Ref. 2), this forecast evaluates possible support on 34BWG1 (and 26M) subnet over the period August 1, 2006 through September 20, 2006 which encompass weeks 31-38 of 2006. This report identifies the effects that the requirements to support the mission will have on the Deep Space Network (DSN) resources and other users of the DSN.

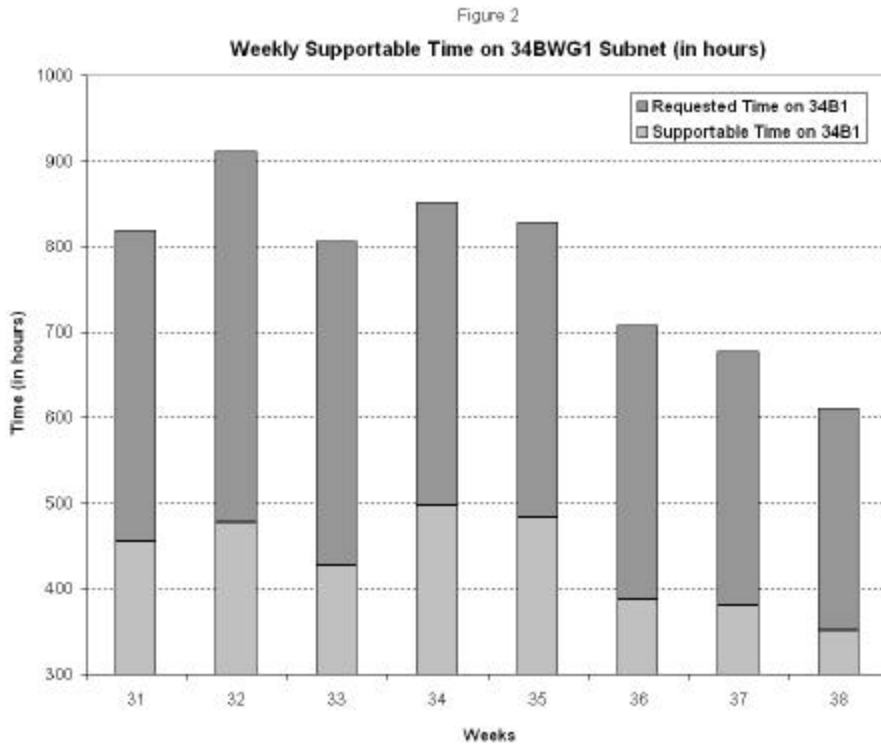
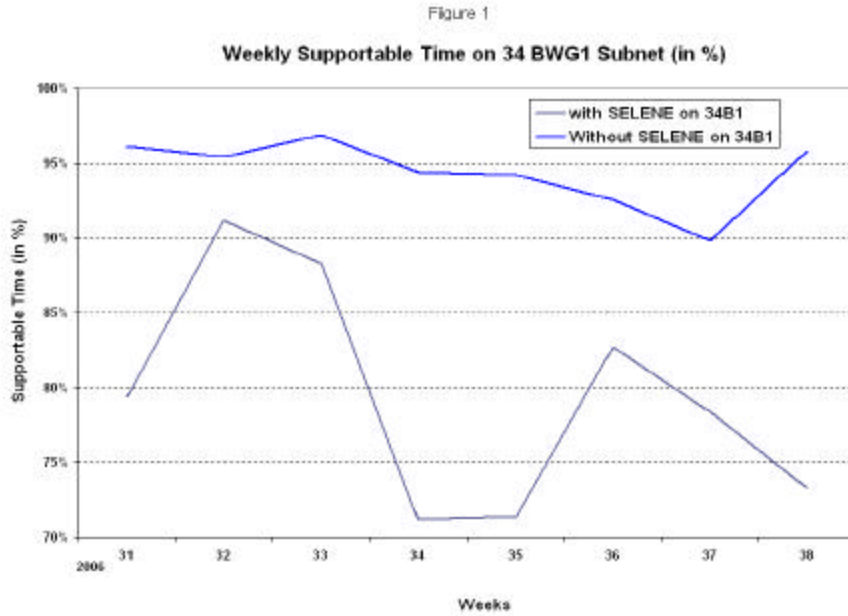
SELENE will orbit the Moon. The lunar viewperiod sweeps through all mission viewperiods over the lunar cycle. Mars (where three spacecraft orbit) is nearing superior conjunction, there are three missions at the Sun-Earth L1 orbit and weekly daylight maintenance is a factor. This means that when the Moon's phase is nearing inferior conjunction (New Moon), greater contention is observed in the results. This occurs in weeks 31, 34, 35, and 38 in 2006 on the 34BWG1 subnet. In addition, DSS-24 has scheduled 7 weeks of downtime beginning September 4, 2006.

Analysis was accomplished using the FASTER (forecasting and scheduling tool for earth-based resources) forecasting system and the updated mission set database from the February 2004 Resource Allocation review Board (RARB).

Assumptions:

1. Lunar viewperiods would be adequate to approximate spacecraft viewperiods throughout the mission. Conversation with both the Telecommunications and Mission Services Manager and Navigation Lead for SELENE confirms that a direct approach to the Moon is planned for SELENE. Lunar Orbit Insertion (LOI) will occur sometime on Day 4 of the mission.
2. DSS-24 is down for X/X-Ka Band implementation in weeks 36-38.
3. To maintain continuous support for assessment on 34BWG1 subnet, DSS-16 will be used to replace DSS-24 if launch support extends into weeks 36-38.
4. Setup and Teardown time is 1-hour and 15minutes respectively.

34B1 Subnet Assessment:



The forecasted weekly supportable time (in percent) and (in hours) is shown in figure 1 and figure 2 respectively for the study period with and without the SELENE requirements on the 34-meter beam wave guide one (34BWG1) subnet. SELENE should expect to

receive about 79% of the requested time on an average during week 31-38 of 2006. However, supportable time does fall below 75% in week 34, week 35 and week 38.

In weeks 31-38, SELENE is in their Launch phase and requires continuous support. It has contention, with requirements supporting Chandra X-ray Observatory (CHDR), Deep Space Station (DSS) preventative maintenance, Mars Reconnaissance Orbiter (MRO), New Horizons (NHPC), SOHO, Stereo Ahead (STA), Stereo Behind (STB) and Ulysses (ULYS) on the 34-meter beam wave guide one (34 BWG1) Subnet.

In weeks 34-35, SELENE has nearly 100% overlap with STB, 0-60% overlap with CHDR (due to fluctuating view periods of CHDR), 0-30% overlap with DSS, 50-95% overlap with MRO, 80% overlap with NHPC, 85-90% overlap with SOHO and 10-75% overlap with ULYS.

In week 34, SELENE has no view at Goldstone on day of year (DOY) 235 and DOY 239. DSS requires 3 passes ranging from 6-8 hours for preventative maintenance, MRO requires four 8-hour passes for aero-braking support, NHPC requires two 8-hour passes for cruise, SOHO requires ten 4-hour passes for keyhole support, STB requires five 3.5-hour passes for prime science and ULYS requires five 6-hour passes for routine support.

In week 35, SELENE has no view at Canberra on DOY 242 and no view at Goldstone on DOY 245 and DOY 246. CHDR requires twenty one 1-hour passes for routine tracking, DSS requires 4 passes ranging from 4.5-8 hours for preventative maintenance and antenna calibration, MRO requires three 8-hour passes for aero-braking support, NHPC requires two 8-hour passes for cruise and five 8-hour passes for flyby rehearsal, SOHO requires two 4-hour passes for keyhole support, STB requires five 3.5-hour passes for prime science and ULYS requires three 6-hour passes for routine support.

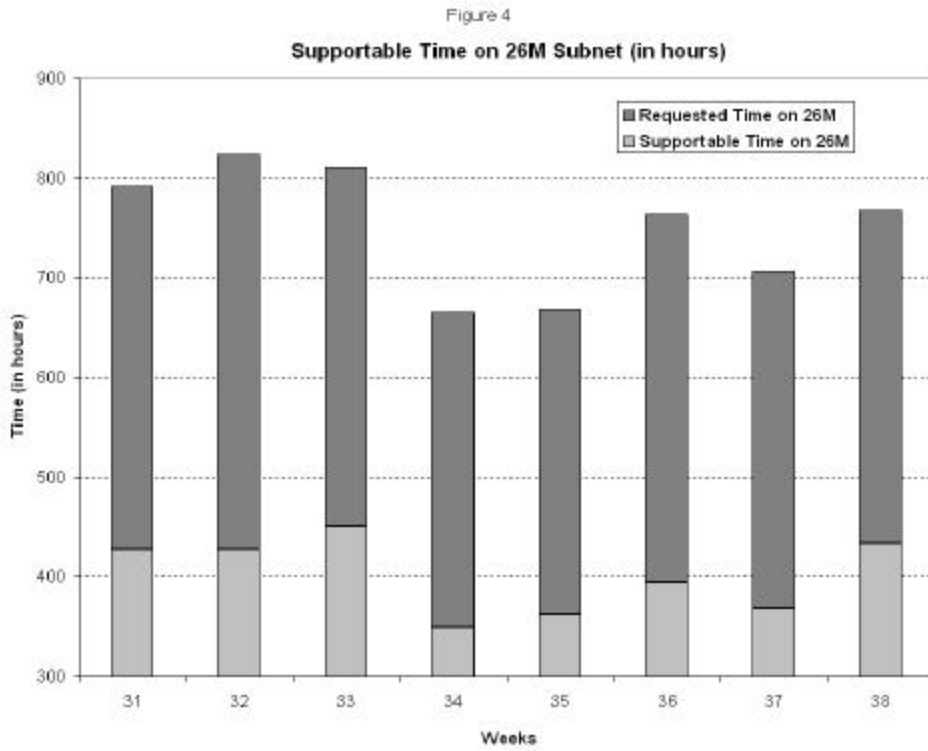
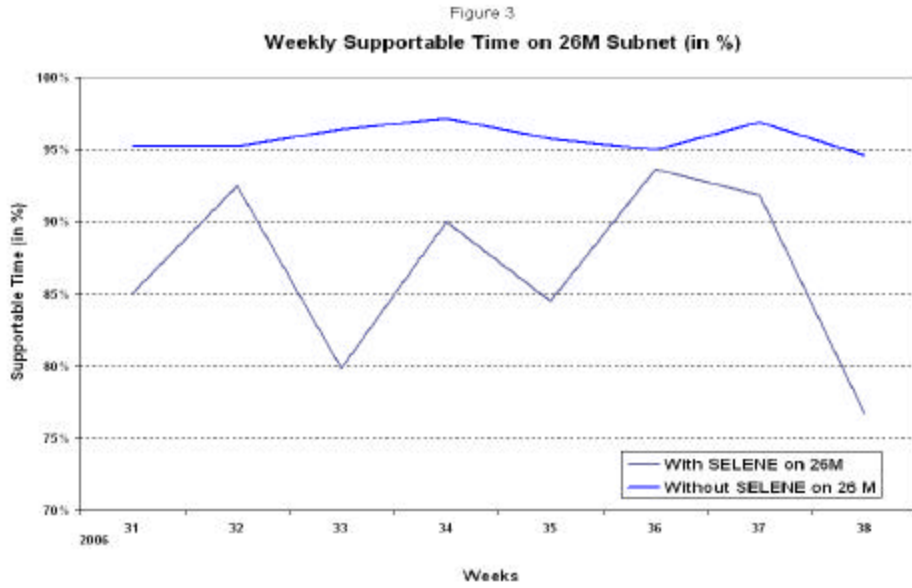
In week 38, SELENE has nearly 75% overlap with STA, 0-100% overlap with CHDR (due to fluctuating view periods of CHDR), 0-60% overlap with DSS, 95% overlap with MRO, 100% overlap with Messenger (MSGR), 80% overlap with NHPC, 85-90% overlap with SOHO and 40-75% overlap with ULYS.

In week 38, SELENE has no view at Goldstone on DOY 266 and DOY 267. DSS requires 3 passes ranging from 6-8 hours for preventative maintenance, MSGR requires one 8-hour pass for routine support, CAS requires two 9-hour passes for Saturn tour, CHDR requires fourteen 1-hour passes for routine tracking, WIND requires seven 2.5-hour passes for routine tracking, NHPC requires two 8-hour passes for cruise, STA requires three 3.5-hour passes for prime science and ULYS requires two 6-hour passes for routine support.

In summary during weeks 34, 35 and 38, SELENE can receive their requested support on 34B1 if MSGR, NHPC, STB, STA and CAS supports are moved to 34H and 34B2 subnets, CHDR moves approximately 7-14 passes to the 26M subnet, SOHO supports are reallocated to the 34HSB and 26M subnet, ULYS support is moved to DSS-43, 45 and

WIND supports are scheduled at either Canberra or Goldstone during the Goldstone /Canberra overlap for SELENE to avoid contention with it.

26M Subnet Assessment:



The forecasted weekly supportable time (in percent) and (in hours) is shown in figure 3 and figure 4 respectively for the study period with and without the SELENE requirements on the 26-meter (26M) subnet. SELENE should expect to receive about 87% of the requested time on an average during weeks 31-38 of 2006. However, supportable time does fall below 85% in week 33 and week 38.

In weeks 31-38, SELENE is in their Launch and LEOP phase and requires continuous support. It has contention, with requirements supporting International Gamma Ray Astrophysics Lab (INTG), Deep Space Station (DSS) preventative maintenance and SOHO on the 26M subnet. During this study period, SELENE has 70-100 % overlap with INTG, and 80-100% overlap with SOHO.

In week 33, DSS requires 3 passes ranging from 6-8 hours for preventative maintenance, INTG requires seven 5.3-hour passes at DSS-16 for routine tracking and SOHO requires ten 8-hour passes for TSO and routine support.

In week 38, DSS requires 3 passes ranging from 6-8 hours for preventative maintenance, INTG requires seven 5.3-hour passes at DSS-16 for routine tracking and SOHO requires seven 9.6-hour passes and fourteen 1.6-hour passes respectively for routine support.

The projected supportable time for SELENE ranges from 77-94%. In order for SELENE to receive continuous support for Launch and LEOP, INTG should schedule their supports outside of the SELENE view periods, DSS should reduce their supports at Goldstone and Madrid from 8-hour to 6-hour passes and SOHO should reallocate their support on 34HSB and 34BWG1 subnets.

Supporting Data:

Table 1

| Major Events in Week 31-38 ,2006 |
|---|
| Cassini Tour |
| Mars Express Bi-static Radar |
| Mars Reconnaissance Orbiter Aero breaking |
| New Horizons Flyby Rehearsal |
| Soho Keyhole Event |
| STEREO Ahead Prime Science |
| STEREO Behind Prime Science |
| MESSENGER Delta DOR and TCM |

Figure 5 and Figure 6 show the supportable time versus the requested time for SELENE on the 34BWG1 and 26M subnets respectively.

Figure 5

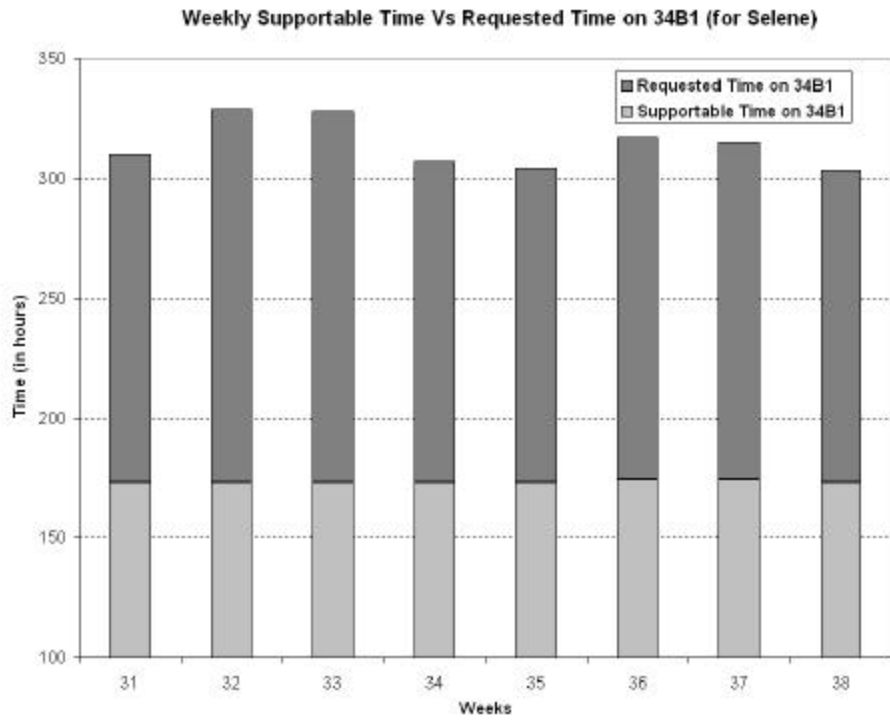


Figure 6

