

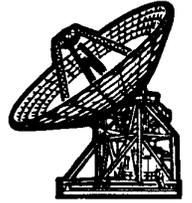


# **VLBI Space Observatory Programme 2 (VSOP2)**

## **DSN Loading Study**

William Hincy  
March 12, 2001

# VSOP2 DSN Support Assessment



## Introduction

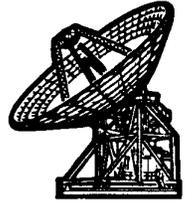
The Resource Allocation Planning and Scheduling Office (RAPSO) has reviewed the VSOP2 requested DSN requirements. These requirements are from the VSOP2 PSLA, signed Space VLBI User Loading Profile (ULP), and email correspondence from Valery Altunin and Joel Smith. Based upon this information, RAPSO has performed an analysis to determine the expected supportable time for VSOP2 in 2008 and 2009 and identified the periods of contention with other users of the DSN.

## Loading Study Criteria

A review of the July 1, 1999 VSOP2 PSLA shows VSOP2 requesting the 11 meter subnet (DSS-23, 33 and 53) for prime science coverage requirements. The ULP, which was signed on October 24, 2000, shows VSOP2 requesting both 70 meter and 34 meter Beam Wave Guide (BWG) support in 2007 and 2008. Reference Figure 8. The email correspondence from Valery Altunin, which was sent on March 5, 2001, requests an analysis of the 34 meter BWG. Likewise, email correspondence from Joel Smith, indicates that VSOP2 requires 34 meter BWG antennas with Ka band capability. Viewperiod range was from January 31, 2008 through December, 31, 2009.



# VSOP2 DSN Support Assessment



## VSOP2 Study Parameters

This study was conducted for years 2008 and 2009. Only 34 meter BWG antennas with S and Ka band capability were considered in the study.

## Summary of Study Results

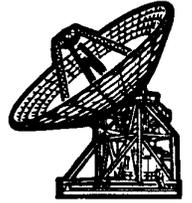
Preliminary DSN loading study results for 2008 and 2009 show the following:

- 1) If VSOP2 uses DSS-34 in 2008 at seven 4-hour passes per week, then VSOP2 is forecasted to receive greater than 90% of their requested support from January through August, and greater than 80% of their requested support from September through December.

The total support requested (ULP - four 4-hour passes per week on BWG) is 1,248 hours including pre-and post-calibration times from January 1 through December 31, 2008. However, VSOP2 is forecasted to receive 2,184 hours including pre-and post-calibration times from January 1 through December 31, 2008. This is a 1.75% increase in support.

- 2) If VSOP2 uses DSS-24, 34 in 2009 at seven 5-hour passes per week, then VSOP2 is forecasted to receive greater than 90% of their requested support in 2009. Likewise, the total support requested is 1,248 hours including pre-and post-calibration times from January 1 through December 31, 2009. However, VSOP2 is forecasted to receive 2,548 hours including pre-and post-calibration times from January 1 through December 31, 2009. A 2.04% increase.

# VSOP2 Parameters



- **Mission Objectives:**

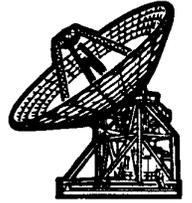
- VSOP2's objective is to study energetic events in the universe; the origin, structure and evolution of active galactic nuclei; the birth and death of stars.

- **Projected Launch:** January 01, 2008

- **Trajectory:** High-Earth Orbit

- **Mission Duration:** Prime - 3 years    Extended - 2 Years

# DSN Mission Support



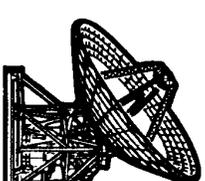
- **Project Tracking Requirements**

- ▶ DSN requested to provide standard S-band uplink and downlink and Ka-band downlink services from 34-m BWG
- ▶ Current trajectory ephemeris file date: January 22, 2001
- ▶ Viewperiods range from January 31, 2008 through January 13, 2013

- **DSN Loading Study Support Documents**

- ▶ PSLA (July 1, 1999)

# VSOP2 2008 - 2009 Viewperiods



VSOP2 Goldstone Complex Viewperiod

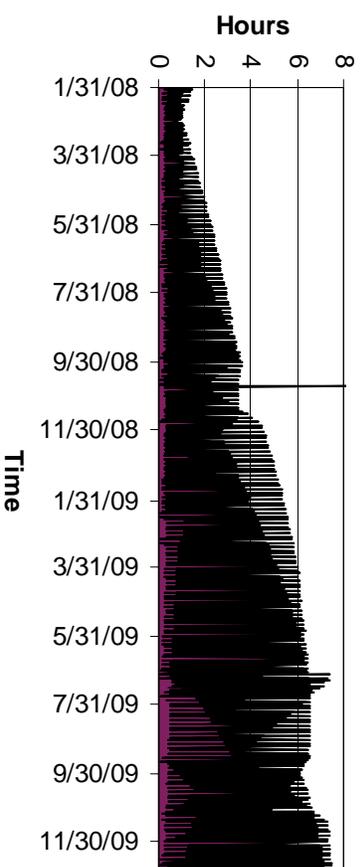


Figure 1

VSOP2 Canberra Complex Viewperiod

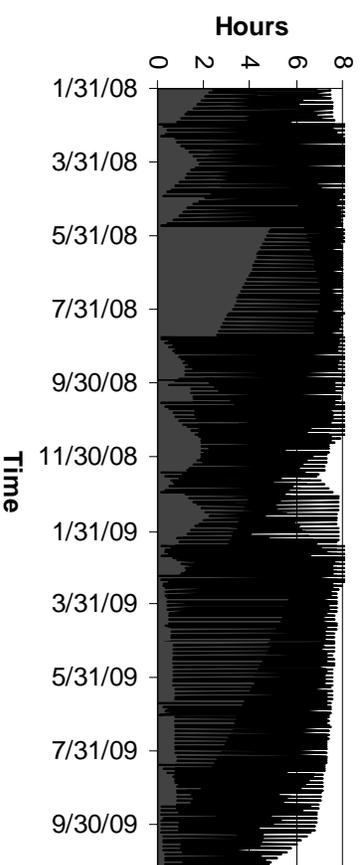
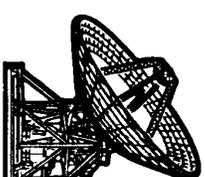


Figure 2

# VSOP2 2008 - 2009 Viewperiods



VSOP2 Madrid Complex Viewperiod

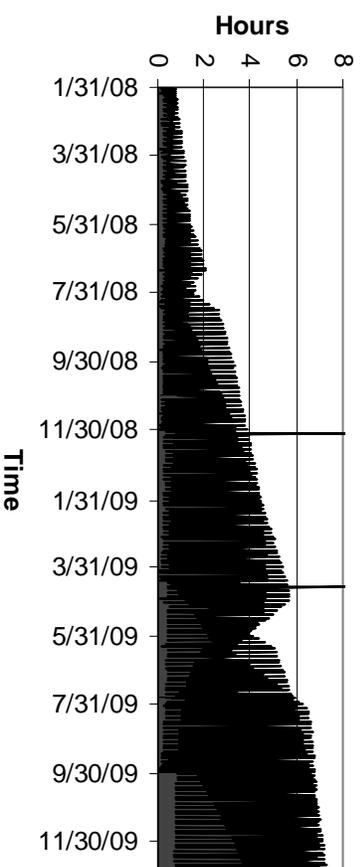
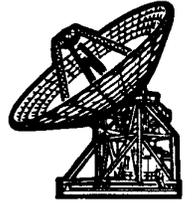


Figure 3

# Viewperiod Analysis



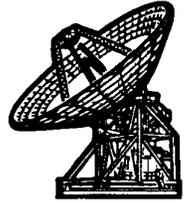
## Goldstone Viewperiod

Figure's 1, 2 and 3 displays the Goldstone, Canberra and Madrid viewperiods for VSOP2. The viewperiod range is from January 31, 2008 through December 31, 2009. The viewperiod trend is shown in solid black in the figures. The average Goldstone viewperiod from January 31 through March 31, 2008 is approximately one hour. The viewperiod gradually increases to three hours on September 30, 2008 and then drops to two hours around October 30, 2008. Starting in November 2008, the viewperiod again increases to six hours around June 15, 2009, where it again drops to approximately four hours in July 2009. From September 30 through December 31, 2009, the viewperiod gradually increases to seven hours. Consequently, VSOP2 would receive marginal support from the Goldstone Complex during 2008 and moderate support in 2009.

## Canberra Viewperiod

The average Canberra viewperiod from January 31, through March 31, 2008 is approximately six hours. The viewperiod gradually increases to an average of eight hours until October 2008 and then drops to around five hours in December 2008. From January through June 31, 2009, the viewperiod averages about seven hours and then decreases to five hours on November 30, 2009. Consequently, VSOP2 would receive moderate support from the Canberra Complex during 2008 and 2009.

# Viewperiod Analysis



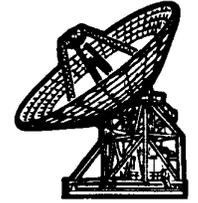
## **Madrid Viewperiod**

The average Madrid viewperiod from January 31 through August 31, 2008 is approximately one hour. The viewperiod gradually increases to four and one-half hours until April 30, 2009 and then drops to three hours around May 31, 2009. Starting in June 2009, the viewperiod again increases to seven hours around October 30, 2009 and maintains this through December 31, 2009. Consequently, VSOP2 would receive marginal support from the Madrid Complex during 2008 and moderate support in 2009.

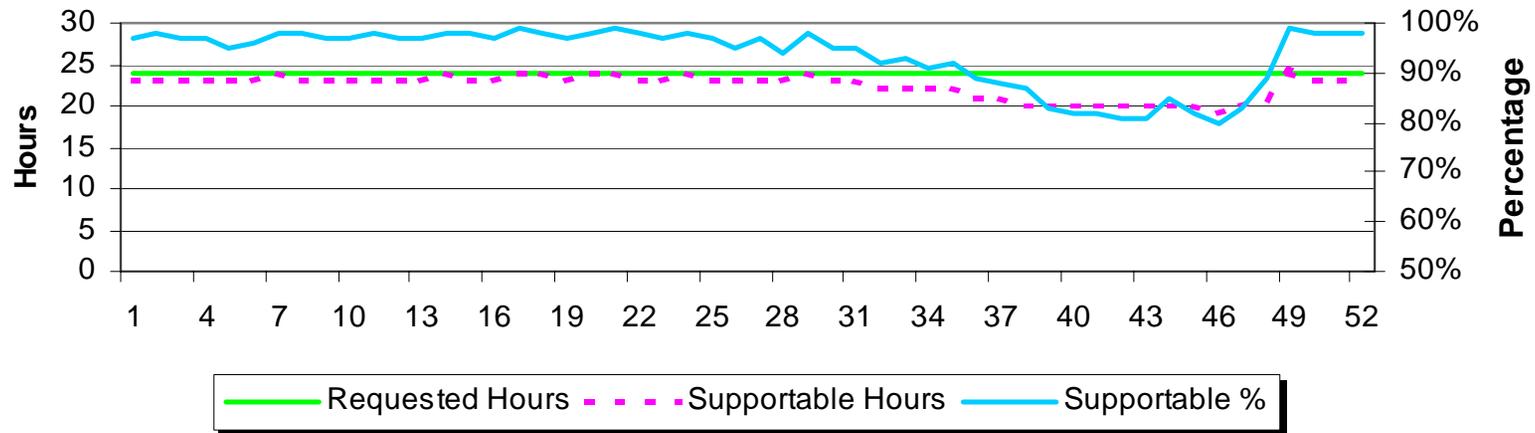
## **Overall Viewperiod Analysis**

Overall, VSOP2 should use only the Canberra Complex for support during 2008. The average viewperiod at Canberra is between four and five hours per day. In 2009, VSOP2 should use the Goldstone and Madrid Complexes. The average viewperiod for Goldstone and Canberra is approximately five hours.

# 2008 DSN Support Profile

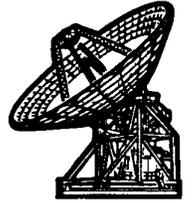


**VSOP2 Forecasted 2008 Weekly Support  
Using DSS-24,34,54 With Four 4-Hour Passes Per Week**

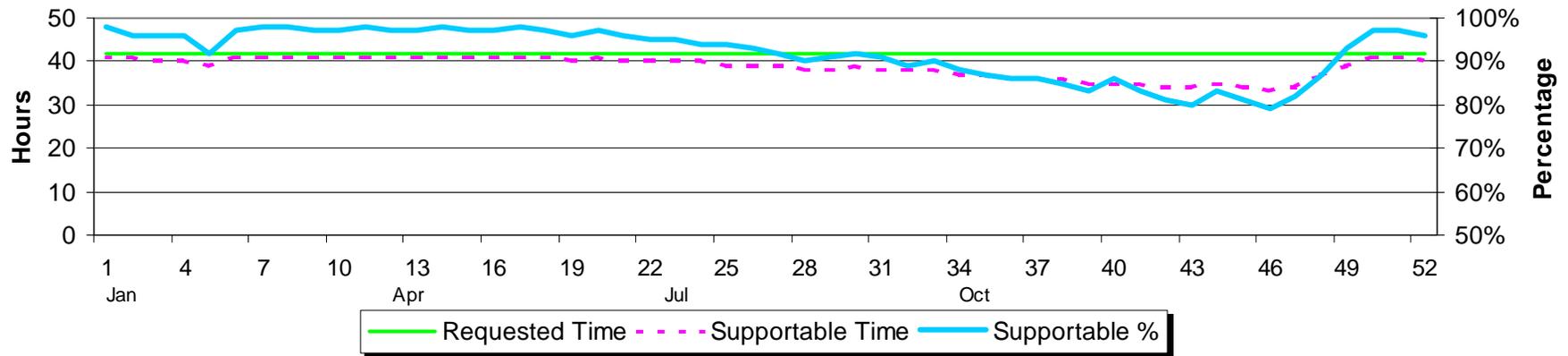


**Figure 4**

# 2008 DSN Support Profile

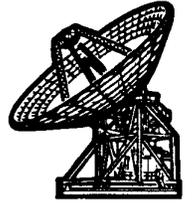


**VSOP2 Forecasted 2008 Weekly Support  
Using DSS-34 With Seven 4-Hour Passes Per Week**

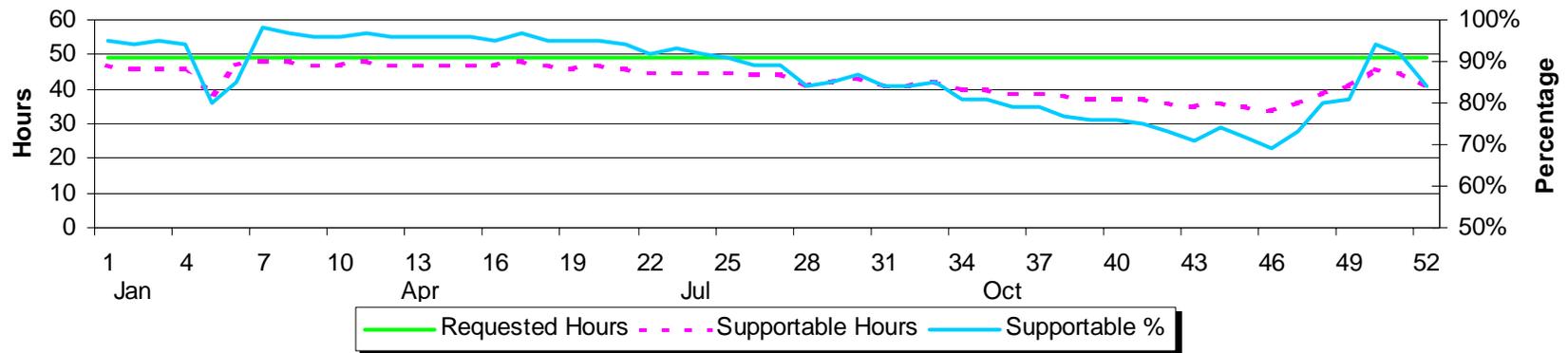


**Figure 5**

# 2008 DSN Support Profile



**VSOP2 Forecasted 2008 Weekly Support  
Using DSS-34 With Seven 5-Hour Passes Per Week**



**Figure 6**

# 2008 DSN Viewperiod Profile

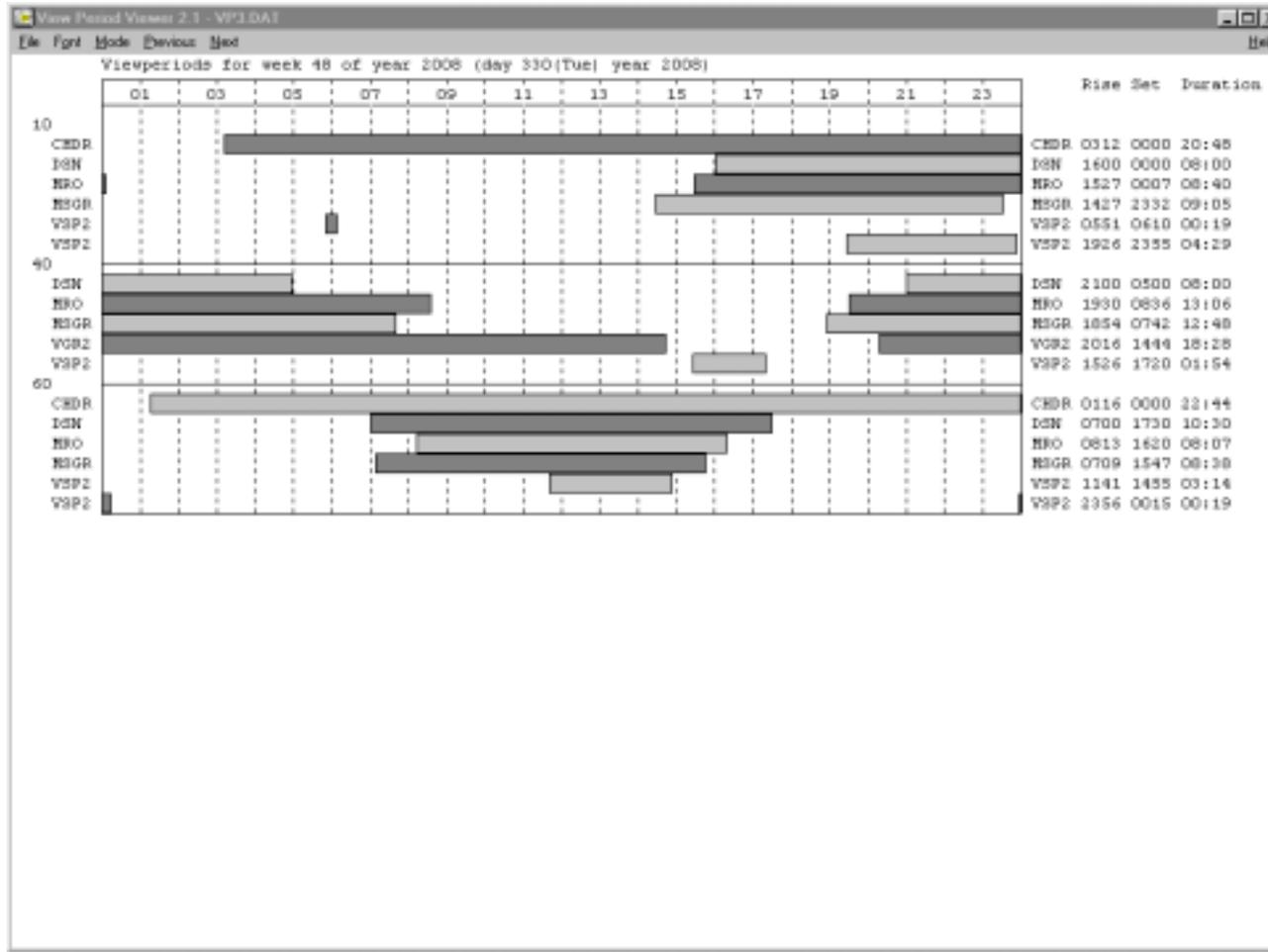
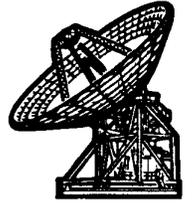
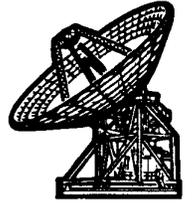


Figure 7

# 2008 DSN Support Analysis



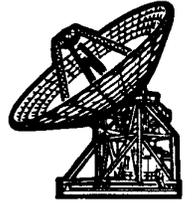
## General DSN Support

Figure's 4, 5 and 6 shows VSOP2's requested hours (solid green line), forecasted supportable hours (dashed purple line) and supportable percentage (heavy blue line). In Figure 4, VSOP2 should receive greater than 90% of their requested support from January through August, greater than 80% of their requested support from September through mid-November, and increasing to 98% in December. This figure shows VSOP2 using DSS-24,34,54 at four 4-hour passes per week throughout the year.

In Figure 5, VSOP2 should receive greater than 90% of their requested support from January through August, and greater than 80% of their requested support from September through December. This figure shows VSOP2 using DSS-34 at seven 4-hour passes per week throughout the year.

In Figure 6, VSOP2 should receive greater than 80% of their requested support from January through August, and greater than 70% of their requested support from September through December. This figure shows VSOP2 using DSS-34 at seven 5-hour passes per week throughout the year. Week 48, for example, shows VSOP2 at 70% supportable time. This is due to the lack of viewperiod at Canberra during this week. Reference Figure 7.

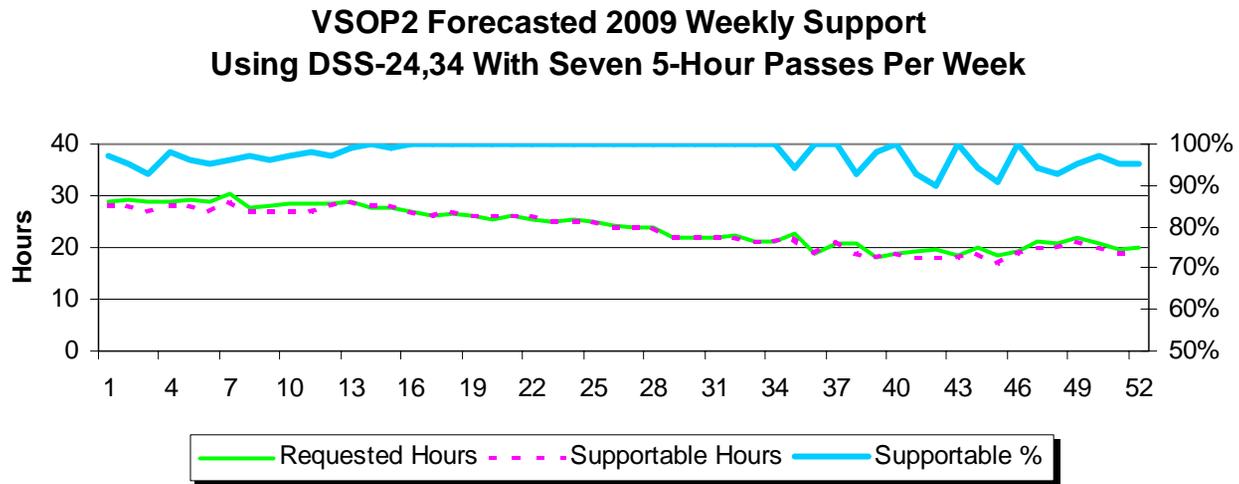
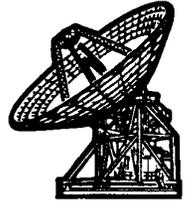
# 2008 DSN Support Analysis



## Impact to Other User

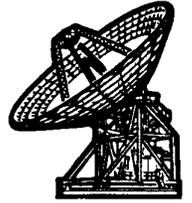
During this time, VSOP2 can only be viewed mainly from DSS-34 at Canberra. VSOP2 will cause minimum contention to other users if they uses DSS-34 at seven 4-hour passes per week. Other users who are using DSS-34 and are in VSOP2 viewperiod are: Chandra (CHDR), DSS Maintenance (DSN), Mars Reconnaissance Obiter (MRO), Messenger (MSGR) and Voyager 2 (VGR2). CHDR is performing routine operations and requesting twenty-one 1-hour passes per week on the 34 meter BWG antennas. MRO is mapping and requesting fourteen 8-hour passes per week on the 34 meter BWG antennas. MSGR is in routine operations. In addition MSGR is conducting a Venus flyby in January 2008 and Mercury flyby during late September through late October 2008. VGR2 is in routine operations and requesting seven 8-hour passes per week on DSS-34. Negotiation with these projects to secure additional support is required.

# 2009 DSN Support Profile



**Figure 7**

# 2009 DSN Support Analysis



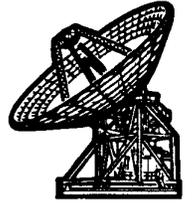
## General DSN Support

Figure 6 shows VSOP2's requested hours (solid green line), forecasted supportable hours (dashed purple line) and supportable percentage (heavy blue line). In Figure 6, VSOP2 should receive greater than 90% of their requested support. This figure shows VSOP2 using DSS-24, 34 at seven 5-hour passes per week throughout the year.

## Impact to Other User

During this time, VSOP2 is viewed mainly from DSS-24, 34 at the Goldstone and Canberra Complexes. VSOP2 will cause minimum contention to other users if they uses DSS-24, 34 at seven 5-hour passes per week. Other users who are using DSS-24, 34 and are in VSOP2 viewperiod are: DSS Maintenance (DSN), Mars Reconnaissance Obiter (MRO), Messenger (MSGR) and Voyager 2 (VGR2). MRO is in relay phase, MSGR is in Mercury orbit and VGR2 is in routine operations. Negotiation with these projects to secure additional support is required.

## Comments/Questions



- **Comment:**

- **As always, the results of this analysis are preliminary in that the network load changes as requirements for planned missions are input and updated. We will continue to work with the VSOP2 project and other users of the DSN to maximize the time available for each user.**

- **Questions:**

- **Does VSOP2 Have trajectory information for the beginning of January 2008?**

