JET PROPULSION LABORATORY INTEROFFICE MEMORANDUM

June 25, 2001

IOM JLV002-2001-06

TO: E.Burke

FROM: J.Valencia

SUBJECT: DSN Antenna Resource Study for the Space Infrared Telescope Facility (SIRTF) Support

INTRODUCTION

The Resource Allocation Planning and Scheduling Office (RAPSO) has reviewed SIRTF's request for DSN support. RAPSO has performed a study to determine the supportable hours and to identify periods of contention with other DSN resource users during SIRTF's planned five-year prime mission phase. References for this study include the SIRTF User Loading Profile, the SIRTF Project Level Service Agreement, and the February 2001 Resource Allocation Review book.

SUMMARY OF STUDY

SIRTF is scheduled for launch July 15, 2002 and is followed by an eight-week In-Orbit Checkout (ICO) period. SIRTF is forecasted to receive 98 percent of its requested support during the five-year prime mission phase from 2002 to 2007. The Weekly forecasted *Requested Hours* and the Weekly forecasted *Supportable Hours* are shown in *Graphs 1.1* to *1.9.*

Comet Nucleus Tour (CONTOUR) is scheduled for launch July 1, 2002 and will be followed by a sixteen-week In-Orbit Checkout (ICO) phase. The CONTOUR ICO phase will extend into SIRTF's launch support period, but CONTOURS reduced support request will have minimal impact to SIRTF.

DSS-15 is scheduled for the Network Simplification Plan (NSP) upgrade from early August 2002 to late September 2002 and will be removed from DSN operations during this period. The Resource Allocation Review Board (RARB) has reviewed and approved the NSP implementation task schedule. *See Figure 2* for the NSP downtime schedule

Mars Orbit Injection (MOI) activity is planned from Mid-November to late December 2003 reducing SIRTF's routine supportable hours by 8 percent in Week 47, and 11 percent in Week 52 as illustrated in *Graph 1.4.*

Starlight launch and its In-Orbit Checkout (ICO) phase is planned for Mid-July 2006, and will reduce SIRTF's forecasted routine supportable hours by 11 percent as illustrated in *Graph 1.7.*

SCOPE OF STUDY

To conduct a DSN antenna load study using the FASTER software tools, FASTER database, User Loading Profiles, and View Periods. This study will perform forecast analysis from Mid-July 2002 to Mid-September 2007 and report the estimated *supportable hours*, and the estimated *requested hours* as of May 25, 2001. In addition, this study will identify all significant events, to include launch support activities, antenna downtimes, and potential periods of high contention during SIRTF's launch and subsequent eight-week In-Orbit Checkout period. This study also identifies all missions that are planned for launch between 2002 and 2007.

SIRTF MISSION LOAD STUDY

MISSION DETAILS

SIRTF is scheduled for launch July 15, 2002 and will use X-band frequencies for uplink and downlink support. The launch is followed by an eight-week In-Orbit Checkout (ICO) period. During the ICO phase, beginning at launch plus 1 day to September 13, the project is requesting continuous 34m-subnet coverage from either a 34m HEF or 34m BWG antennas. SIRTF is forecasted to receive 1498 hours of supportable track time or 98 percent of its requested hours during ICO.

The Prime Mission Phase will be a minimum of 2.5 years in duration beginning at the end of IOC phase, and will have a mission goal of five years. The SIRTF Prime Mission Phase is from September 13, 2002 to Mid-September 2007. *Figure 3* is a forecast of all mission launch dates planned between 2002 and 2007.

During the Prime Mission phase the support request is for two one-hour passes per day. SIRTF is forecasted to receive approximately 8002 hours of supportable track time or 98 percent of its requested support from launch to End of Prime Mission Phase (EOPM) as shown in *Graph 1.1*. The User Loading Profile *(Figure-1)* shows the Weekly requested hours of support from 2002 to 2007.

From early August, 2004 to late February, 2005 the project is requesting 70m support of two one-hour passes per day in order to meet the DSN high data rate capture requirement of 2.2 million bits-second. SIRTF is forecasted to receive 700 hours of supportable 70m-antenna coverage or 97 percent of its requested support. 34m-subnet support is not requested during this period.

From late February 2005 to Mid-September 2007 (EOPM), the project is requesting two one-hour passes per day: 1-hour of 70m-subnet support, and 1-hour of 34m-subnet support (HEF or BWG). SIRTF is forecasted to receive 3177 hours of supportable track time or 99 percent of the requested hours during this period.

SIGNIFICANT EVENTS

CONTOUR is scheduled for launch July 1, 2002. CONTOUR's In-Orbit Checkout (ICO) phase support is approximately sixteen weeks in duration and ends in Mid-October 2002. DSN coverage of CONTOUR's ICO phase extends into SIRTF's scheduled launch support period. For launch support, CONTOUR is requesting seven-days of 34m HEF continuous coverage during the first week of July. Routine support coverage during the ICO phase will consist of 4 to 7 eight-hour tracks per week. In addition to the routine ICO coverage, COUTOUR is requesting seven-days of continuous support in Mid-August (Week 33).

SIRTF Launch is scheduled in Week 29 (July 15, 2002) and DSN coverage of CONTOUR's In-Orbit Checkout is on going; however, CONTOUR's reduced support request of five eight-hour tracks per week will have minimal impact to SIRTF's launch support in Week 29. SIRTF's view period overlaps less than 60% with CONTOUR in Week 29 as illustrated in *Graph 1.2.* SIRTF's supportable hours are reduced by 10 percent in Week 33 as illustrated in Graph *1.3* because of CONTOUR's requests for seven-days of continuous 34m HEF coverage, and DSS-15 is down for the NSP upgrade.

MARS Express Orbiter (MEX) launch is planned for June 1, 2003 followed by Mars Orbit Injection (MOI) support activity planned for Mid-November to late December 2003. For MOI, the project is requesting eight-weeks of 70m and 34m HEF coverage consisting of two to ten 7-hours passes per week. *Graph 1.4* shows SIRTF's routine supportable hours are reduced by 8 percent in Week 47 and 11 percent in Week 52, because of Mars Express MOI activity.

Starlight launch is planned for Week 23 of June 2006 and the subsequent In-Orbit Checkout (ICO) ends in July Week 27. The ICO phase support causes an 11 percent reduction to SIRTF's requested routine support from Week 27 through Week 30 as shown in *Graph 1.7*. Starlight has view periods that overlap close to 100 percent with SIRTF's views in Week 23 as illustrated in *Graph 1.8*.

Currently, there are approximately twenty-five missions planned between 2002 through 2007. *Figure 3* shows a list of all available launch dates as of May 25, 2001.

ANTENNA DOWNTIMES

DSS-15 is scheduled for downtime from August 1 to September 27, 2002 for the Network Simplification Plan (NSP) implementation task. This downtime occurs during the SIRTF In-Orbit Checkout Phase, which is from SIRTF launch plus one-day to September 8, 2002. RAPSO has moved DSS-15 supports to DSS-25 to clear contentions, as approved by the February 2001 Resource and Allocation Review Board (RARB). *See Figure 3* for the NSP downtime schedule

NSP implementation is scheduled at DSS-24, DSS-45, DSS-54, and DSS-26 from October 1, to November 22, 2002. RAPSO has worked all contentions and the February 2001 RARB has reviewed and approved the NSP implementation task schedule. In

addition, the 20kwatt X-band transmitter installation task is planned at DSS-24 and DSS-54 from October 1 to November 22, 2002 and will be performed on a non-interference basis to the NSP task.

CONCLUSION

The SIRTF DSN antenna load study was completed on May 25, 2001 and covers the period from launch to EOPM. The FASTER software tools, FASTER database, User Loading Profiles, and View Periods were used in the analysis.

This study identified four significant events that are planned between SIRTF launch and EOPM: CONTOUR launch, DSS-15 NSP implementation, MEX Orbit Injection, and Starlight launch support.

Based on available data as of May 25 2001, forecast analysis estimate SIRTF to receive approximately 8002 hours of supportable track time or 98 percent of its requested support from launch to EOPM. Moreover, no high contention periods with other DSN users were identified during SIRTF launch Week of July 15, 2002 and its subsequent eight-week In-Orbit Checkout Phase.

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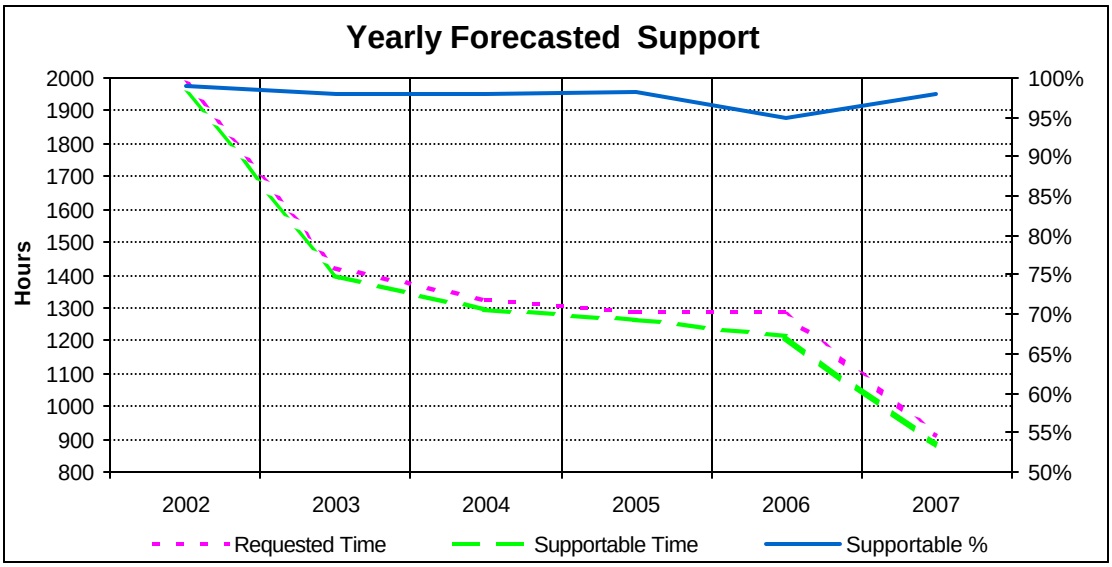
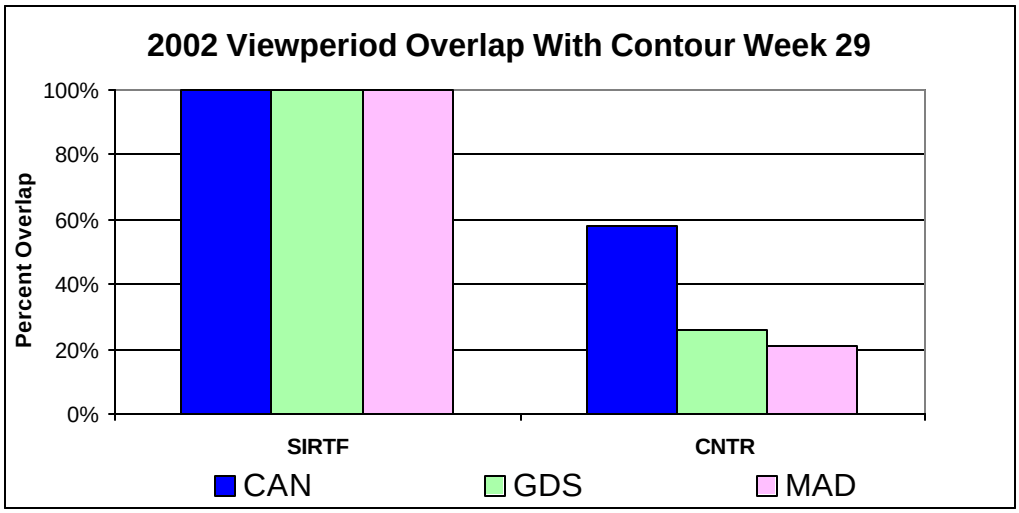
Graph 1.1



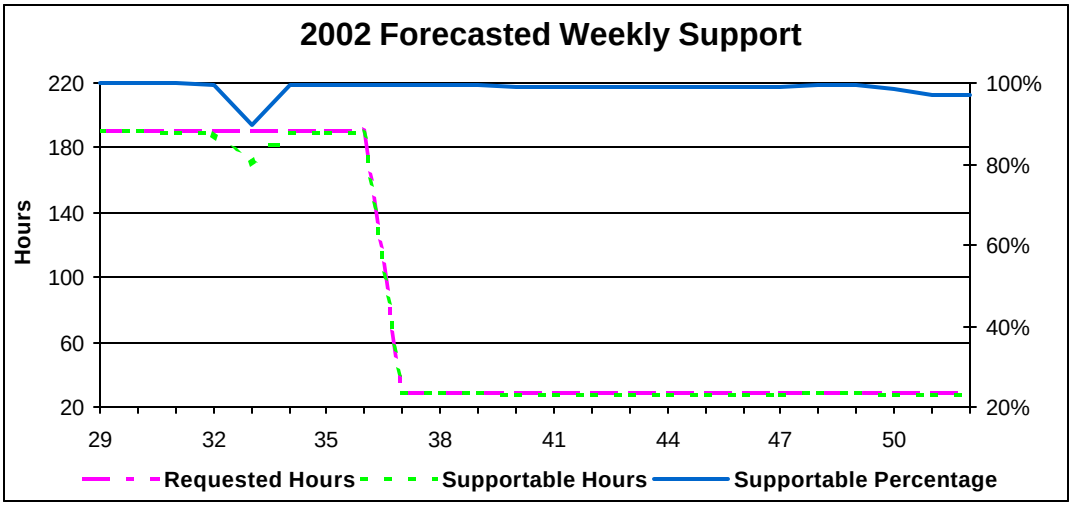
SIRTF is forecasted to receive approximately 98 percent of its requested support from launch to End of Prime Mission as shown in *Graph 1.1*

Graph 1.2



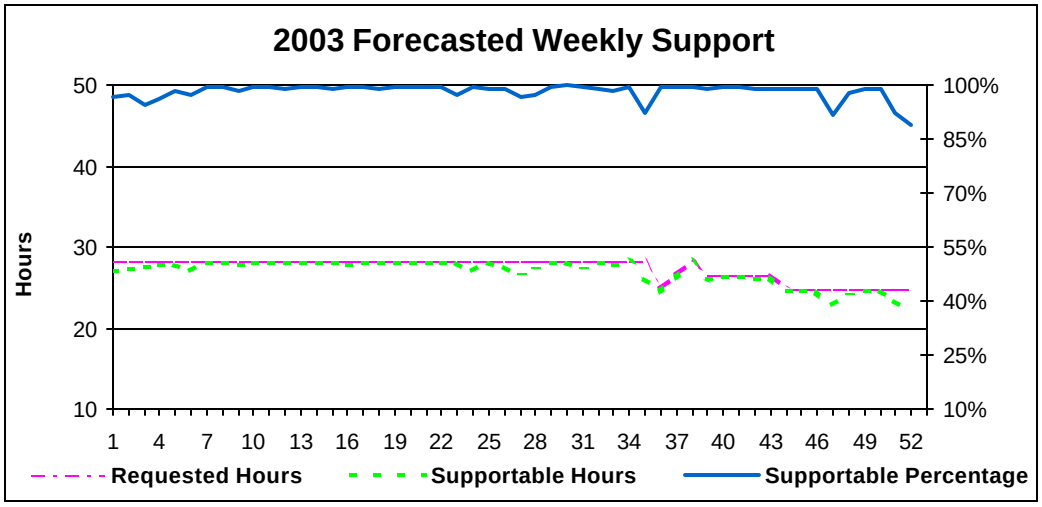
During SIRTF launch (Week 29), CONTOUR's view period overlap less than 60% with SIRTF's view as illustrated in *Graph 1.2.*

Graph 1.3



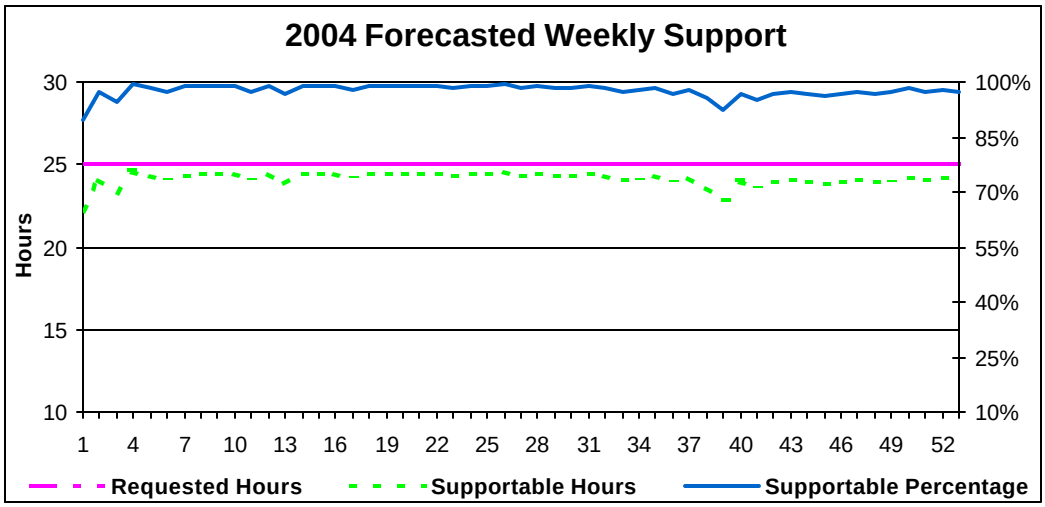
The null in Week 33 reflects a 10% reduction of SIRTF supportable hours because of CONTOUR launch support and DSS-15 NSP downtime as illustrated in *Graph 1.3.*

Graph 1.4



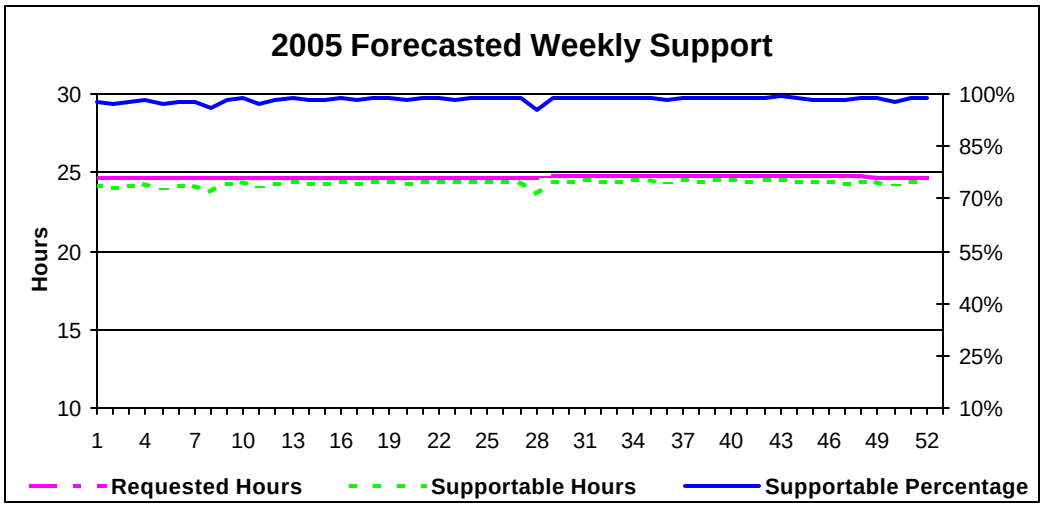
Mars Express MOI activity reduces SIRTF'S supportable hours by 8% in Week 47 and 11% in Week 52 as shown in *Graph 1.4.*

Graph 1.5



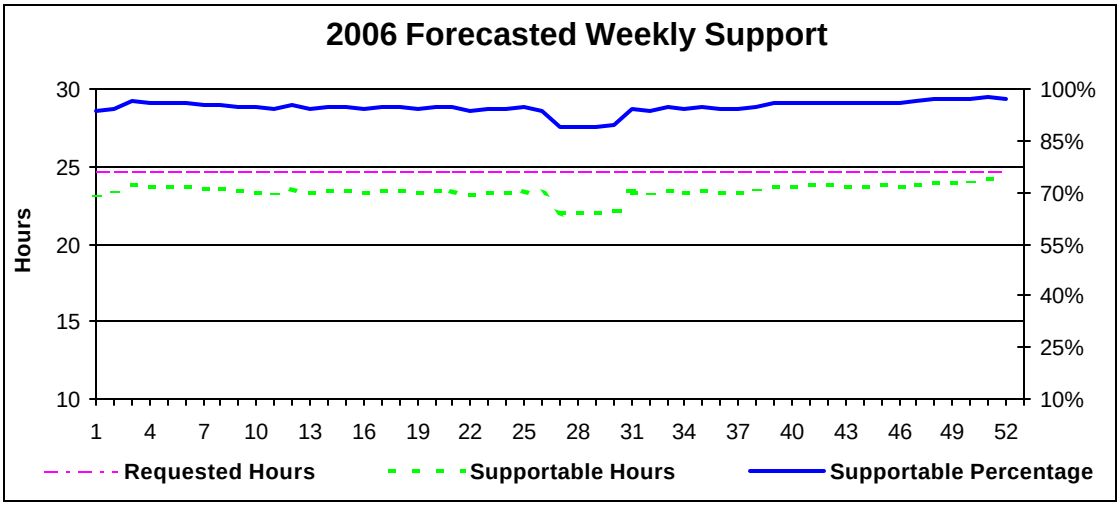
SIRTF 70-meter coverage starts in Week 33 of 2004, and ends in Week 8, 2005. SIRTF does not request support from the 34-meter sub-net during this period.

Graph 1.6



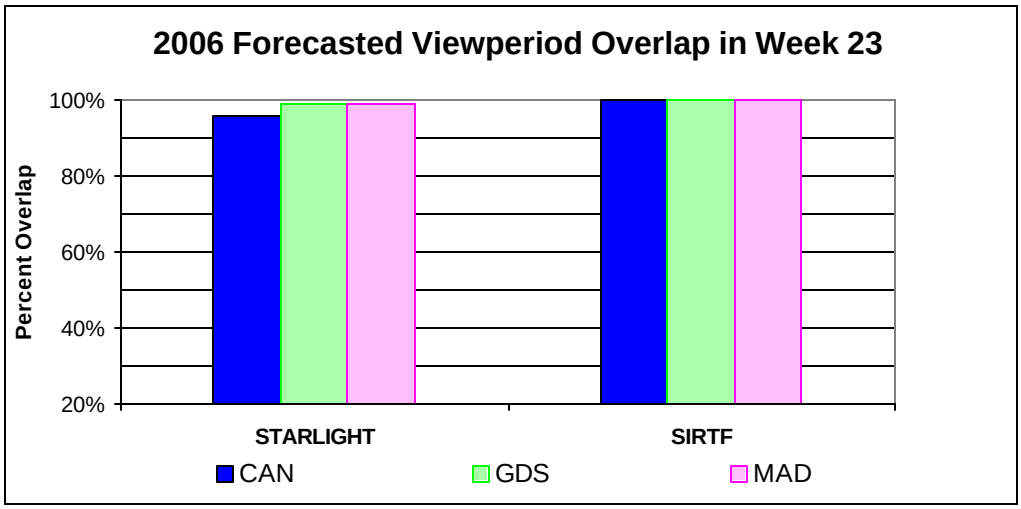
SIRTF's forecasted supportable hours are greater than 99% in 2005 as illustrated in *Graph 1.6.*

Graph 1.7



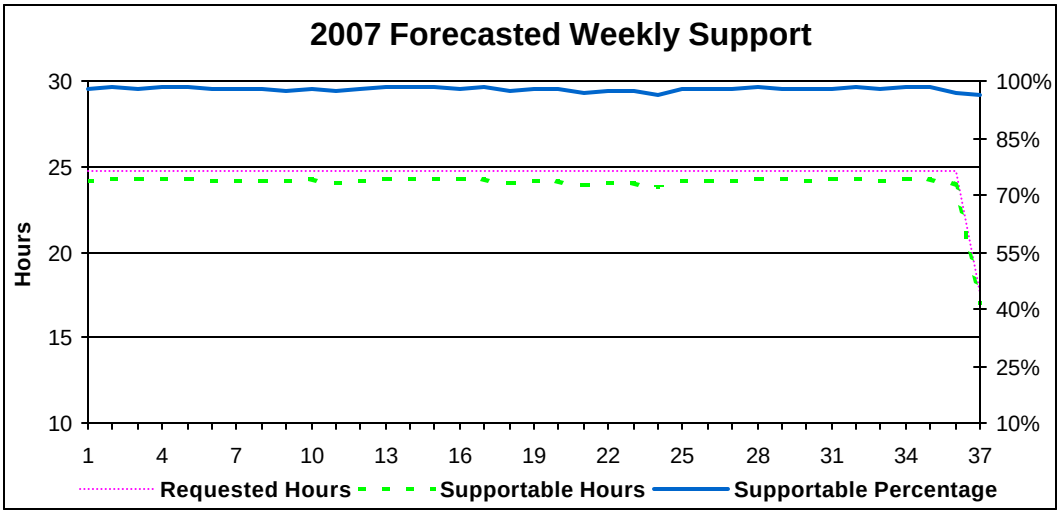
Starlight launch and its In-Orbit Checkout phase reduces SIRTF's routine support in Weeks 27 through 30 by 11 percent as shown in *Graph 1.7*

Graph 1.8



Graph 1.8 illustrates Starlight's view periods overlap SIRTF's view by 100 percent during Starlight launch in Week 23, 2006

Graph 1.9



SIRTF Prime Mission phase ends in Week 37 (EOPM) as shown in *Graph 1.9*

Figure-1

SRTF USER LOADING PROFILE

VP Object	User	Resource	Durations Ave	Durations Min	Calibration Pre	Calibration Post	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
							January					February				March					April					May					June					July					August					September					October					November					December				
2002																																																													
SRTF	SRTF	34H,25,34,54	1.0	1.0	0.75	0.25																																																										
SRTF	SRTF	DSS-15,25,34,65	1.0	1.0	0.75	0.25																																																										
SRTF	SRTF	DSS-15,45,54	1.0	1.0	0.75	0.25																																																										
SRTF	SRTF Launch	34H,25,34,54	8.0	4.0	0.75	0.25																																																										
SRTF	SRTF Launch	DSS-45,65,34,54	8.0	4.0	0.75	0.25																																																										
SRTF	SRTF	DSS-25,34,54	1.0	1.0	0.75	0.25																																																										
SRTF	SRTF Launch	DSS-25	8.0	4.0	0.75	0.25																																																										
2003																																																																
SRTF	SRTF	70M	1.0	1.0	0.50	0.25																																																										
SRTF	SRTF	DSS-14,43,54	1.0	1.0	0.75	0.25							7	7	7	7	7	7	7	7																																													
SRTF	SRTF	DSS-14,15,43,54	1.0	1.0	0.75	0.25							7	7	7																																																	
SRTF	SRTF	34H,25	1.0	1.0	0.75	0.25																															14	14	14	14																									
SRTF	SRTF	DSS-15,65	1.0	1.0	0.50	0.25																																					7		7	7	7	7	7														
SRTF	SRTF	34H,25	1.0	1.0	0.50	0.25																																			14																						
SRTF	SRTF	DSS-25,34,54	1.0	1.0	0.75	0.25	14	14	14	14	14	14									7	7	7	7	14	14	14	14	14	14	14	14	14	14	14	14	14							7																					
SRTF	SRTF	DSS-26,45,65	1.0	1.0	0.75	0.25										7	7	7	7	7	7	7	7	7																																								
SRTF	SRTF	DSS-25,34,54	1.0	1.0	0.75	0.25																																					7	7	7	7	7	7	7														
SRTF	SRTF	DSS-25,34,54	1.0	1.0	0.50	0.25																																												14	14	14	14	7	14	14	7	7
2004																																																																
SRTF	SRTF	70M	1.0	1.0	0.50	0.25																																14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
SRTF	SRTF	34H	1.0	1.0	0.50	0.25																											14	14	14	14	14	14																									
SRTF	SRTF	34H,25,34,54	1.0	1.0	0.50	0.25						14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14																																	
SRTF	SRTF	DSS-25,34,54	1.0	1.0	0.50	0.25	14	14	14	14	14																																																			
2005																																																																
SRTF	SRTF	70M	1.0	1.0	0.50	0.25	14	14	14	14	14	14	14	13	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
SRTF	SRTF	34H	1.0	1.0	0.50	0.25								1	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
2006																																																																
SRTF	SRTF	70M	1.0	1.0	0.50	0.25	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
SRTF	SRTF	34H,25,34,54	1.0	1.0	0.50	0.25	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
2007																																																																
SRTF	SRTF	70M	1.0	1.0	0.50	0.25	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5																					
SRTF	SRTF	34H,25,34,54	1.0	1.0	0.50	0.25	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5																					

Figure-2

MAJOR DSN DOWNTIMES by SITE by Year								
		The latest update is on:4/6/01 5:07:00 PM *The highlighted portion indicates the last change made.						
Year	**Site**	**Description**	**Start**	**End**	**Duration (Days)**	**Weeks**	**Start DOY**	**End DOY**
2002	DSS 14	70M Servo Drive Upgrade	07/15/02	09/27/02	75	29-39	196	270
2002	DSS 14	NIB - NSP Implementation	07/15/02	09/27/02	75	29-39	196	270
2002	DSS 15	NSP Implementation	08/01/02	09/27/02	58	31-39	213	270
2002	DSS 24	NSP Implementation	10/01/02	11/22/02	53	40-47	274	326
2002	DSS 24	NIB - 20 KW X-Band Txr Installation	10/01/02	11/22/02	53	40-47	274	326
2002	DSS 26	NSP Test and Training	10/01/02	02/01/03	124	40-05	274	032
2002	DSS 43	70M Servo Drive Upgrade	11/25/02	02/09/03	77	48-06	329	040
2002	DSS 43	NIB - Ball-Joint Pad Refurbishment	11/25/02	02/09/03	77	48-06	329	040
2002	DSS 43	NIB - NSP Implementation	12/02/02	02/09/03	70	49-06	336	040
2002	DSS 45	NSP Implementation	10/01/02	11/22/02	53	40-47	274	326
2002	DSS 54	NSP Implementation	10/01/02	11/22/02	53	40-47	274	326
2002	DSS 54	NIB - 20 KW X-Band Txr Installation	10/01/02	11/22/02	53	40-47	274	326
2002	DSS 65	NSP Implementation	12/02/02	02/09/03	70	49-06	336	040
2002	DSS 66	Servo Hydraulic Drive Replacement	06/24/02	07/21/02	28	26-29	175	202
2003	DSS 15	Antenna Controller Replacement	03/03/03	05/04/03	63	10-18	062	124
2003	DSS 25	NSP Implementation	02/10/03	04/06/03	56	07-14	041	096
2003	DSS 25	NIB - 20 KW X-Band Txr Installation	02/10/03	04/06/03	56	07-14	041	096
2003	DSS 26	X/X/Ka Downlink Implementation	02/01/03	04/01/03	60	05-14	032	091
2003	DSS 34	NSP Implementation	02/10/03	04/06/03	56	07-14	041	096
2003	DSS 34	NIB - 20 KW X-Band Txr Installation	02/10/03	04/06/03	56	07-14	041	096
2003	DSS 45	Antenna Controller Replacement	09/08/03	10/25/03	48	37-43	251	298
2003	DSS 46	Servo Hydraulic Drive Replacement	05/05/03	06/01/03	28	19-22	125	152
2003	DSS 63	70M Servo Drive Upgrade	02/10/03	04/20/03	70	07-16	041	110
2003	DSS 63	NIB - Ball-Joint Pad Refurbishment	02/10/03	04/20/03	70	07-16	041	110
2003	DSS 63	NIB - NSP Implementation	02/10/03	04/06/03	56	07-14	041	096

Figure 2 shows the Major DSN Downtime Schedule.

Figure-3

DSN User / Mission Planning Set 2002-2007			
PLANNED PROJECTS			
Project	**Acronym**	**Launch or Start**	**EOPM**
Comet Nucleus Tour (CONTOUR)	CNTR	07/01/02	09/05/08
Space Infrared Telescope Facility	SRTF	07/15/02	09/14/07
RadioAstron*	RADA	10/01/02	10/01/07
MUSES - C	MUSC	12/14/02	07/01/07
Rosetta	ROSE	01/13/03	07/10/13
Mars Exploration Rover - A	MERA	05/30/03	04/06/04
Mars Express Orbiter	MEX	06/01/03	12/01/05
Mars Exploration Rover - B	MERB	06/27/03	05/10/04
ADVANCED PLANNING PROJECTS			
Project	**Acronym**	**Launch or Start**	**EOPM**
Space Technology 4 / Champollion	DS4	04/19/03	10/21/06
Mars Surveyor 03 Lander	M03L	05/28/03	12/20/03
Lunar - A	LUNA	08/09/03	03/03/04
Deep Impact	DEEP	01/02/04	08/05/05
Messenger	MSGR	03/10/04	04/06/10
Stereo Ahead	STA	11/12/05	02/18/08
Stereo Behind	STB	11/12/05	02/18/08
Pluto Kuiper Express	PKE	12/01/04	02/23/18
Mars 05 Lander	M05L	08/10/05	
Mars Reconnaissance Orbiter	MRO	08/17/05	02/27/16
Europa Orbiter	EURO	01/03/06	08/22/10
Starlight	SL	06/06/06	11/30/06
Solar Probe	SOLP	02/01/07	03/31/15
Mars Smart Lander 2007	M07L	09/04/07	08/19/10
Mars 07 Orbiter	M07O	09/22/07	
Mars Competed Scout 2007	M07S	09/04/07	11/19/08
Mars CNES Orbiter 2007	M07O	09/09/07	08/11/08
Mars ASI/NASA Telecommunications Orbiter 2007	M07T	09/09/07	08/09/18

Figure 3 is a forecast of planned missions from 2002 through 2007