JET PROPULSION LABORATORY INTEROFFICE MEMORANDUM

September 2, 2004

TO: Eugene Burke

FROM: E. C. Hampton

SUBJECT: MEcury Surface, Space ENviroment, Geochemistry, and Ranging (MESSENGER) Loading Study

The purpose of this study is to evaluate MESSENGER's requirements based upon a new launch day of August 3, 2004, and a complete mission re-plan of all major events to be supported on the Deep Space Network (DSN) as requested. This study will also assess the impact of DSS-45 downtime on MESSENGER requirements.

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) and MESSENGER's updated requirements and events received 10 June 2004.

**Summary**

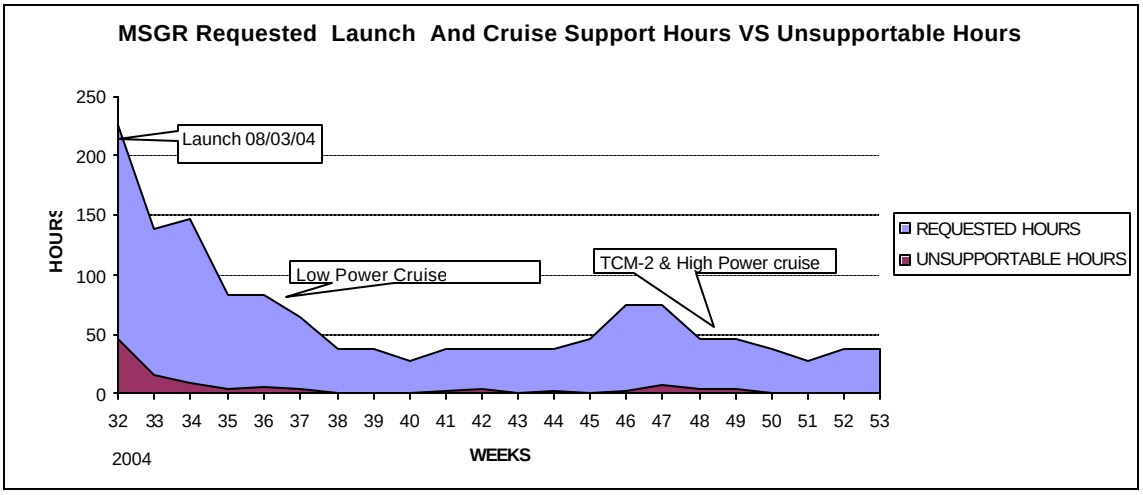
The analysis of the DSN network loading and contention for the period of August 2004 through March 2012 projects that MESSENGER can expect to receive from 80 to 100 percent of their requested time through 2012. The analysis shows that MESSENGER's view period overlaps with Cassini and all the Mars missions; however due to their scheduling flexibility, MESSENGER will have no problem getting their requested support during the remainder of 2004 through 2008. The projected supportable time for the outer years, 2009 through 2012, range from 90 to 100 percent. Please keep in mind that the projected supportable time for 2009 through 2012 is based upon the current approved DSN Mission Set for on-going and advanced missions that have an End of Mission (EOM) or an End of Extended Mission (EOEM) through 2012. The RAPSO Mission Set for these years has not been fully defined and therefore, the projected supportable time is subject to change.

**General Assumptions for 2004 through 2012**

1. MESSENGER does not require dual or backup support for maneuvers.
2. Setup calibration time is 60 minutes for nominal tracking, 90 minutes for Delta DORs and Teardown calibration time is 15 minutes for 34M and 70M stations.
3. The current DSN supportable time is the supportable time in hours on the subnets after updating the mission set database with the February 2004 RARB approved recommendations and MESSENGER's updated requirements received 10 June 2004.
4. DSS-14 is down for antenna controller and hydrostatic bearing maintenance in weeks 28 thru 50 of 2004.

5. DSS-45 is down for Life Extension maintenance in weeks 33 thru 50 of 2004.
6. DSS-46 was down for Performance Reliability maintenance in week 32 of 2004 and was not available for MESSENGER's launch and initial acquisition.
7. Genesis End of Mission is 09/08/04
8. DSS-63 is down for USC installation in weeks 03 thru 04 of 2005.
9. DSS-26 is down for USC installation in weeks 04 thru 05 of 2005.
10. DSS-65 is down for Antenna Controller and Life Extension maintenance in weeks 05 thru 26 of 2005.
11. DSS-34 is down for X/X-Ka Band installation in weeks 07 thru 14 of 2005.
12. DSS-15 is down for USC installation in weeks 17 thru 18 of 2005.
13. DSS-25 is down for USC installation in weeks 22 thru 23 of 2005.
14. DSS-24 is down for USC installation in week 26 of 2005.
15. DSS-55 is down for USC installation in week 27 of 2005.
16. DSS-54 is down for USC installation in week 28 of 2005.
17. DSS-43 is down for Antenna Controller and Hydrostatic Bearing maintenance in weeks 29 thru 52 of 2005.
18. DSS-15 is down for Antenna Controller installation in weeks 37 thru 47 of 2005.
19. End of Extended Mission for POLAR and WIND is 09/30/05
20. DSS-63 is down for Antenna Controller installation in weeks 21 thru 35 of 2006.
21. DSS-24 is down for Antenna Controller installation in weeks 36 thru 42 of 2006
22. DSS-45 is down for Antenna Controller installation in weeks 41 thru 49 of 2006.
23. End of Extended Mission for Ulysses and Voyager 1 and Voyager 2 is 09/30/06
24. DSS-54 is down for X/X-Ka Band installation in weeks 23 thru 30 of 2007.

***Figure - 1***

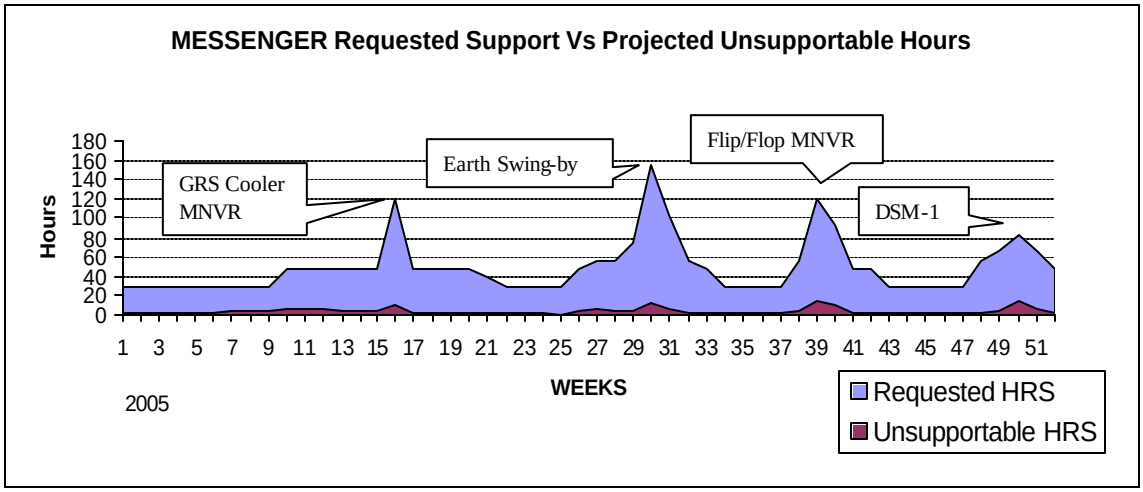



**Assessment on DSN for 2004**

Figure 1 show the projected supportable time for launch through week 53 of 2004 in hours. MESSENGER was successful in negotiating their requested launch and initial acquisition support and launch phase support. MESSENGER's Low Power and High Power cruise phase beginning in week 37 of 2004 have been successfully

negotiated through week 44, 46 and 47 of 2004. The unsupportable time for MESSENGER projected for weeks 37 through 53 ranges from 1 to 7 hours per week. The 7 hours of unsupportable time occurs in week 47 of 2004 and can be attributed to Cassini's Orbit Trim Maneuver (OTM) and backup maneuver support, DSS-45 downtime and DSS-14 is downtime. MESSENGER is able to get at a minimum 1 Southern Hemisphere (Canberra) track per week during the DSS-45 downtime.

***Figure - 2***




**Assessment on DSN for 2005 through 2012**

MESSENGER can expect to receive approximately 80 to 100 percent of their requested support for 2005 through 2012. Figures 3-5 compares the number of requested hours verses unsupportable hours for 2005 -2008. In 2005, MESSENGER is requesting three to five 8-hour passes per week, with the number of passes increasing up to 11 passes per week for special events such as Gamma-Ray and Neutron Spectrometer (GRS) Cooler maneuver, Earth swing-by, Flip and Flop maneuvers and Deep Space Maneuvers (DSM). For 2005, MESSENGER can expect to receive 85 to 100 percent of their requested support. See Figure 5.

The projected supportable time that MESSENGER can expect to receive in 2006 through 2008 ranged from 80 to 100 per cent of their requested supports. See Figures 3-5. Although there are several DSN downtime periods planned for 2006 and one downtime period in 2007, the impact to MESSENGER is minimal, as MESSENGER is able to use any combination of DSN 34M and 70M resources to support their requirement for three to fourteen 8-hour passes per week and two 4-hour Delta DOR passes per week 3 to 4 times a year. The 4-hour Delta DOR passes can be supported as requested using the Goldstone/Canberra (North/South) baseline but the Goldstone/Madrid (North/North) baseline view period overlap does not support a 4-hour overlap. The view period overlap of the North/North baseline range from 1 to 3 hours.

*Figure - 3*

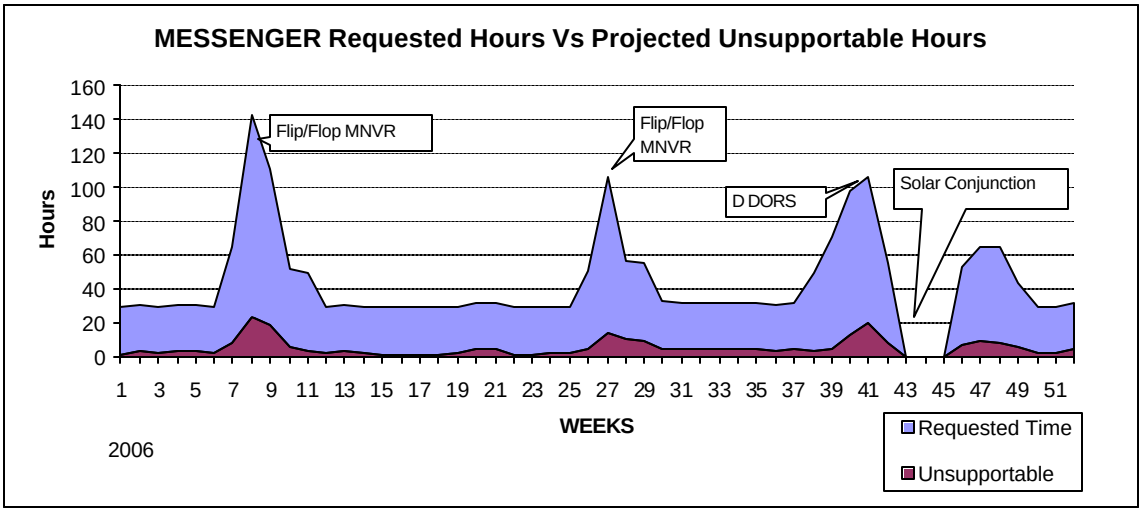



*Figure - 4*

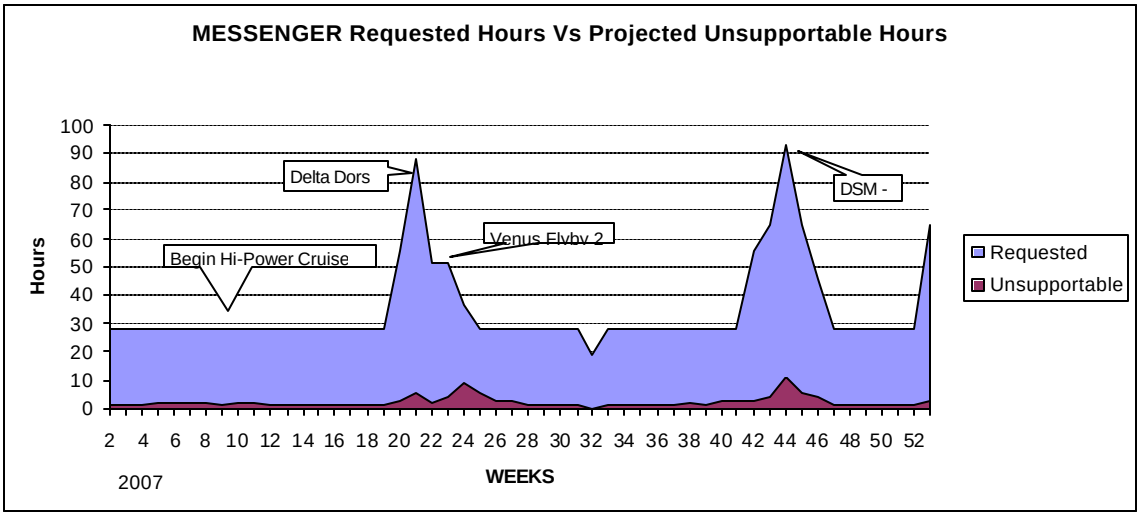
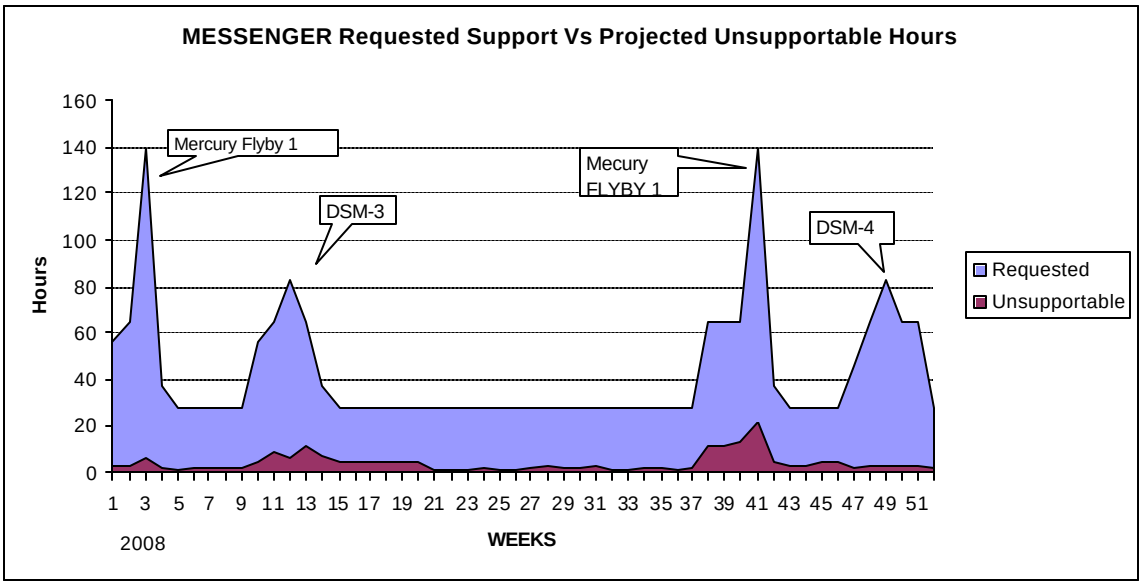


***Figure - 5***




The projected forecast of supportable time in 2009 through 2012, the End of Mission (EOM), that MESSENGER can expect to receive range from 90 to 100 percent. The requirements for the years 2009 through 2012 have not been fully defined at this time; therefore this period should be reassessed at a later date when the data base is fully populated and more defined.

There are no big problem areas from 2004 through 2008 and from 2009 through 2012. The downtime in 2005 – 2007 will play a big part in the Mid-range negotiations but due to MESSENGER's ability to use any combination of 70M and 34M antennas, the downtime will not be an impact to MESSENGER. Overall, MESSENGER can expect to receive from 80 to 100 percent of its requested support from launch through EOM. The results of this study are subject to change. Network loading changes as mission update requirements and periods of antenna downtime are identified. RAPSO will continue to work with MESSENGER and other users of the DSN to maximize the time available for each individual user.

CC:
A. Andujo
R. Bartoo
G. Obrien
S. Guduru
N. Lacey
D. Morris
J. Retana