JET PROPULSION LABORATORY INTEROFFICE MEMORANDUM

May 13, 2009

TO: D. Morris

FROM: A. Andujo

SUBJECT: SOHO SDO Mission Supportability Study

This study is in response to a request from SOHO project management. The purpose of this study is to forecast the DSN's ability to provide support to the SOHO mission 60-day continuous support during instrument calibration with the SDO mission. The three periods being assessed are November 14, 2009 through January 13, 2010, February 5, 2010 through April 6 2010 and April 30 through July 13, 2010.

Summary of Results

The results of this study indicate an average supportable percentage of 72% can be achieved in the first period and 60% in the second and 77% in the third period utilizing the 34BWG1 and DSS-27,45,65 antennas. Utilizing only one set of antennas markedly reduces supportability in both periods. Based on the current information the DSN is not capable of fully supporting the SOHO continuous coverage periods without concessions from users to reduce their nominal support requirements. Heavy utilization by 34 meter antenna users is the primary reason for contention during these periods.

Assumptions

Reference information was acquired using the updated mission set database from the February 2009 Resource Allocation Review (RAR).

The 60 day periods analyzed were in, weeks 46 of 2009 through Week 03 of 2010 and week 05 through 16 of 2010. Analysis was performed using continuous coverage of at least three 8-hour passes for 60 days in between keyhole periods

The planned antenna downtimes that influence the outcome of this study are listed as follows:

	Site	Details	Start	End	Duration (Days)	Weeks	Start DOY	End DOY
2009	DSS 46	Extended Downtime	08/03/2009 00:00	01/01/2020 00:00	3802	32 - 52	215	365
	DSS 24	Depot Level Maintenance - NIB	08/31/2009 00:00	09/27/2009 00:00	28	36 - 39	243	270
	DSS 24	Paint Repair	08/31/2009 00:00	10/25/2009 00:00	56	36 - 43	243	298
	DSS 54	ACQ AID	09/28/2009 00:00	10/11/2009 00:00	14	40 - 41	271	285
	DSS 14	Grouting	10/27/2009 00:00	10/30/2009 00:00	3	44 - 44	300	302
	DSS 15	Elevation Gearbox Replacement	11/02/2009 00:00	11/15/2009 00:00	14	45 - 46	306	319
	DSS 15	Pintle Bearing	11/02/2009 00:00	01/09/2010 00:00	69	45 - 01	306	009
2010	Site	Details	Start	End	Duration (Days)	Weeks	Start DOY	End DOY
	DSS 14	Grouting	01/19/2010 00:00	01/21/2010 00:00	3	03 - 03	019	021
	DSS 34	AZ Track Replacement	02/01/2010 00:00	04/11/2010 00:00	70	05 - 14	032	101
	DSS 34	M1-5 Mirror Alignment NIB	02/01/2010 00:00	04/11/2010 00:00	70	05 - 14	032	101
	DSS 34	M5 Support Ring Replacement NIB	02/01/2010 00:00	04/11/2010 00:00	70	05 - 14	032	101
	DSS 14	Depot Level Maintenance - NIB	03/08/2010 00:00	10/10/2010 00:00	217	10 - 40	067	283
	DSS 14	Fall Arrest - NIB	03/08/2010 00:00	10/10/2010 00:00	217	10 - 40	067	283
	DSS 14	Life Extension	03/08/2010 00:00	10/10/2010 00:00	217	10 - 40	067	283

Note that some downtimes listed are not necessarily used by SOHO, but do impact SOHO by offloading support to antennas supporting SOHO.

Trajectory information used in this study is from the life of mission (2008 – 2015) .spk file submitted by the mission in June 2008.

Analysis

The supportability forecast indicates that heavy contention exists in all scenarios; the first period weeks 46/2009 – 03/2010, the second period weeks 05 – 16/2010 and the third period weeks 18 – 28/2010. Overall supportability in the first period averages 72% and the second period 60% and 77% in the third. The third period at 77% supportability makes it the preferable choice for performing the continuous coverage support.

The large difference in supportability is primarily due to the DSS-34 downtime that occurs in the second period. Overall supportability is well below a level that can be negotiated in the schedule except in the third period. Canberra supportability is, as expected, lower than at Madrid and Goldstone due to less assets to support the DSN overall. Canberra supportability is more of an issue in the second period due to the DSS-34 downtime.(See Figures 1 and 2)

DSS-27,45,65 Analysis indicates that supportability at the DSS-27,45,65 antenna combination averages 83% in the first period and 72% in the second period. (See figure 3)

Forecasting indicates the following for individual antennas (See Figure 4):

DSS-27	Supportability is 92% in the 1st, 89% in the 2nd and 93% in the 3rd.
DSS-45	Supportability is 77% in the 1st, 60% in the 2nd and 89% in the 3rd.
DSS-65	Supportability is 85% in the 1st, 83% in the 2nd and 86% in the 3rd.

34BWG1 Analysis indicates that supportability at the 34BWG1 subnet averages 56% in period 1 and 60% in period 2. (See figure 5)

Forecasting indicates the following for individual antennas (See Figure 6):

DSS-24	Supportability is 77% in the 1st, 71% in the 2nd and 88% in the 3rd.
DSS-34	Supportability is 46% in the 1st, 9% in the 2nd and 55% in the 3rd. (Note: DSS-34 is down in weeks 05 – 14 of 2010)
DSS-54	Supportability is 51% in the 1st, 50% in the 2nd and 52% in the 3rd.

Based on continuous coverage requirements neither 60-day period can be fully supported. However the third period, weeks 18 – 28/2010 has a higher probability of success.

Recommendations

It is recommended that SOHO perform the 60-day continuous calibration in the third period, weeks 18 – 28/2010, primarily due to the DSS-34 downtime in the second period. It is also recommended that SOHO approach JPL/DSN management and request that the DSS-46 antenna remain operational during this period.

As always, the results of this study are subject to change, in that network loading changes as requirements for planned missions are input and updated and periods of antenna downtime are identified. We will continue to work with SOHO and other users of the DSN to maximize the time available for each individual user.

Figure 1: SOHO SDO Calibration Supportability DSS-27,45,65 and 34BWG1

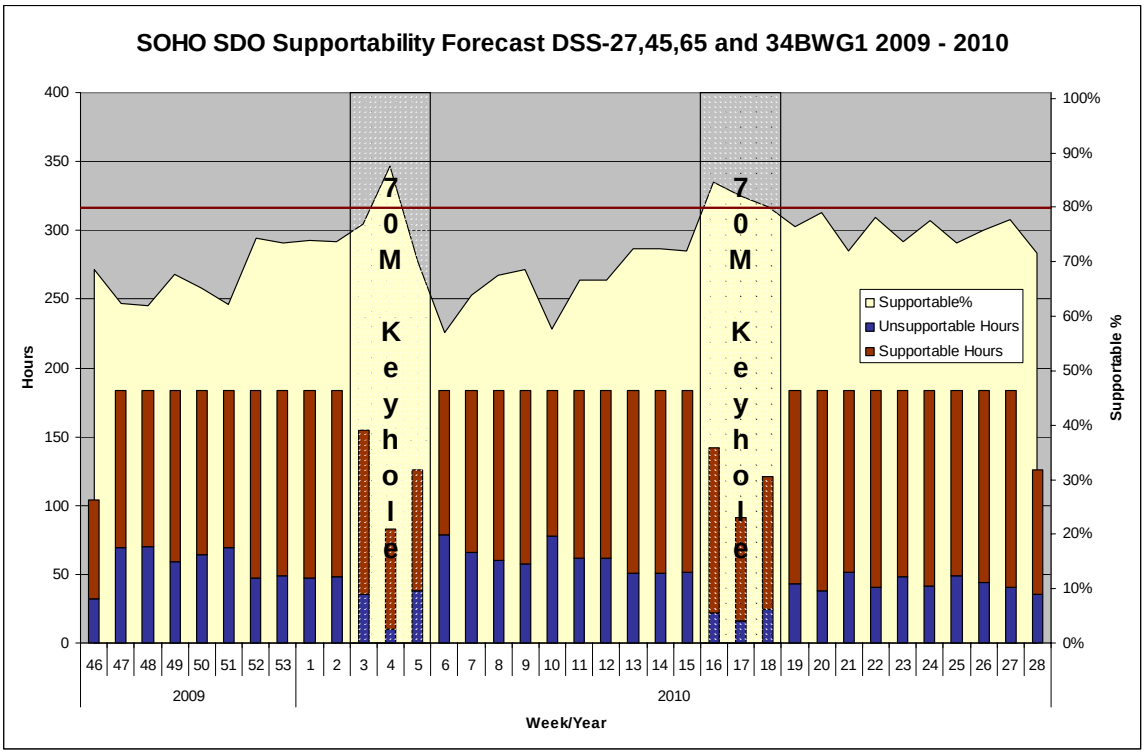

Figure 2: SOHO SDO Calibration Supportability DSS-27,45,65 and 34BWG1

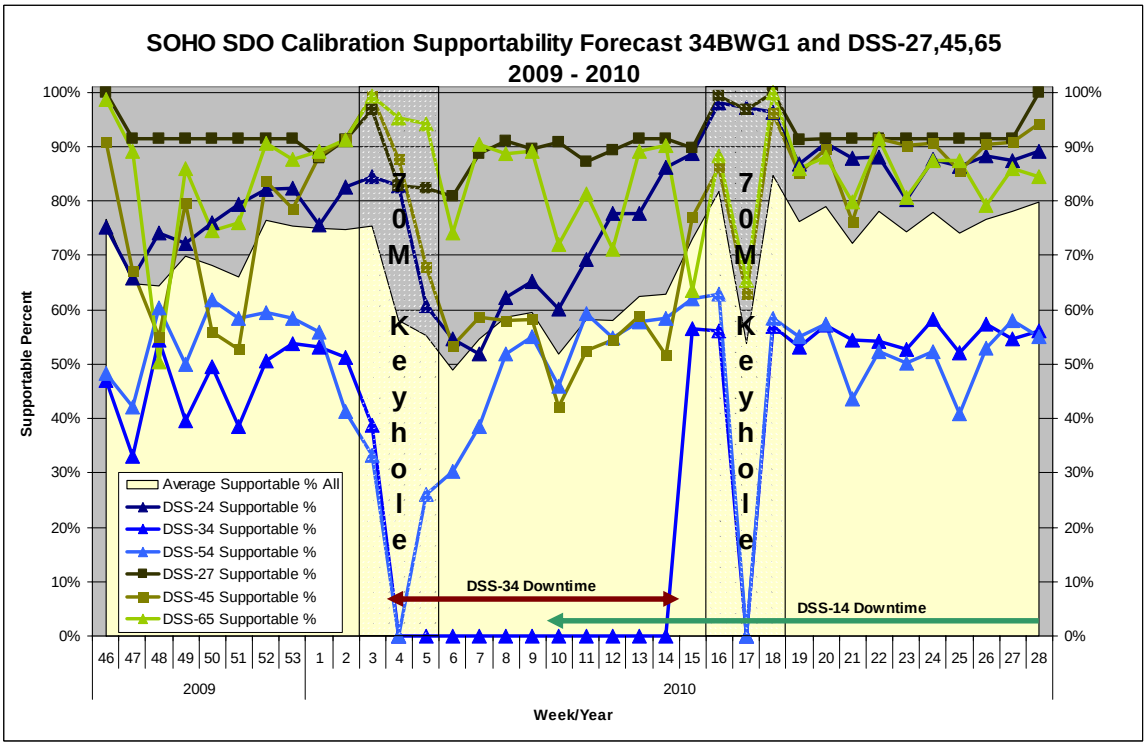

Figure 3: SOHO SDO Calibration Supportability DSS-27,45,65

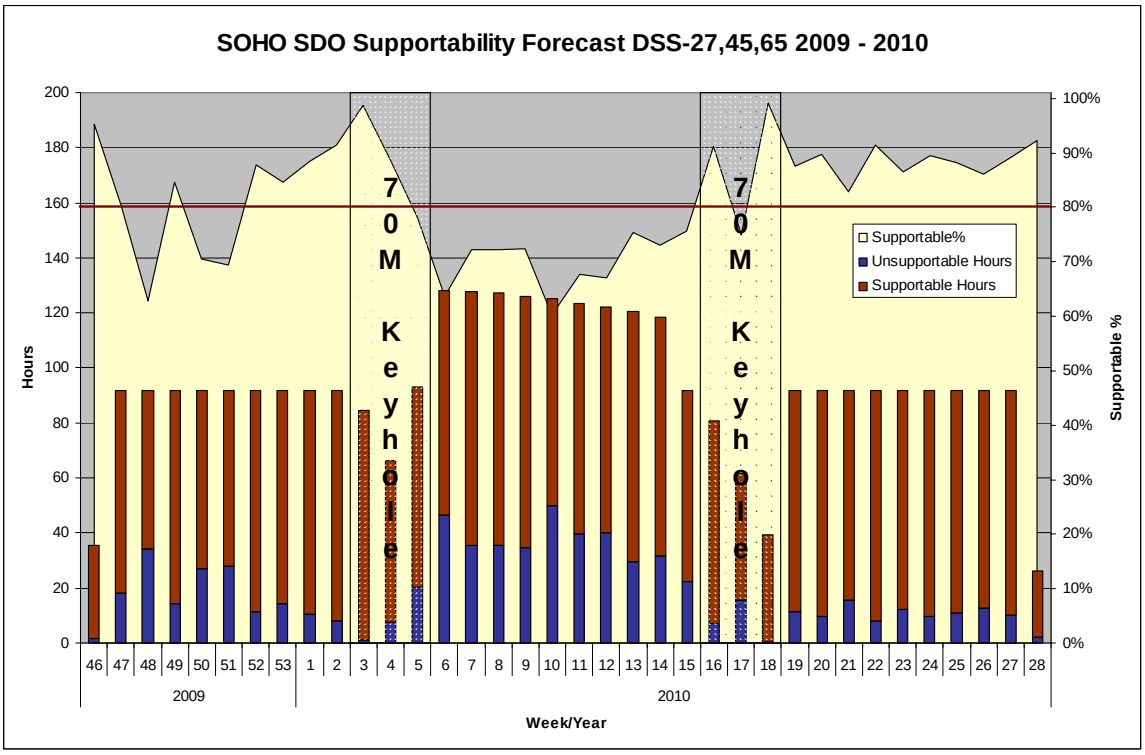

Figure 3: SOHO SDO Calibration Supportability DSS-27,45,65

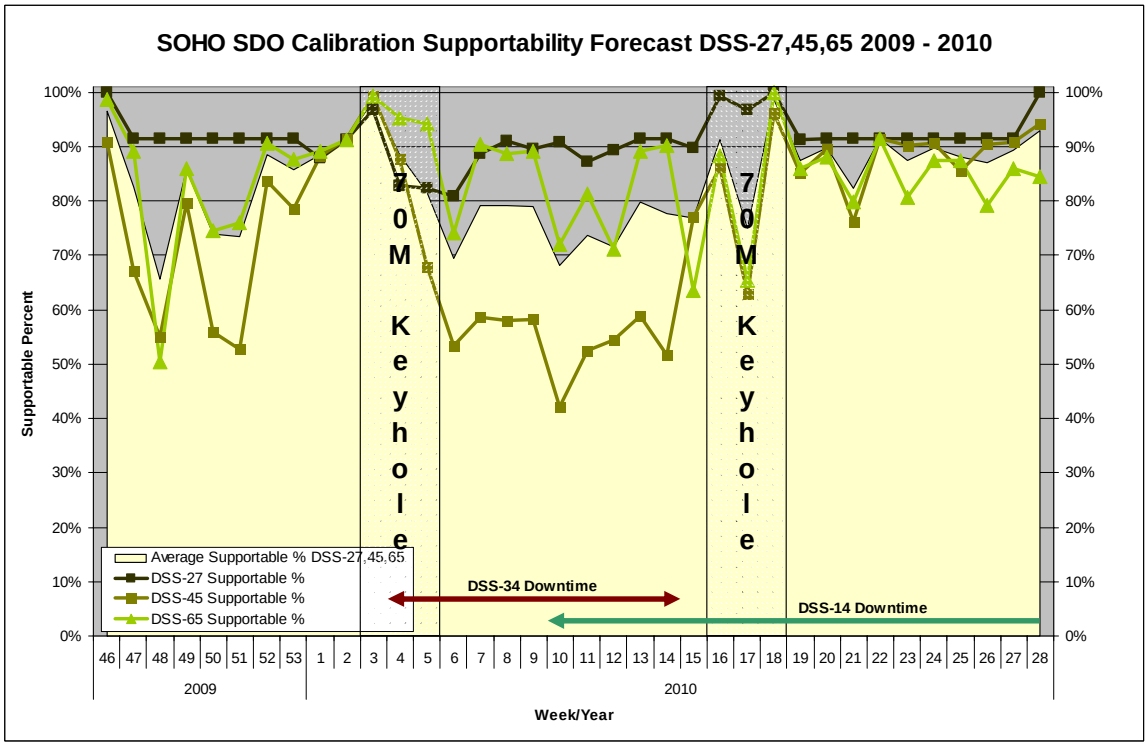

Figure 5: SOHO SDO Calibration Supportability 34BWG1

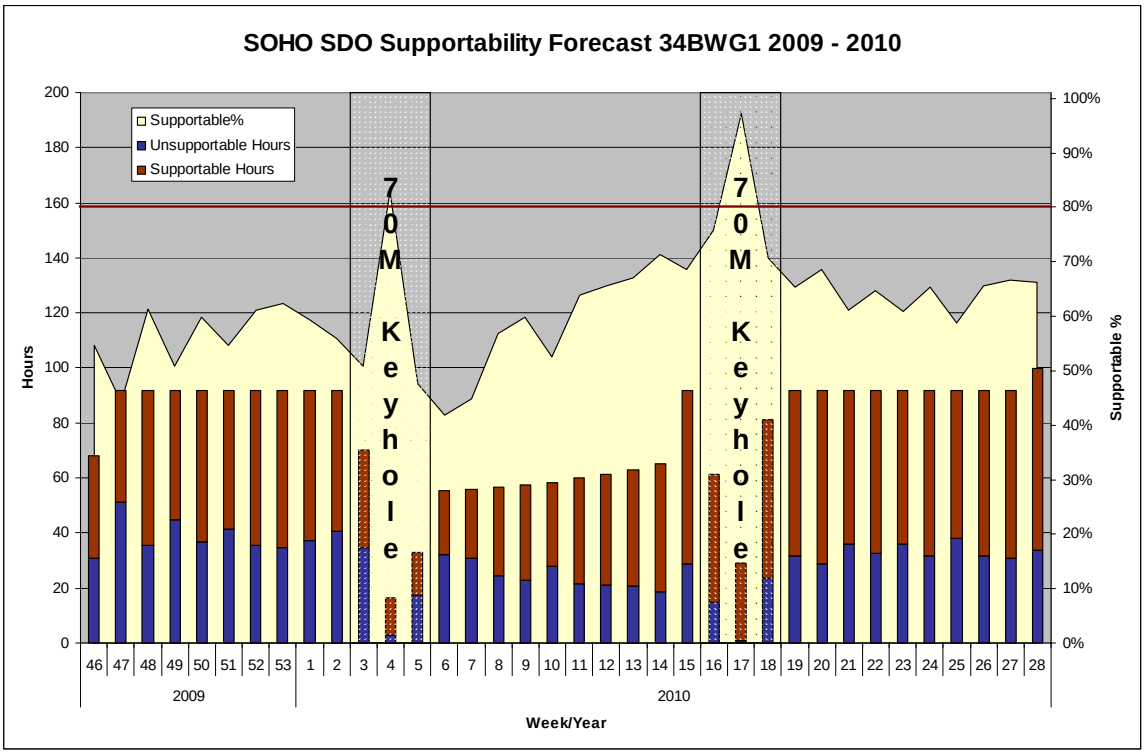

Figure 6: SOHO SDO Calibration Supportability 34BWG1