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Deep Space Network

Mission Support Requirements

Jet Propulsion Laboratory
California Institute of Technology

JPL D-0787, Rev. AF

870-14, Rev. AF
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Deep Space Network

Mission Support Requirements

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JPL D-0787, Rev. AF

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INTRODUCTION

A. PURPOSE AND SCOPE

The purpose of this document is to provide NASA and JPL management with a concise summary of information concerning the forecasting of the necessary support and requirements for missions described in this publication.

This document presents a brief description of various missions along with specific support requirements for each. The missions described herein are those listed in the Mission Set prepared by the Mark IVA DSN Operations Planning group (see Figure 1). Figure 1 is presented here to provide the reader with a general overview of the mission support requirements.

B. REVISION AND CONTROL

Revisions or changes to the information presented in this document may be initiated by all DSN personnel. The initiator should submit a written request for change to the TDA Mission Support and DSN Operations Manager Office.

Revisions, changes, and additions to this document will be issued on the first day of the first month of a calendar quarter.

C. ORGANIZATION OF DOCUMENT 870-14

This document describes each individual mission, which is titled and included in this document in alphabetical order. (Appendix A consists of a listing and description of various potential flight projects that are being investigated by JPL at the present time.)

D. ABBREVIATIONS

Abbreviations used in this document are normally defined at the first textual use of the technical term. Abbreviations and acronyms approved for use by the JPL Office of Telecommunications and Data Acquisition (TDA) are listed in Document 810-3, TDA Standard Practice - Glossary of Deep Space Network Abbreviations and Acronyms. Those not listed in Document 810-3, but used in this document, can be found in the Glossary (Appendix B) at the end of this document. The Glossary is followed by a listing of various terms and their definitions (Appendix C), which will assist readers who would like clarification of one or more of the terms used in this document. A list of facility identifiers and their definitions is contained in Appendix D.

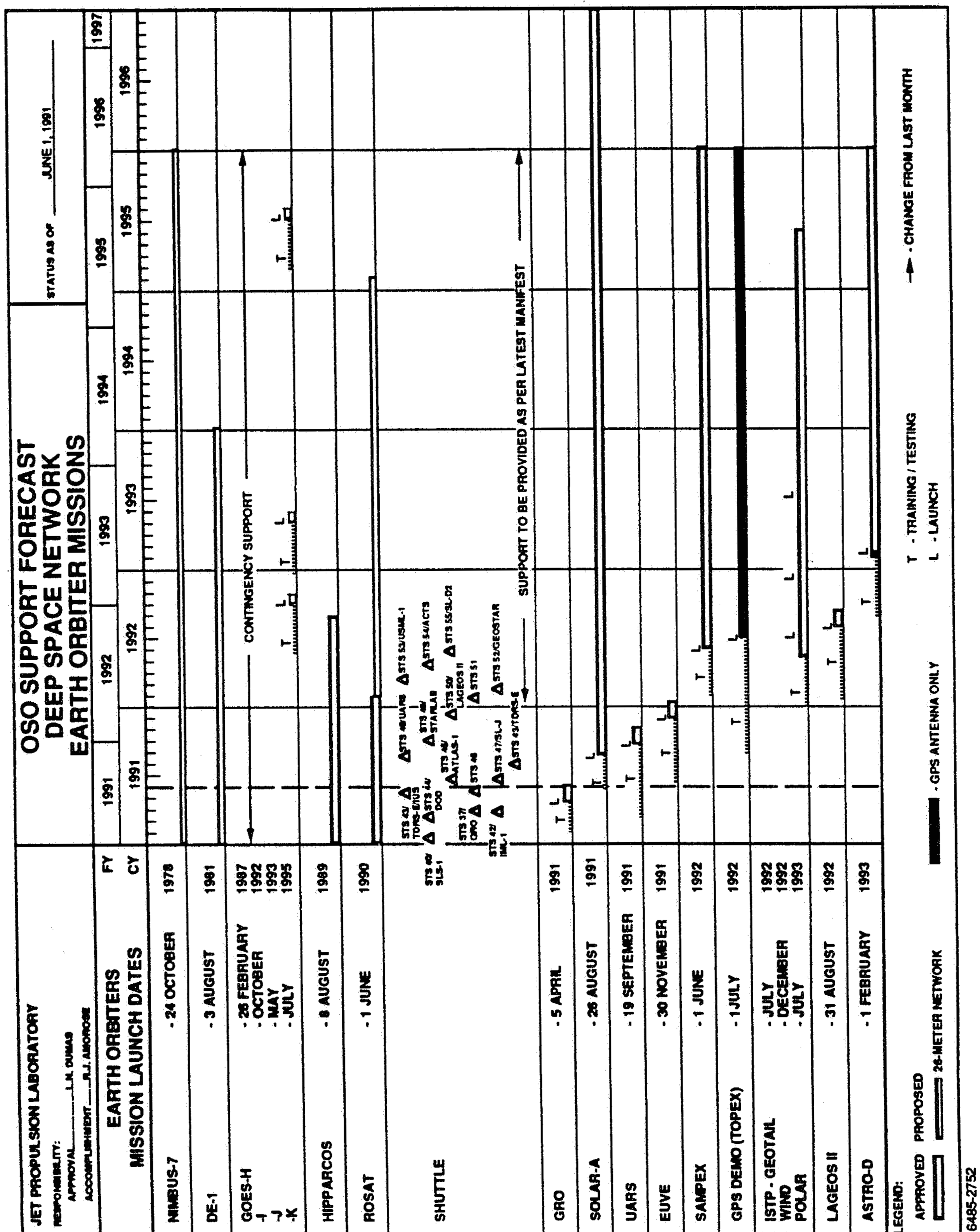

Figure 1. Mission Set (Sheet 1 of 4)

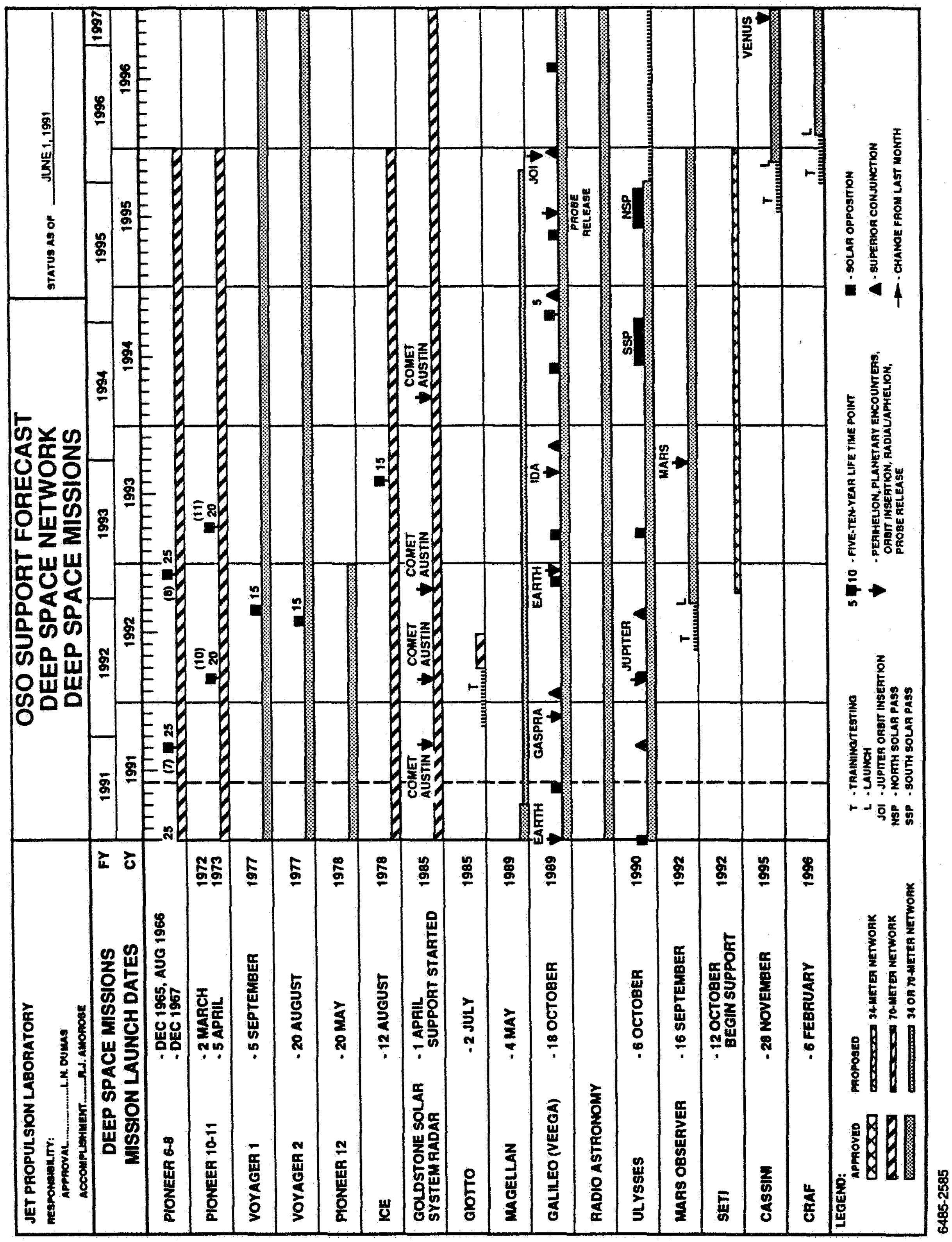

Figure 1. Mission Set (Sheet 2 of 4)

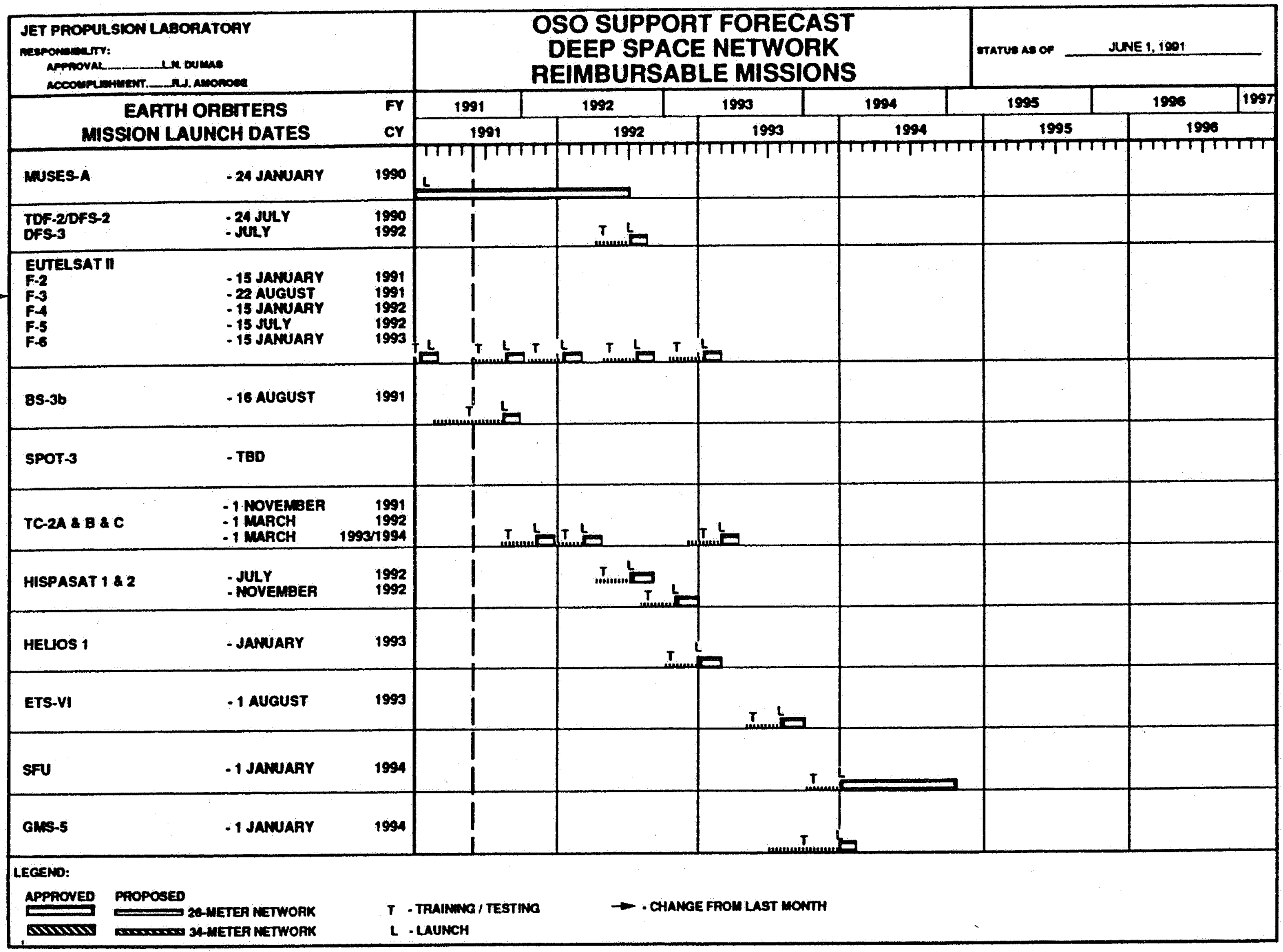

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Figure 1. Mission Set (Sheet 3 of 4)

TELECOMMUNICATIONS AND DATA ACQUISITION

TDA MISSION SUPPORT & DSN OPERATIONS

EMERGENCY SUPPORT MISSION SET

JPL

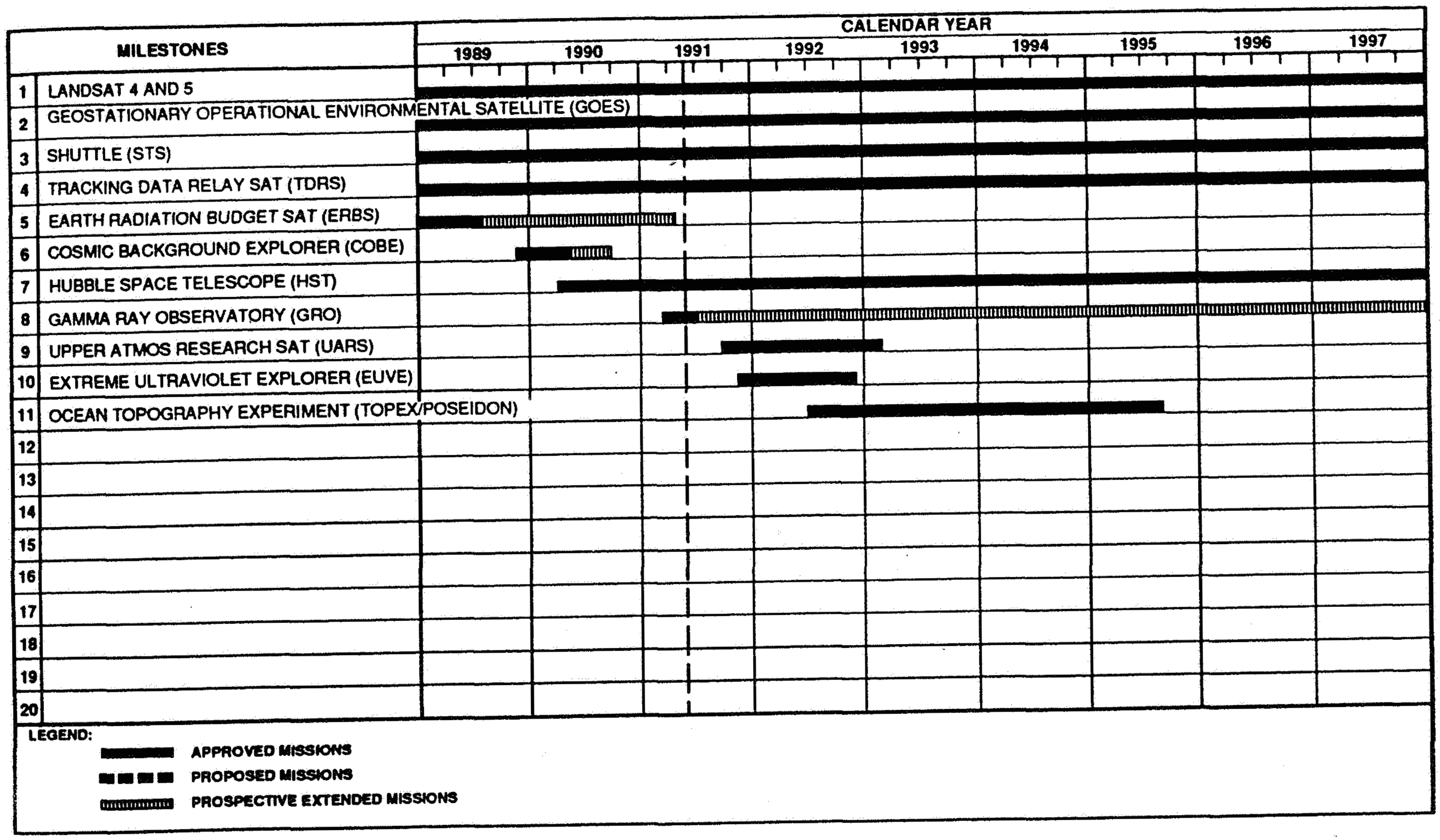

Figure 1. Mission Set (Sheet 4 of 4)

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ASTRO-D

TDS Mgr: J. Goodwin
NOPE: R. Nevarez

Project Mgr: Y. Tanaka (ISAS)
G. W. Ousley, Sr. (GSFC)
MOM: K. Ninomiya (ISAS)

Launch Date: February 1, 1993
Projected SC Life/DSN Support: 2 years/2 years

Project Responsibility: Institute of Space and Astronautical Science (ISAS)

Source: TBS
Sponsor: ISAS

A. MISSION DESCRIPTION

ASTRO-D, which is to be launched by a MU-3II vehicle, is a scientific Earth orbiting satellite of the Institute of Space and Astronautical Science (ISAS) of the Ministry of Education, Science, and Culture of Japan. Its mission is TBS.

B. FLIGHT PROFILE

ASTRO-D will be launched on a MU-3II-5 launch vehicle from Kagoshima Space Center (KSC) in Uchinoura, Kagoshima Prefecture, Japan. Additional flight information is TBS.

C. COVERAGE

No DSN lauch vehicle support is required. The DSN will support the Mission phase only.

1. Coverage Goals

The DSN will support 4 to 8 contacts per day depending on the Launch and Early Orbit phase (LEOP) and Mission phase, providing downlink telemetry recording only at all stations.

Additional coverage information is TBS.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16 17	42 43 45 46	61 63 66
S-band TLM	P	P	P
S-band CMD			
S-band TRK			

NOTE: P = Prime

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Goldstone	Canberra	Madrid
S-band TLM	N/A	TBS	RCP
S-band CMD	N/A	N/A	N/A
S-band TRK	N/A	N/A	N/A

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM (NRZ-S)Bi0/PM or PCM (NRZ-S)PSK/PM
Subcarrier Frequency	524000 Hz
Bit Rates	1024, 4096, and 32768 b/s (Real-time) 131072 and 262144 b/s (Playback)
Coding	Convolutional, K=7 R=1/2
Record	Required

(2) Command

Format	PCM (NRZ-L)/PSK/PM
Subcarrier Frequency	TBS
Bit Rate	4000 b/s

(3) Support

Uplink Power	1 to 10 kW
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Required (26-m only)
Doppler Rates	Modest
Range Formats	N/A
Recording	
o Analog	N/A
o Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibility for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Prelaunch	ISAS
Launch	ISAS
LEOP & Mission	DSN, ISAS

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BROADCASTING SATELLITE-3A AND -3B (BS-3A AND 3B)

NM 693939

(Reimbursable)

TDS Mgr: N. Fanelli
NOPE: R. Nevarez

Project Mgr: K. Funakawa (NASDA)
MOM: M. Horii (NASDA)
LV/Range: N-11/TaSC

Launch Date: BS-3A: August 28, 1990; BS-3B: August 17, 1991
Projected SC Life/DSN Support: 5 years/7 to 30 days

Project Responsibility: National Space Development Agency, Japan (NASDA)

Source: SIRD
Sponsor: NASDA

A. MISSION DESCRIPTION

The Broadcasting Satellites-3A and -3B (BS-3A and -3B) are being planned and developed by Japan's National Space Development Agency (NASDA) as a follow-on to the BSE and BS-2 project that began in April 1978. The BS-3A and -3B will provide direct color TV boradcasting to the Japanese mainland and remote islands including the Okinawa and Ogasawara island groups. Control of the satellite will be from the Tsukuba Space Center.

B. FLIGHT PROFILE

The BS-3A and -3B satellites will be launched from Tanegashima Space Center (TaSC) in southern Japan by a type H-1 three-stage launch vehicle. The mission has been designed to follow the conventional injection sequence; i.e.,

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parking orbit, transfer orbit, and near-synchronous orbit. Attitude maneuvers will be performed to orient the spacecraft to the correct attitude prior to the Apogee Kick Motor (AKM) firing, which will occur at the 4th, 7th, 9th or 11th apogee. After AKM firing, drift phase orbital and attitude maneuvers will be performed to place the spacecraft at its final geostationary station position.

C. COVERAGE

1. Coverage Goals

The coverage will consist of the 26-m antenna as prime and the Madrid 34-m antenna as backup support for the transfer and drift orbits. Maximum support will consist of one 8-hour tracks per station for a 7-day period, plus 23 days of contingency support from all complexes.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone					Canberra				Madrid		
	12	14	15	16	17	42	43	45	46	61	63	66
S-band TLM				P					P	B		P
S-band CMD				P					P	B		P
S-band TRK				P					P	B		P

NOTE: B = Backup; P = Prime

3. Compatibility Testing

The BS-3A and -3B compatibility tests were completed in 1989 at JPL's compatibility test area (CTA-21) and include radio metric, telemetry, and command data flow.

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2280.721	RCP
S-band CMD	2100.164	--	RCP
S-band TRK	2100.164	2280.721	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	
Format	PCM(SP-L)/PSK/PM
Subcarrier Frequency	192 kHz
Bit Rate	512 b/s
Record	Required

(2) Command

Format	PCM (BiØ-L) PSK/PM
Bit Rate	1 25 G/s
Subcarrier Frequency	16 kHz

(3) Support

Uplink Power	1 to 10 kW
Antenna Rate	Moderate
Antenna Autotrack	Transfer - drift orbits
Doppler Rates	Modest
Range Format	Tone (100 kHz major)
Recording	
. Analog	Required
. Digital	N/A

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Launch	TaSC
Transfer/Drift Orbits	DSN
Geostationary Orbits	TACS (NASDA)

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CRAF/CASSINI (C/C)

TDS Mgr: R. Gillette
NOPE: TBS

Project Mgr: J. Casani
Deputy Project Mgr: R. Draper

Launch Date: Cassini - November 26, 1995
CRAF - February 10, 1996

Projected SC Life/DSN Support: CRAF - 9.4 years
Cassini - 12.6 years

Project Responsibility: Jet Propulsion Laboratory

Source: SIRD August 1991
Sponsor: OSO

A. MISSION DESCRIPTION

CRAF (Comet Rendezvous Asteroid Flyby) - A mission to rendezvous with the comet Tempel 2 and to station-keep at the comet for a period of 2.6 years, including the comet perihelion. There is a flyby of the asteroid Mandeville prior to arrival at Tempel 2.

Cassini - A mission to place a spacecraft in a highly elliptical orbit around the planet Saturn and deliver a probe to the surface of its satellite Titan. There is a flyby of the asteroid 1989 UR1 prior to Saturn arrival.

Current Status - Congressional action on the Fiscal Year 1992 budget has cut funding for CRAF/Cassini, which will likely result in launch date changes. The next CRAF opportunity is a May 1997 launch to comet Kopff with arrival in late 2005. A likely Cassini launch would be October 1997 with arrival at Saturn in June 2004.

B. FLIGHT PROFILE

1. CRAF

Event	Date
Launch	10 February 1996
Maneuvers	6 November 1997, 1 November 1998, 18 September 2000, Others are TBD
Venus Gravity Assist	28 April 1997
Venus Gravity Assist	5 June 1998
Asteroid Flyby	25 February 1999
Earth Gravity Assist	19 June 2000
Comet Rendezvous	16 February 2003
Perihelion	15 February 2005
End of Mission	31 June 2005

2. Cassini

Event	Date
Launch	26 November 1995
Maneuvers	9 July 1998, 22 November 1998, Others are TBD
Venus Gravity Assist	2 December 1996
Earth Gravity Assist	5 July 1998
Asteroid Flyby 1989 UR1	7 January 1999
Jupiter Gravity Assist	9 April 2000
Saturn Orbit Insertion	25 June 2004
Probe Separation	20 October 2004
Probe Entry	12 November 2004
End of Mission	1 July 2008

C. COVERAGE GOALS

1. CRAF

The Project requires one tracking pass (plus one Delta VLBI pass) per week from the 34-m HEF stations during cruise periods, continuous 34-m HEF coverage from launch to L + 30 days and around gravity assists and maneuvers. Coverage from the 70-m is required during asteroid flyby, maneuvers, comet arrival and search. For a radio science experiment, continuous 34-m HEF and 70-m coverage is required for 30 days (March 20 through April 16, 2001).

2. Cassini

The Project requires one tracking pass (plus one Delta VLBI pass) per week from the 34-m HEF stations during cruise, continuous 34-m HEF coverage from launch to L + 30 days and around gravity assists and maneuvers. During Saturn orbital operations, one 34-m HEF pass per day for the 24 days of cruise-like activities, and continuous 34-m HEF support during the 6 days of high- level activities for each 30-day orbit are required.

3. Additional Anticipated Coverage

Both CRAF and Cassini will use their Low Gain Antenna (LGA) during most of the first three years of cruise. While using the LGA, 70-m support will be required to support the low 5- and 10-b/s telemetry. If the 70-m subnet is not implemented with an X-band uplink capability, simultaneous 34-m coverage will be required to provide the uplink in order to meet the command and navigation requirements.

D. FREQUENCY ASSIGNMENTS

CRAF is an X-band uplink and downlink mission. Cassini will be X-band uplink with either X- or Ka-band downlink. Ka-band will not be supported until January, 2002. Cassini will also have an S-Band Radio Science downlink capability. X-band, Ka-band and S-band channel assignments are TBS.

E. SUPPORT PARAMETERS

The support parameters for these missions are:

1. Telemetry	CRAF	Cassini
Initial Acquisition Time	30 min	Same
Radio frequency	X-band	S-, X-, and Ka-band (S-band carrier only)

Data rate	5 b/s to 497.7 kb/s	5 b/s to 497.7 kb/s (X-band), 169.5 (Ka-band)
Subcarrier frequency	22.5 kHz, 360 kHz	Same
Coding		
Convolutional	K-15, R=1/6	Same
Reed-Solomon	J=8,E=16,I=5	Same

2. Command

Radio frequency	X-band	Same
Data rate	7.8125 to 500 b/s	Same
Subcarrier frequency	16 kHz	Same
Subcarrier waveform	sinewave	Same
Coding	PSK/NRZ-L	Same
Power (emergency support)	20 kW on 70m or 80 kW on 34m (Jan., 2000)	Same

3. Navigation

Doppler, ranging, wide-band and narrow-band VLBI	Required	Required

4. Radio Science

Open-loop (near-real time)	Required	Required
Closed-loop (real time)	Required	Required

5. Monitor

Real-time station data	Required	Required

F. TRACKING SUPPORT RESPONSIBILITY

The DSN is responsible for all support for both CRAF and Cassini, including pre-launch checkout at CTA 21 and MIL 71.

COSMIC BACKGROUND EXPLORER (COBE)

(Emergency Support)

TDS Mgr: N. A. Fanelli
NOPE: R. E. Nevarez

Project Mgr: R. Mattson
MOM: R. Stanford
LV/Range: Delta 5920/WTR

Launch Date: October 15, 1989 (Launched November 1989)
Projected SC Life/DSN Support: 1 year/1 year

Project Responsibility: Goddard Space Flight Center (GSFC)

Source: SIRD
Sponsor: OSO

A. MISSION DESCRIPTION

The Cosmic Background Explorer (COBE) Mission will measure the diffuse radiation from the universe in the wavelength band 1 micron to 9.6 mm. The band includes the 3°K cosmic background radiation, the known relic of the primeval cosmic explosion. It is also expected to contain the radiation produced at the time of the formation of the first galaxies or stars in the universe. The mission will provide the most comprehensive observations to date of the radiative energy content of the universe, a data set essential for the further iteration of theory and observation in cosmological research.

B. FLIGHT PROFILE

The COBE satellite will be launched from the Western Space and Missile Center (EWSMC) via the Delta into a circular parking orbit of about 300 km. COBE will be placed into a 900-km altitude circular orbit.

C. COVERAGE

1. Coverage Goals

Coverage will be provided by the DSN for COBE emergencies that would prevent communications via the normal channels of TDRSS. Emergency support will be provided by the DSN 26-meter subnetwork.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	E	E	E
S-band CMD	E	E	E
S-band TRK	E	E	E

NOTE: E = Emergency Support

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2287.5	LCP
S-band CMD	2106.4	--	LCP
S-band TRK	2106.4	2287.5	LCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	2
Format	PCM/PSK/PM BiØ-L
Subcarrier Frequency	1024 kHz
Bit Rates	1000, 4096, 655.36 kb/s
Coding	Convolutional
Record	Analog

(2) Command

Format	PCM/PSK/PM
Bit Rate	2000 Hz
Subcarrier Frequency	16000 Hz
Subcarrier Waveform	Sine

(3) Support

Uplink Power	Up to 2 kW
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Yes
Doppler Rates	Up to 70 Hz/s
Range Format	Sine
Recording	
. Analog	Yes
. Digital	No

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DYNAMICS EXPLORER-1 (DE-1)

TDS Mgr: N. Fanelli
NOPE: R. Nevarez

Project Mgr: P. Pashby (GSFC)
MOM: F. Gordon (GSFC)
LV/Range: Delta 3913/WTR

Launch Date: August 3, 1981
Projected SC Life/DSN Support: 12 years/9 years

Project Responsibility: Goddard Space Flight Center (GSFC)

Source: SIRD June 28, 1983
Sponsor: OSO

A. MISSION DESCRIPTION

The Dynamics Explorer (DE) mission is designed to study the Earth's electromagnetic fields at varying heights up to 4 Earth radii.

B. FLIGHT PROFILE

The DE-1 was launched on a Delta 3913 launch vehicle from the Western Test Range (WTR) and was placed in a 561 x 23279 km orbit with a 90-degree inclination. The orbital period is approximately 439 minutes.

C. COVERAGE

The DSN began to support this GSFC extended mission on February 1, 1985.

1. Coverage Goals

Coverage consists of five passages per day that last for 45 minutes each.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	P	P	P
S-band CMD	P	P	P
S-band TRK	P	P	P

NOTE: P = Prime

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2214.0	Linear
S-band CMD	2038.725	--	TBD
S-band TRK	2038.725	2214.0	TBD

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	2
Format	PCM/PSK/PM + PCM/PM or Analog/PM
Subcarrier Frequency	768 kHz
Bit Rate	1.024 to 131.072 kb/s
Record	Required

(2) Command

Format	PCM/PSK/PM
Bit Rate	1000 b/s
Subcarrier Frequency	16 kHz

(3) Support

Uplink Power	Nominal 2 kW
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Not required
Doppler Rates	Modest
Range Format	Tone (500 kHz major tone)
Recording	
. Analog	Required
. Digital	Not required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Delta 3913 Launch	WTR
Earth Orbit	GSTDN until Feb. 1985 DSN after Feb. 1985

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EARTH RADIATION BUDGET SATELLITE (ERBS)

(Emergency Support)

TDS Mgr: N. A. Fanelli
NOPE: R. E. Nevarez

Project Mgr: P. Pashby (CSFC)
MOM: J. Williamson (CSFC)
LV/Range: Delta/WTR

Launch Date: October 5, 1984
Projected SC Life/DSN Support: 7 years/7 years

Project Responsibility: Goddard Space Flight Center

Source: SIRD May 1982
Sponsor: OSO

A. MISSION DESCRIPTION

The primary purpose of the Earth Radiation Budget Satellite (ERBS) project is to study the Earth's atmospheric processes and their relationship to the Earth's climate.

B. FLIGHT PROFILE

The ERBS satellite was launched by the STS shuttle. Following deployment from the shuttle, a hydrazine propulsion system maneuvered the satellite into a circular orbit. Orbit parameters are: 610 km x 610 km x 57 degrees, with a period of 99.6 minutes.

The ERS spacecraft was launched in 1984 from the Western Test Range (WTR) on a two-stage Delta launch vehicle and placed into a constant local time circular orbit with a nominal altitude of 610 km and an inclination of

57 deg. This project support is expected to be ongoing for a minimum of 7 years

C. COVERAGE

1. Coverage Goals

The DSN will support ERBS during emergency situations in the event the standard TDRSS to White Sands data link is inoperative. Emergency support will be provided by the DSN's 26-meter antenna subnetwork.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	E	E	E
S-band CMD	E	E	E
S-band TRK	E	E	E

NOTE: E = Emergency

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2287.5	RCP
S-band CMD	2106.4	--	RCP
S-band TRK	2106.4	2287.5	RCP

E. SUPPORT PARAMETERS

The support parameters for the telemetry, command, and support systems are listed below:

(1) Telemetry

Data Streams	2
Format	PCM/PSK/PM
Subcarrier Frequency	1024 kHz

Bit Rates	1.0, 1.6, 12.8, 32, or 128 kb/s
Coding	BiØ-L
Record	Analog

(2) Command

Format	PCM (NRZ-L) PSK/PM
Subcarrier Frequency	16 kHz
Bit Rate	1 kb/s

(3) Support

Uplink Power	2 kW
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Required
Doppler Rates	Required
Range Format	SINE
Recording	
. Analog	Required
. Digital	Not required

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NM 693939

ENGINEERING TEST SATELLITE VI (ETS-VI)

TDS Mgr: J. Goodwin
NOPE: R. Nevarez

Project Mgr: K. Funakawa (NASDA)
MOM: M. Horii (NASDA)

Launch Date: August 1993
Projected SC Life/DSN Support: 10 years/10 days

Project Responsibility: National Space Development Agency, Japan (NASDA)

Source: SIRD June 1989
Sponsor: NASDA

A. MISSION DESCRIPTION

The Engineering Test Satellite-VI (ETS-VI) is being developed by the National Development Agency of Japan (NASDA) as the third Japanese three-axis stabilized engineering test satellite to establish the 2-ton geostationary operational satellite bus system and to demonstrate the high performance satellite communication technology for future operational satellites. The satellite is to be stationed at 154 deg east longitude. The mission life is expected to be 10 years.

B. FLIGHT PROFILE

The ETS-VI satellite will be launched from Tanegashima Space Center (TaSC) in southern Japan by a type H-II launch vehicle. The mission has been designed to follow the conventional injection sequence into synchronous orbit via parking orbit, transfer orbit, and drift orbit. The sequence in transfer orbit requires firing the liquid Apogee Engine three times to raise the perigee of the transfer orbit to the geostationary altitude. Attitude maneuvers will be performed to orient the spacecraft to the correct attitude prior to the Apogee Engine Firing (AEF), which will occur at the 2nd, 6th, and 7th apogee. After AEF drift phase orbital and attitude maneuvers will be performed to place the spacecraft at its final geostationary position.

C. COVERAGE

The DSN will support the prelaunch compatibility test, data interface verification testing, and launch rehearsals. The DSN primary support period is from launch through the final AEF plus 1 hour. Contingency support is from final AEF plus 1 hour until launch plus 1 month.

1. Coverage Goals

The coverage will consist of all the 26-m antennas as prime and the 34-m antennas at Madrid and Canberra as backup through this support. Maximum support will consist of two 8-hour tracks per station for a 7-day period, plus the contingency support, if required.

2. Network Support

The support provided by the DSN is indicated in he following table:

System	Goldstone				Canberra				Madrid		
	12	14	15	16	42	43	45	46	61	63	66
S-band TLM				P	B			P	B		P
S-band CMD				P	B			P	B		P
S-band TRK				P	B			P	B		P

NOTE: P = Prime
B = Backup

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	N/A	2212.000	RCP
S-band CMD	2036.883	N/A	RCP
S-band TRK	2036.883	2212.000	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM (SP-L)/PM
Subcarrier Frequency	TBS
Bit Rates	512 b/s
Coding	N/A
Record	Required

(2) Command

Format	PCM (NRZ-L)/PSK/PM
Subcarrier Waveform	Sine
Subcarrier Frequency	16 kHz
Bit Rate	1000 b/s

(3) Support

Uplink Power	1 to 10 kW
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Required (26-m only)
Doppler Rates	Modest
Range Formats	Tone (Prime) (100 kHz Major Tone)
	DSN Standard (Backup)
Recording	
. Analog	N/A
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibility for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Launch	TaSC
Transfer/Drift Orbits	DSN
Geostationary Orbit	TACC (NASDA)
Contingency	DSN (on request)

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EUROPEAN TELECOMMUNICATIONS SATELLITE II (EUTELSAT II)

(Reimbursable)

TDS Mgr: N. Fanelli
NOPE: R. Nevarez

Project Mgr: P. Brittinger (GSOC)
MOM: G. Laemmel (GSOC)
LV/Range: Ariane/CSG

Launch Date: F-1 August 30, 1990; F-2 January 15, 1991; F-3 August 8, 1991; F-4 January 15, 1992; F-5 July 15, 1992, F-6 January 15, 1993

Projected SC Life/DSN Support: 7 years/10 days

Project Responsibility: Research Agency for Aerospace Technology, Germany (DLR)

Source: SIRD (Rev. 5) July 1989
Sponsor: DLR

A. MISSION DESCRIPTION

EUTELSAT II is a regional public telecommunications system for Europe. The services which will be provided are telephone and television.

EUTELSAT is a European telecommunication satellite organization created in 1977 by 17 member states of the European Conference of Postal and Telecommunications Administrations (CEPT) which now is comprised of 26 member states.

The satellites will be placed at a geostationary orbit within the arcs 6 degrees east to 19 degrees east or 26 degrees east to 36 degrees east. The designed lifetime is 7 years.

B. FLIGHT PROFILE

EUTELSAT II satellites will be launched using one of the following launch vehicles: Ariane 4, Titan, or Atlas G Centaur depending on their availability.

After separation of the satellites from the launch vehicle, telemetry, telecommand, and ranging will be performed within S-Band frequencies. After positioning of the satellite at its final geostationary orbit the Ku-Band telecommunication equipment will be activated. From this time on all satellite control operations will be performed in Ku-Band. S-Band will only be reactivated in case of emergency.

C. COVERAGE

The DSN will support the transfer and drift orbit mission phases.

1. Coverage Goals

The coverage will consist of the 26-m antennas at Goldstone and Canberra as prime support for the transfer and drift orbits. Maximum support will consist of a 7-day period, plus 14 days of contingency support.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone					Canberra				Madrid		
	12	14	15	16	17	42	43	45	46	61	63	66
S-band TLM				P	B	B			P	B		B
S-band CMD				P	B	B			P	B		B
S-band TRK				P	B	B			P	B		B

NOTE: P = Prime
B - Back-up

3. Compatibility Testing

CTA 21 will support compatibility testing with the EUTELSAT TT&C "suitcase" model at approximately launch minus 11 months. These tests will verify and test the spacecraft RF compatibility with the DSN.

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2264.6250	RCP
S-band CMD	2085.3420	--	RCP
S-band TRK	2085.3420	2264.6250	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM(NRZ-L)/PSK/PM
Subcarrier Frequency	32768 Hz
Bit Rate	512 b/s
Record	Required

(2) Command

Format	PCM(NRZ-L)/PSK/PM
Bit Rate	500 b/s
Subcarrier Frequency	8000 Hz

(3) Support

Uplink Power	1 to 10 kW
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Required (26-m antenna, only)
Doppler Rates	Modest
Range Format	Tone (Prime) (100 kHz major tone) DSN standard (Backup)
Recording	
. Analog	Required
. Digital	Required for 34-m backup

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Ariane Launch	CSG
Transfer/Drift Orbits	DSN
Geostationary Orbit	DFVLR

EXTREME ULTRAVIOLET EXPLORER (EUVE)

(Emergency Support)

TDS Mgr: N. A. Fanelli
NOPE: R. E. Nevarez

Project Mgr: J. Barrowman (GSFC)
MOM: H. Zayas (GSFC)
LV/Range: Delta/ETR

Launch Date: January 18, 1992
Projected SC Life/DSN Support: 24 months/13 months

Project Responsibility: Goddard Space Flight Center (GSFC)

Source: SIRD Draft
Sponsor: NASA

A. MISSION DESCRIPTION

The Extreme Ultraviolet Explorer (EUVE) will conduct a survey of the entire celestial sphere in the extreme ultraviolet (UV) spectrum, 100 to 1000 angstrom units. This survey will be accomplished using four grazing incidence telescopes mounted on a spinning spacecraft whose spin axis is along the Sun line. The axes of three telescopes sweep out a circle perpendicular to the Sun line for each revolution of the spacecraft. The fourth telescope points in the anti-solar direction. Data is taken only when the spacecraft is in the Earth's shadow.

B. FLIGHT PROFILE

The EUVE will be placed into a near-circular orbit by a Delta expendable launch vehicle.

The design orbit is circular at an altitude of 550 km by 28.5 degrees for a period of 96 minutes.

The EUVE will be flown on a standardized Explorer Platform (EP) which will be reused for followup explorer missions. The EP is a new Multimission Spacecraft (MMS).

C. COVERAGE

1. Coverage Goals

Coverage will be provided by the DSN for EUVE emergencies that would prevent communications via the normal channels of the Tracking and Data Relay Satellite System (TDRSS). Emergency support will be provided by the 26-meter subnet.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	E	E	E
S-band CMD	E	E	E
S-band TRK	E	E	E

NOTE: E = Emergency Support

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	2287.5	TBD	
S-band CMD	2106.4		TBD
S-band TRK	2106.4	2287.5	TBD

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	2
Formats	TBD
Subcarrier frequencies	1024 kHz
Bit Rates	384 b/s, 16 kb/s
Coding	
Record	Analog

(2) Command

Format	PCM (NRZ-L) PSK/PM
Bit Rate	2 kb/s
Subcarrier Frequency	16 kHz

(3) Support

Uplink Power	Up to 2 kW
Antenna Rate	High
Antenna Angle Rate	Required
Antenna Autotrack	Required
Doppler Rates	TBD
Range Format	Sine
Recording	
. Analog	Yes
. Digital	No

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47748
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FRENCH DIRECT TV BROADCAST SATELLITE (TDF-1 AND -2)

(Reimbursable)

CL 469024

NSM: N. Fanelli
NOPE: R. Nevarez

Project Mgr: A. Pouzet (CNES)C)
MOM: R. Vacheyroux (CNES)
LV/Range: Ariane/CSG

Launch Date: TDF-1: Launched October 27, 1988; TDF-2: Launched July 24, 1990
Projected SC Life/DSN Support: 8 years/30 days

Project Responsibility: Centre National d'Etudes Spatiales (CNES)

Source: SIRD (Rev. 1) October 1989
Sponsor: CNES

A. MISSION DESCRIPTION

The French Direct TV Broadcast Satellite (TDF-1 and -2) missions are to provide three channels of TV and sound broadcasting to France within the 12 to 18 GHz bands. The satellites will be placed in a geostationary orbit at 19 degrees west longitude.

B. FLIGHT PROFILE

TDF-1 and -2 will be launched from the Centre Spatial Guyanis in French Guiana on an Ariane launch vehicle. The missions follow the typical injection sequence; i.e., parking orbit, transfer orbit, and drift orbit. Attitude maneuvers will be performed to orient the spacecrafts prior to Apogee Kick Motor (AKM) firing. After AKM firing, drift phase orbital and attitude maneuvers will be performed to place the spacecrafts in their final geostationary position.

C. COVERAGE

The DSN will support the transfer and drift orbit mission phases.

1. Coverage Goals

The coverage will consist of the 26-m antennas at Goldstone and Canberra as prime support for the transfer and drift orbits. Maximum support will consist of two 8-hour tracks per station for a 7-day period, plus 14 days contingency support.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	P	P	
S-band CMD	P	P	
S-band TRK	P	P	

NOTE: P = Prime

3. Compatibility Testing

CTA 21 will support spacecraft compatibility testing with the TDF-1 Telemetry, Tracking, and Command (TT&C) "suitcase" model at approximately launch minus 6 months. These tests will verify and test the spacecraft RF compatibility with the DSN.

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2204.73	RCP
S-band CMD	2030.189	--	RCP
S-band TRK	2030.189	2204.73	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM(SP-L)/PSK/PM
Subcarrier Frequency	32768 Hz
Bit Rate	512 b/s
Record	Required

(2) Command

Format	PCM/PSK/PM
Bit Rate	500 b/s
Subcarrier Frequency	8000 Hz

(3) Support

Uplink Power	1 to 10 kW
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Required
Doppler Rates	Modest
Range Format	Tone (Prime), (100 kHz major tone) DSN standard (Backup)
Recording	
. Analog	Required
. Digital	Required for 34-m backup

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Ariane Launch	CSG
Transfer/Drift Orbits	DSN
Geostationary Orbit	CNES

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GALILEO

TDS Mgr: P. E. Beyer
NOPE: R. O'Connor

Project Mgr: W. J. O'Neil
Mission Director: N. E. Ausman
LV/Range: STS-IUS/ETR

Launch Date: October 18, 1989
Projected SC Life/DSN Support: 10 years/10 years

Project Responsibility: Jet Propulsion Laboratory (JPL)

Source: SIRD May, 1988; NSP November, 1988
Sponsor: OSO

A. MISSION DESCRIPTION

The purpose of the Galileo missions is to make observations of Jupiter and its satellites using an orbiting spacecraft and an atmospheric entry probe. The mission will determine the chemical composition and physical state of the Jovian atmosphere and its satellites, and the topology and behavior of the magnetic field and energetic particle flux of Jupiter.

B. FLIGHT PROFILE

The current Galileo Mission Plan calls for a Venus Earth Earth Gravity Assist (VEEGA) trajectory having a launch to end-of-mission duration of approximately 8 years.

The Galileo spacecraft consisting of an Orbiter and a Probe, together with an Intertial Upper Stage (IUS), was placed in Earth orbit by the Space

Transportation System (STS) on October 18, 1989. The IUS placed the spacecraft on a trajectory to encounter Venus (20,000-km altitude) on February 10, 1990. The first Earth encounter (1000-km altitude) occurred on December 8, 1990. A second Earth encounter occurring on December 8, 1992 at 300-km altitude will establish the final trajectory to Jupiter with arrival date of December 7, 1995.

The Probe will be released 150 days prior to Jupiter arrival and will enter the Jovian atmosphere at just prior to JOI. During descent, the Probe will transmit its telemetry data directly to the orbiter for playback to Earth as soon as possible thereafter.

Following JOI, the orbiter will commence a 22-month, 10-satellite tour to complete the mission by July 1997.

C. COVERAGE

1. Coverage Goals

The current (1/91) estimate of the antenna coverage profile is given below. IOM GLL-MDT-90-141 is the basis for the updates to the profile as defined in the SIRD. This profile reflects the changes induced by the actual launch on 18 October 1989. Such changes include time of oppositions and conjunctions, size and locations of maneuvers, and a more comprehensive understanding of spacecraft performance. This will be refined as the actual mission design progresses. Note that the support rate is given in passes per month (ppm) for all mission phases, even though the duration of several phases is much less than one month.

Mission Phase	Period		Passes/Month	Antennas
(a) Launch	10/89	10/89	5	26m
			5	34 STD
			39	70m
(b) Cruise	11/89	12/89	88	70m
(c) Venus Encounter	1/90	2/90	3	34 STD
			56	70m
(d) Cruise	3/90	10/90	2	34 STD
			40	70m
(e) Earth Encounter 1	11/90	12/90	6	26m
			6	34 STD
			80	70m
(f) Cruise	1/91	9/91	13	34 HEF
			20	70m
(g) Gaspra Encounter	10/91	11/91	11	34 HEF
			35	70m

Mission Phase	Period		Passes/Month	Antennas
(h) Conjunction 1	12/91	2/92	62	34 HEF
			4	70m
(i) Cruise Science	3/92	9/92	4	34 HEF
			12	70m
(j) Earth Encounter 2	10/92	12/92	16	34 HEF
			70	70m
			6	26m
(k) Cruise Science	1/93	2/93	30	34 HEF
			4	70m
(l) Opposition 3	3/93	3/93	10	34 HEF
			4	70m
(m) Cruise Science	4/93	7/93	12	34 HEF
			8	70m
(n) TCM	8/93	9/93	8	34 HEF
			42	70m
(o) Cruise Science	10/93	3/94	36	34 HEF
			7	70m
(p) Opposition 4,	4/94	4/94	90	34 HEf
Gravity Wave			4	70m
(q) Cruise Science	5/94	1/95	36	34 HEF
			4	70m
(r) Probe Release,	2/95	7/95	36	34 HEF
Opposition 5			20	70m
(s) Pre JOI	8/95	9/95	3	34 BWG
			9	34 HEF
			28	70m
(t) Pre JOI	10/95	10/95	6	34 BWG
			90	70 34 HEF
			90	70 70m
(u) Jupiter Orbit	11/95	12/95	90	34 BWG
Insertion			90	34 HEF
			90	70m
(v) Tour	1/96	10/97	28	34 BWG
			15	34 HEF
			50	70m

2. Network Support

DSN support will be provided as indicated in the following table:

System	Goldstone				Canberra				Madrid		
	12	14	15	16	42	43	45	46	61	63	66
S-band TLM	P	P		*	P	P			P	P	*
X-band TLM	P	P	P		P	P	P		P	P	
S-band CMD	P	P		*	P	P			P	P	*
X-band CMD			P				P				
S-band TRK	P	P	P	*	P	P			P	P	*
X-band TRK	P	P			P	P					

NOTE: P = Prime; * = 26-m S-band support for near-Earth support only.

3. Prelaunch System Tests

Prelaunch and system testing was supported by MIL 71.

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2295.0/2296.5	Linear/RCP*
X-band TLM	--	8415.0/8420.4	RCP
S-band CMD	2114.7 (Prime) 2113.3 (Spare)	--	RCP*
X-band CMD	7166.9	--	RCP

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TRK	2114.7	2296.5	Linear/RCP*
X-band TRK	7166.9 (Prime) 7162.3 (Spare)	8420.4	RCP

Note: *S-band HGA equals Linear
S-band LGA equals RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	2
Format	PCM(NRZ)/PSK/PM
Subcarrier Frequency	22.5, 360 kHz
Bit Rate	10, 40, 1200 b/s 7.68, 168, 28.8, 67.2, 80.64, 115.2, 134.4 Kb/s
Record	Required
Coding	Convolutional, K=7 R=1/2; K=15 R=1/4 (115, 134.4 Kb/s only)

(2) Command

Format	PCM (Manchester encoded)/PSK/PM
Bit Rate	32 b/s
Subcarrier Frequency	512 Hz

(3) Support

Uplink Power	10 to 125 kW
Antenna Rate	Sidereal, except at launch
Antenna Angle Data	Not required
Antenna Autotrack	First pass (26-m autotrack)
Doppler Rates	Moderate, except first pass and encounter
Range Format	Standard DSN
Recording	
. Analog	Not required
. Digital	Required
. VLBI	ΔDOR

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
STS Launch (complete)	TDRSS
IUS Injection (complete)	RTS
Cruise/Planetary (in progress)	DSN

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GAMMA RAY OBSERVATORY (GRO)

NC999967

(Emergency Support)

TDS Mgr: N. A. Fanelli
NOPE: R. E. Nevarez

Project Mgr: J. Madden (GSFC)
MOM: K. Schauer (GSFC)
LV/Range: STS/ETR

Launch Date: November 1, 1990
Projected SC Life/DSN Support: 2 years/2 years

Project Responsibility: Goddard Space Flight Center

Source: SIRD January 1983
Sponsor: OSO

A. MISSION DESCRIPTION

The Gamma Ray Observatory (GRO) is an Earth orbiting satellite that studies sources of localized, galactic, and extragalactic gamma rays.

B. FLIGHT PROFILE

The GRO satellite will be carried into a near-circular orbit by the STS shuttle. Following launch from the shuttle, it will be placed in its operational orbit by the on-board hydrazine propulsion system. Formal orbit parameters are 350 km x 450 km x 28.5 degrees with a period of 93 minutes.

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C. COVERAGE

1. Coverage Goals

DSN coverage for the GRO will be provided during emergencies that would prevent communications via the normal TDRSS-White Sands link. Emergency support will be provided by the DSN's 26-meter antenna subnetwork.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	E	E	E
S-band CMD	E	E	E
S-band TRK	E	E	E

NOTE: E = Emergency

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2287.5	TBD
S-band CMD	2106.4	--	TBD
S-band TRK	2106.4	2287.5	TBD

E. SUPPORT PARAMETERS

The support parameters for the telemetry, command, and support systems are listed below:

(1) Telemetry

Data Streams	2
Format	TBD
Subcarrier Frequency	32768 Hz
Bit Rates	1, 32, or 512 kb/s
Coding	TBD
Record	TBD

(2) Command

Format	PCM(NRZ-L)PSK/PM
Subcarrier Frequency	16 kHz
Bit Rate	125 G/s or 1 kb/s

(3) Support

Uplink Power	TBS
Antenna Rate	TBS
Antenna Angle Data	Required
Antenna Autotrack	Required
Doppler Rates	TBS
Range Format	TBS
Recording	
. Analog	
. Digital	

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GEOSTATIONARY METEOROLOGICAL SATELLITE-5 (GMS-5)

NM 693939

(Reimbursable)

TDS Mgr: J. Goodwin
NOPE: R. Nevarez

Project Mgr: TBS
MOM: M. Horii (NASDA)

Launch Date: 1 January 1994
Projected SC Life/DSN Support: 7 years/10 days

Project Responsibility: National Space Development Agency, Japan (NASDA)

Source: TBS
Sponsor: NASDA

A MISSION DESCRIPTION

The Geostationary Meteorological satellite (GMS-5) which is being developed by the National Space Development Agency of Japan (NASDA) is the fifth geostationary, spin stabilized, weather satellite. Its purposes are observation of cataclysmic events such as hurricanes, typhoons, and regional weather phenomena; day and night observations of regional weather; relay of meteorological observation data from surface collection points (ships, buoys and weather stations) to the Data Processing Center in Japan; and transmission of processing imaging data for facsimile reproduction of distribution points in the Western Pacific area.

B. FLIGHT PROFILE

The GMS-5 satellite will be launched from Tanegashima Space Center (TaSC) in southern Japan by a type H-II launch vehicle. The mission has been designed to follow the conventional injection sequence; i.e., parking orbit, transfer orbit, and near-synchronous orbit. Attitude maneuvers will be performed to orient the spacecraft to the correct attitude prior to the Apogee Kick Motor (AKM) firing, which will occur at the 2nd (nominal), or the 4th (contingency) apogee. After AKM firing, drift phase orbital and attitude maneuvers will be performed to place the spacecraft at its final geostationary position.

C. COVERAGE

The DSN will support the transfer and drift orbit mission phases.

1. Coverage Goals

The coverage will consist of the 26-m antennas as prime and the 34-m antenna at Madrid as backup support for launch through drift orbit. Maximum support will consist of two 8-hour tracks per station for a 7-day period, plus 23 days of contingency support from all complexes.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone				Canberra				Madrid		
	12	14	15	16	42	43	45	46	61	63	66
S-band TLM				P				P	B		P
S-band CMD				P				P	B		P
S-band TRK				P				P	B		P

NOTE: P = Prime
B = Backup

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	N/A	TBS	Vertical Linear Parallel
S-band CMD	TBS	N/A	Vertical Linear Parallel
S-band TRK	TBS	TBS	Vertical Linear Parallel

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM (SP-L)/PSK/PM and FM/PM
Subcarrier Frequency	48.25 kHz, IRIG 12, IRIG B
Bit Rates	250 b/s
Coding	N/A
Record	Required

(2) Command

Format	PCM/FSK-AM/PM
Subcarrier Frequency	8.6 kHz Sinewave for (1) tone 7.4 kHz Sinewave for (0) tone
Executive Tone	5.79 kHz Sinewave
Clock/Data Phase	90 deg
Bit Rate	128 b/s

(3) Support

Uplink Power	1 to 10 kW
Antenna Rate	Moderate
Antenna Angle Rate	Required
Antenna Autotrack	Required (26-m only)
Doppler Rates	Modest
Range Format	Tone (Prime) (100 kHz Major Tone) DSN Standard (Backup)
Recording	
. Analog	N/A
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Launch	TaSC
Transfer/Drift Orbits	DSN
Geostationary Orbit	TACC (NASDA)
Contingency	DSN (on request)

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p.4

GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE (GOES I-M) METSAT PROJECT

NC 999967

TDS Mgr: N. A. Fanelli
NOPE: R. E. Nevarez

Project Mgr: C. Thienel (GSFC)
MOM: K. Blaney (GSFC)
LV/Range: Atlas Centaur/ETR

Launch Date: October 1992 - (I); May 1993 - (J); July 1995 - (K); February 1997 - (L); 2000 - (M)

Projected SC Life/DSN Support: 5 years/Launch + 30 to 45 days

Project Responsibility: Goddard Space Flight Center (GSFC)

Source: SIRD December 1983
Sponsor: OSO

A. MISSION DESCRIPTION

The primary objective of the METSAT project is to provide a satellite system that meets the National Environmental Satellite Data and Information Service (NESDIS) requirements as specified by the National Oceanic and Atmospheric Administration (NOAA). For the GOES I-M spacecraft, these requirements include an Imager and Sounder system, a Space Environment Monitoring (SEM) System, a Data Collection System, and a Search and Rescue (SAR) System. The SEM subsystems include a Solar X-Ray Sensor (XRS), an Energetic Particle Sensor (EPS), a High-Energy Proton and Alpha Detector (HEPAD), a Magnetometer, and an X-Ray Imager (XRI). The GOES I-M spacecraft will be designed to meet specified performance requirements for a period of 5 years.

The GOES I-M mission profiles are identical. The NASA phase extends from liftoff through completion of spacecraft checkout (approximately 30-45 days after launch). The GOES I-M spacecraft are launched using an Expendable Launch Vehicle (ELV) from Kennedy Space Center (KSC). At completion of spacecraft checkout, operations are transferred to NOAA, which will operate the spacecraft for the remainder of the mission.

B. FLIGHT PROFILE

The GOES I-M spacecraft has been designed to be launched using an ELV. Additionally, the spacecraft has been designed to be retrieved by the Shuttle in the event of a Perigee Kick Motor (PKM) or similar failure that would prevent the spacecraft from leaving low Earth orbit.

1. STS Launch and GOES I-M Development Philosophy

The GOES-I/M spacecraft will be launched, maneuvered into geostationary orbit, and checked out in orbit by the NASA/GSFC flight operations team using NASA, Air Force, and NOAA ground systems. The NASA phase of the GOES-I/M mission will be designed to satisfy the following mission objectives:

(a) Ensure the health and safety of the spacecraft from launch through handover to NESDIS.

(b) Conduct on orbit testing of the satellite and instruments to characterize system performance.

(c) Hand over the spacecraft to NOAA for operations with sufficient on-board propellant for a minimum of five years of stationkeeping.

2. Satellite Transfer Orbit Philosophy

The GOES-I/M spacecraft will be launched from KSC using Atlas G/Centaur D-1A expendable launch vehicles.

Approximately four minutes before liftoff, the satellite is switched to internal battery power. During the launch vehicle ascent phase, spacecraft telemetry is relayed to MSOCC using the STDN stations at MILA and Bermuda. After Atlas/Centaur separation, the Centaur upper stage performs two main engine burns to place the satellite into an elliptical orbit with the apogee close to geosynchronous altitude. Prior to satelite separation, the Centaur upper stage performs a reorb maneuver to ensure that the GOES omni antenna rotation is normal to the plane of the earth to eliminate look-angle nulls.

The DSN stations (Canberra, Goldstone, and Madrid) are used for Telemetry, Tracking, and Command (TT&C) operations. The DSN is supplemented by telemetry and commanding capability from the NOAA Wallops CDA station. Each DSN station complex is fully redundant within itself.

C. COVERAGE

1. Coverage Goals

The coverage required for launch and the support of transfer and drift orbits will consist of the 26-m antenna as prime and the TBD antenna as backup for 11 days at all complexes. There will also be contingency support for 15 days, for on-station spacecraft checkout. After the initial 30-45 days, the DSN is committed for emergency support. Contingency and emergency support will be provided by Goldstone only.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone					Canberra				Madrid		
	12	14	15	16	17	42	43	45	46	61	63	66
S-band TLM				P	B	B			P	B		P
S-band CMD				P	B	B			P	B		P
S-band TRK				P	B	B			P	B		P

NOTE: B = Backup; P = Prime

NOTE

After checkout, all normal CMD and TLM support is to be provided by NOAA (Command and Data Acquisition) facilities at Wallops Island, Va. NASA contingency support following handover will be committed on a noninterference basis with ongoing NASA missions.

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2209.086/2208.586	RCP
S-band CMD	2034.2	--	RCP
S-band TRK	2034.2	2209.086	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PM 1024 MHz subcarrier Manchester II
Bit Rate	2 kb/s
Record	Required

(2) Command

Format	PCM/PSK/PM
Bit Rate	1 kb/s
Subcarrier Frequency	16 KHz

(3) Support

Uplink Power	10 kW
Antenna Rate	Nil, except for launch and transfer orbit
Antenna Angle Data	Not required
Antenna Autotrack	Launch and transfer orbit
Doppler Rates	Nil, except for launch and transfer orbit
Range Format	Tone (Prime) DSN standard (Backup)
Recording	
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
STS Shuttle Launch	JSC
ELV Launch	STDN/KSC
Transfer/Drift Orbits	DSN
Geostationary Orbit	NOAA/CDA
Emergency Support	DSN

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GERMAN TELECOMMUNICATIONS SATELLITE (DEUTSCHER FERNMELDE SATELLIT) (DFS-1 AND -2)

(Reimbursable)

TDS Mgr: N. Fanelli
NOPE: R. Nevarez

Project Mgr: H. Schmeller (GSOC)
MOM: G. Hiendlmeier (GSOC)
LV/Range: Ariane/CSG

Launch Date: Launched June 5, 1989; Launched July 24, 1990; July 1992
Projected SC Life/DSN Support: 10.1 years/30 days

D0945599

Project Responsibility: Research Agency for Aerospace Technology, Germany (DLR)

Source: SIRD December 1985/1989
Sponsor: DLR

A. MISSION DESCRIPTION

The German Telecommunications Satellite (DFS) program is to provide telecommunications service for high data rate transmission of text and video data to the Federal Republic of Germany within the 11 GHz to 14 GHz and 20 GHz to 30 GHz bands. The space segment of this program is composed of three satellites, DFS-1, DFS-2, and DFS-3, which will be located at 23.5°E longitude of the geostationary orbit.

B. FLIGHT PROFILE

The DFS will be launched from the Centre Spatial Guyanis in French Guiana on an Ariane launch vehicle. The mission follows the typical injection sequence; i.e., parking orbit, transfer orbit, and drift orbit. Attitude maneuvers will be performed to orient the spacecraft prior to Apogee Kick Motor (AKM) firing. After AKM firing, drift phase orbital and attitude maneuvers will be performed to place the spacecraft in its final geostationary position.

C. COVERAGE

The DSN will support the transfer and drift orbit mission phases. The USAF IOS station will provide early support to DFS pre-Canberra AOS.

1. Coverage Goals

The coverage will consist of the 26-m initial acquisition at Canberra followed by 34-m support at Goldstone and Canberra as prime support for the transfer and drift orbits. Maximum support will consist of two 8-hour tracks per station for a 9-day period, plus 14 days of contingency support.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone				Canberra				Madrid		
	12	14	15	16	42	43	45	46	61	63	66
S-band TLM	P				P			*	O		
S-band CMD	P				P			*	O		
S-band TRK	P				P			*	O		

NOTE: P = Prime
O = Option
*26m S-band support for initial acquisition

3. Compatibility Testing

CTA 21 and GSFC test van will support compatibility testing with the DFS S/C TT&C "suit-case" model at approximately launch minus 7 months. These tests will verify and test the spacecraft RF compatibility with the DSN.

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2201.600	RCP
S-band CMD	2027.752	--	RCP
S-band TRK	2027.752	2201.600	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM(SP-L)/PSK/PM
Subcarrier Frequency	32768 Hz
Bit Rate	512 b/s
Record	Required

(2) Command

Format	PCM(NRZ-L)/PSK/PM
Bit Rate	500 b/s
Subcarrier Frequency	8000 Hz

(3) Support

Uplink Power	1 to 10 kW
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Required (26-m antenna, only)
Doppler Rates	Modest
Range Format	Tone (100 kHz major tone)
Recording	
. Analog	Required
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Ariane Launch	CSG
Transfer/Drift Orbits	DSN
Geostationary Orbit	DFVLR

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GIOTTO EXTENDED MISSION (GEM)

E6883746

(Cooperative)

TDS Mgr: D. Enari
NOPE: R. Rose

Project Mgr: M. Grensemann (ESTEC)
MOM: D. E. B. Wilkins (ESOC)
LV/Range: Ariane/CSG

Launch Date: July 15, 1985

Projected SC Life/DSN Support:

Project Responsibility: European Space Agency (ESA)

Source: SIRD December 1990
Sponsor: ESA
Program Manager: G. Strobel

A. MISSION DESCRIPTION

The primary objectives of the Giotto Extended Mission (GEM), are to determine the composition and physical state of the Grigg Skjellerup comet's nucleus; to determine the processes that govern the composition and distribution of neutral and ionized species in the cometary atmosphere.

Prior objectives of Giotto were the same as those for Halley's comet in March, 1986.

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B. FLIGHT PROFILE

Giotto consists of a single European Space Agency (ESA) spacecraft that was launched in 1985 from Centre Spatial Guyanis in French Guiana on an Ariane launch vehicle. After a successful launch into geostationary orbit and a heliocentric transfer trajectory, the spacecraft successfully encountered Halley's comet in 1986.

One month after encountering Halley's comet, March 1986, the spacecraft was placed in hibernation in a heliocentric orbit slightly less than 1 A.U. Between February 1990 and July 1990 the spacecraft was successfully reactivated, checked out, placed on a trajectory course to intercept comet Grigg Skjellerup in July 1992. The spacecraft has been in hibernation since July 1990.

C. COVERAGE

1. Coverage Goals

The telecommunication link threshold is influenced by the distance of the spacecraft from the Sun and the aspect angle of the spacecraft with respect to the Sun and Earth. Additional coverage is being provided by the DLR Weilheim, Germany, and ESA Perth, Australia, tracking stations. Stage I and Stage II of the Giotto Extended Mission have been completed. The DSN is committed to supporting the Stage III SIRD, whose requirements are listed below.

The DSN expects to meet these coverage goals even though requirements are in excess for the 70-m and 34-m standard subnets. View periods and other user requirements are not in direct conflict with Giotto during the Stage III support.

Mission Phase	Period	(30 days) Passes/Month	Antennas
Stage I			
Reactivation Phase	2/90 - 3/90	30	70-m
Scientific Payload Check Out Phase	4/90	15	34 STD
Near Earth Phase	5/90	28	34 STD
Stage II			
Earth Flyby and Hibernation III	7/90	None	None

Mission Phase	Period	(30 days) Passes/Month	Antennas
Stage III			
Reactivation Phase	5/92	21	70-m
Cruise Operations	6/92	16	70-m/34 STD
Rehearsals and Encounter	6/92 - 7/92	12	70-m/34 STD

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone				Canberra				Madrid			
	12	14	15	16	42	43	45	46	61	63	65	66
S-band TLM	P	P			P	P			P	P		
X-band TLM	P	P			P	P			P	P		
S-band CMD	P	P			P	P			P	P		
S-band TRK	P	P			P	P			P	P		
X-band TRK	P	P			P	P			P	P		

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2298.703704	RCP
X-band TLM	--	8428.580248	RCP
S-band CMD	2116.72	-	RCP
S-band TRK	2116.72	-	RCP
X-band TRK	--	8428.580248	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1 (S- or X-band)
Format	PCM/PSK (uncoded/coded)
Subcarrier Frequency	46.080 kHz for 360 b/s 276.480 kHz for 5760, 23040 and 46080 b/s
Record	DODR Required

(2) Command

Format	PCM/PSK
Bit Rate	125/8 b/s (15.625 b/s)
Subcarrier Frequency	16 kHz
Subcarrier Waveform	Sine

(3) Support

Uplink Power	Up to 20 kW (34-m), 100 kW (70-m)
Antenna Rate	Sidereal
Antenna Angle Data	Not Required
Doppler Rate	Moderate to High
Range Format	Standard DSN
Recording	
. Analog	Not Required
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Stage I	DSN/ESA-Perth/DLR-Weilheim
Stage II	DSN/ESA
Stage III	DSN/ESA-Perth/DLR-Weilheim

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GOLDSTONE SOLAR SYSTEM RADAR (GSSR)

TDS Mgr: H. Cox
NOPE: P. Wolken

Science Mgr: N. A. Renzetti
MOM: TBD

Operational Date: April 1, 1985
Projected DSN Support: Continuous

Project Responsibility: Jet Propulsion Laboratory (JPL)

Source: SIRD January 31, 1989
Sponsor: OSO
Program Manager: S. Ostro

A. MISSION DESCRIPTION

The primary objective of the Goldstone Solar System Radar is the investigation of solar system bodies by means of Earth-based radar. Targets of primary interest include the Galilean moons, Saturn's rings and moons, and Earth-approaching asteroids and comets. Planets are also of interest, particularly Mercury and the planets to which NASA has not yet planned spacecraft visits.

B. PROGRAM PROFILE

Based on a history of solid achievement, includng the definition of the Astronomical Unit, imaging and topography of Mars, Venus, and Mercury, and contributions to the general theory of relativity, the program will continue to support Flight Project requirements and its primary objectives. The individual target objectives are as follows:

Galilean Moons:	X-band observations will be used to put some limits on the small-scale structure of the regolith.
Mercury:	Construct radar maps of portions of the unimaged hemisphere at ~10-km resolution. Make a series of closure-point ranging measurements to be used for testing gravitation theories, including general relativity. Some of this work is coordinated with Arecibo observations, as part of a cooperative effort to minimize systematic sources of error. Refine estimates of Mercury's pole direction, to evaluate available theoretical explanations for the planet's spin/orbit resonance.
Venus:	Refine the rotation period and pole direction as much as possible prior to Magellan's orbital insertion. Obtain high-resolution (to ~1 km) radar images of surface regions that cannot be mapped from Arecibo, at very small incidence angles (θ near 0°), i.e., with a viewing geometry very different from that (θ~30°) in Magellan images. Locate geologically interesting regions as candidates for Magellan high-resolution investigation. Refine existing estimates of Fresnel reflection coefficients for surface units with anomalously high radar albedoes, and determine those regions' angular backscattering law.
Moon:	Construct 100-to-200-meter-resolution images of selected regions in each component of the Stokes vector, to elucidate the scattering mechanism and the nature of near-surface structure, and to constrain the electrical properties of the regolith. Measure topography in selected areas, to refine geologic interpretations of lunar landforms.
Mars:	Maintain the accuracy of the Mars orbital ephemeris. Measure surface topography at tropical latitudes (±20°). Determine the surface reflectivity and effective slope for multiple ground tracks within the tropics. Use dual-polarization, cw measurements and joint Goldstone-VLA bistatic observations to elucidate the global variations in the surface's small-scale structural complexity. Constrain the surface's gross geometry at scales (~1 cm to ~10 m) relevant to the safe landing and maneuverability of a spacecraft. Test hypotheses about temporal variations in radar reflectivity that might result from seasonal melting of subsurface ice.

Phobos and Deimos: Detect 3.5-cm radar echoes and estimate each satellite's radar albedo, polarization signature, and angular scattering law. Constrain the satellites' surface bulk density and small-scale roughness.

Near-Earth Asteroids: Secure recovery of newly discovered objects. Refine orbits of previously observed objects. Use delay/Doppler imaging to obtain information about dimensions, shapes, and spin vector. Constrain surface's dual-polarization scattering properties and elucidate near-surface characteristics at cm-to-km structural scales. Measure the asteroid's radar cross section; estimate the radar albedo and use it to bound the regolith bulk density, porosity, and metal concentration.

Mainbelt Asteroids: Using time-delay measurements, shrink the line-of-sight component of positional error ellipsoid. Use power spectra to constrain pole direction and diameter. Estimate surface slope at topographic scales, and near-surface roughness at small scales. Measure the asteroid's radar cross section; estimate the radar albedo and use it to bound the regolith bulk density, porosity, and metal concentration.

Comets: Search for clouds of large (≥ cm) particles near the nucleus, such as those discovered around Halley and IRAS-Araki-Alcock. Image the nucleus and determine its size, shape, spin properties, and surface characteristics. Refine estimates of orbital elements, to clarify the dynamical history of long-period comets and to assist spacecraft navigation during missions to short-period comets.

Europa, Ganymede, and Callisto: Determine the 3.5-cm radar albedo and circular polarization ratio of each of these icy satellites, whose 13-cm properties are extraordinary. Use the results to constrain existing theoretical explanations for the bizarre radar signatures. Search for radar features, localize them, and seek correlations with features in Voyager (and eventually Galileo) images. Refine the prediction ephemerides for each satellite, especially Callisto, to assist targeting of the Galileo spacecraft, by measuring echo Doppler frequencies. The precision of Doppler estimates depends on echo strength, and radar measurements with the minimum precision required for ephemeris improvement cannot be obtained during 1993-98 unless Goldstone has a 1.0-megawatt transmitter.

Io:	Obtain the first 3.5-cm radar detection of this volcanically active satellite, and use estimates of radar properties to provide information about the surface bulk density and small-scale roughness.
Saturn's Rings:	Use delay-Doppler images in each Stokes vector component to constrain the manner in which radar waves are backscattered from the classical ring sections, and to infer the physical properties of ring particles. Use bistatic observations, with Goldstone transmitting and the VLA receiving, to image the ring system at 1200-km resolution.
Saturn's Icy Satellites:	Detect the first radar echoes from Iapetus and possibly Rhea, to ascertain whether these objects, whose surfaces contain nonwater ices, share the unusual radar properties of Jupiter's icy moons.
Titan:	Detect the first radar echoes from Titan, and measure this object's radar albedo and angular scattering law. These measurements would constitute mankind's first direct measurements of Titan's surface. They would permit evaluation of the diverse models proposed for the configuration of Titan's surface, which might be at least partially covered by a deep, ethane-rich ocean.

C. COVERAGE

1. Coverage Goals

For this program, the coverage goals vary significantly with the target of opportunity. All of these goals (listed Table 1) require the support of DSS 14, which is the only facility with the necessary high-power transmit capability, and occasional support from DSS 12 and DSS 13. DSS 18 will replace DSS 12 in mid-1993. A replacement 34-m antenna (also designated DSS 13) will replace the current DSS 13 in 1992 for X-band reception and at a later date for S-band reception.

Table 1 lists the estimated GSSR usage for 1990-2000.

Table 1. Estimated Program Support for 1990-2000

Targets	Opportunities Per year	Tracks Per Opportunity	Tracks Per year
Mars	1 per 2 to 6 years	40	20
Venus	1 per 1 to 6 years	20	12
Jupiter	1	20	20
Saturn	1	30	30
Objects	6	7	42
Asteroids	4	5	20
Mercury	3	7	21
Moon	15	1	15
Total Tracks per year			180
Average Tracks per Month			15

NOTE: One radar "track" consists of 8 hours of observing time, preceded by 1.5 hours of pre-cal and followed by 0.5 hours of post-cal. Each track requires DSS 14. Interferometric observations (most Venus and selected Mercury tracks) also use DSS 13 and one other 34-m station.

The 10-year period covered by these estimates will include planetary encounters and prolonged planetary operations by several major flight projects. For this reason, it is considered unlikely that the DSN could sustain the average level of radar support requested while meeting its commitments to in-flight projects. It is estimated that 50 percent of the requested support is a more realistic expectation on which the program should base its science planning.

2. Network Support

Specific requirements for antenna time on DSS 14 are prepared on a yearly basis and submitted to the scheduling office for negotiation at least 6 months ahead of the earliest need date. The facility support to be provided by the DSN is indicated in the following table:

System	Goldstone Only 12 14	
S-band RAD	P	Antenna support requirements for 6 months ahead are published in the JEMS GSSR bulletin board which is updated on a weekly basis.
X-band RAD	P	

NOTE: P=Prime

3. Compatibility Tests

Compatibility testing with DSN systems will be supported by the DSN Radio Astronomy Unit. This data type is not required to be supported by the DSN ground data system.

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band	2320.00	2320.00	RCP
X-band	8495.00	8495.00	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command and Support Systems are listed below:

(1) Telemetry

No support required

(2) Command

No support required

(3) Support

Uplink Power	400 kW
Antenna Rate	Sidereal
Antenna Angle Data	Required
Antenna Autotrack	Required
Doppler Rates	Moderate
Range Format	None
Recording	
. Analog	Not Required
. Digital	Not Required
. VLBI	Not Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Program Phase	Support Responsibility
Implementation	DSN (331)
Planetary Operations	DSN (440)

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HIPPARCOS

E6883746

TDS Mgr: N. A. Fanelli
NOPE: R. E. Nevarez

Launch Date: Launched August 8, 1989

Project Responsibility: European Space Agency (ESA)

Source: SIRD
Sponsor: NASA/ESA

A. MISSION DESCRIPTION

The primary objective of Hipparcos is to provide very accurate star map data and star position accuracies on the order of 2 arc seconds.

B. FLIGHT PROFILE

Hipparcos was planned to be in a geostationary orbit, but due to failure of the apogee motor, it is currently in a high elliptical orbit and has a 10.8 hour period.

C. COVERAGE

Goldstone 26-m will provide 6-8 hours per day support for real-time telemetry and command. Mission-dependent equipment is required at Goldstone, and telemetry and command data will be transmitted from Goldstone to European Space Operations Control Center (ESOC) via satellite links. Operations support is scheduled to begin March 12, 1990.

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N92-13107

HUBBLE SPACE TELESCOPE (HST)

ND736801
NC999967

(Emergency Support)

NSM: N. A. Fanelli
NOPE: R. E. Nevarez

Project Mgr: F. Wojtalik (MSFC)
MOM: J. Repass (GSFC)
LV/Range: STS/ETR

Launch Date: Arpil 24, 1990
Projected SC Life/DSN Support: 15 years

Project Responsibility: Marshall Space Flight Center/
Goddard Space Flight Center

Source: NSP March 1983
Sponsor: OSO

A. MISSION DESCRIPTION

The Space Telescope is a national facility. It consists of a 2.4-m aperture Ritchey-Chretien cassegrain telescope weighing approximately 9525 kg with various energy detectors designed for the observation of IR, visible, and UV wavelengths (0.12 to 1000 microns).

B. FLIGHT PROFILE

The space telescope was deployed into a 28.5-degree inclination, circular orbit, which permits a mission lifetime of 15 years. Orbit: Decaying circular between 594 and 400 km x 28.5 deg; period = 95 minutes.

C. COVERAGE

1. Coverage Goals

The DSN is responsible for providing contingency support for the space telescope in the event a Tracking and Data Relay Satellite System (TDRSS) or spacecraft failure prevents communications via that link.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	E	E	E
S-band CMD	E	E	E
S-band TRK	E	E	E

NOTE: P = Prime
E = Emergency support

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2287.5	LCP
S-band CMD	2106.4063	--	LCP
S-band TRK	2106.4063	2287.5	LCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM/PM BiØ-L
Subcarrier Frequency	None
Bit Rate	Engineering: 500 b/s, 4 kb/s, 32 kb/s, 1024 kb/s
Recording	
. Analog	Required

(2) Command

Format	PCM/PSK/PM
Bit Rate	1 kb/s
Subcarrier Frequency	16 kHz

(3) Support

Uplink Power	TBD
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Required
Doppler Rates	TBD
Range Format	TBD
Recording	
. Analog	Required
. Digital	Not required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
STS Launch	TDRSS
Earth Orbit	TDRSS
Contingency Support	DSN

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N92-13108

INTERNATIONAL COMETARY EXPLORER (ICE)

NC999967

TDS Mgr: N. Fanelli
NOPE: R. Nevarez

Project Mgr: P. Pashby (GSFC)
MOM: R. Wales (GSFC)

Launch Date: Aug. 12, 1978
Projected SC Life/DSN Support: 34 years/15 years

Project Responsibility: Goddard Space Flight Center (GSFC)

Source: SIRD November 1985
Sponsor: OSO

A. MISSION DESCRIPTION

The primary mission objectives of the International Cometary Explorer (ICE) comet mission are to determine the composition and physical state of the Giacobini-Zinner comet's nucleus; to determine the processes that govern the composition and distribution of neutral and ionized species in the cometary atmosphere; and to investigate the interaction between the solar wind and the cometary atmosphere.

B. FLIGHT PROFILE

The spacecraft was in a halo orbit around the Sun-Earth libration point until it was moved June 10, 1982 to the Earth's Geomagnetic Tail (GT). The spacecraft reached the GT in January 1983 and remained there until December 1983, at which time a lunar swing-by placed the spacecraft in a trajectory heliocentric orbit which encountered the comet Giacobini-Zinner in September

1985. The spacecraft provideed observations of the solar wind up-stream of comet Halley in 1986.

C. COVERAGE

1. Coverage Goals

Coverage by the 64-/70-m antennas has been provided from January 1984 to date and will continue through the end of mission, consisting of cruise and encounter support. (Prime support will be provided by the Madrid and Goldstone complexes, with additional support from the Canberra complex.)

The 64-m station at Usuda Japan, which is part of the Japanese Institute of Space and Astronautical Science (ISAS), provided supplemental support from May 1985 through Giacobini-Zinner encounter (September 1985), and during the first Halley Radial (October 1985). Support consists of making telemetry recordings, which will be processed in nonreal-time at JPL. The number of hours of coverage (per day/week) will be determined by negotiation between NASA and ISAS.

Limited extended mission coverage will be provided from May 1986 through end of mission.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone		Canberra	Madrid		Usuda
	12 14 15 16		42 43 45 46	61 63 66		
S-band TLM		P	P		P	S
S-band CMD		P			P	
S-band TRK	B	P	B	B	P	

NOTE: P = Prime
B = Backup
S = Supplemental

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	-	2270.4	RCP
S-band TLM	-	2217.5	LCP
S-band CMD	2090.66	-	RCP
S-band CMD	2041.95	-	
S-band TRK	2090.66	2270.4	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM(SP-L)/PM or PCM(NRZ-L)/PSK/PM
Coding	Convolutional, K = 24 R = 1/2
Subcarrier Frequency	1024 Hz (16-256 b/s)
Bit Rates	16, 32, 64, 128, 256, 512, 1024, and 2048 b/s
Recording	Required

(2) Command

Format	PCM/FSK-AM/PM
Subcarrier Frequency	Fo: 9000 Hz, F1: 7500 Hz
Bit Rate	256 b/s

(3) Support

Uplink Power	10 to 80 kW
Antenna Rate	Sidereal
Antenna Angle Data	Not required
Antenna Autotrack	Not required
Doppler Rate	Sidereal
Range Format	DSN Standard
Recording	
. Analog	Not required
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Earth Orbit	STDN (through Dec. 1983)
Planetary	DSN (after Dec. 1983)

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N92-13109

INTERNATIONAL SOLAR TERRESTRIAL PHYSICS (ISTP) PROGRAM

NC 999967

TDS Mgr: J. P. Goodwin
NOPE: S. Wolf

Project Mgr: K. O. Sizemore
MOM: D. Muhonen (GSFC) (SOHO and CLUSTER)
MOM: R. Sanford (GSFC) (GEOTAIL, WIND, POLAR)

Mission	Agency	Launch Date	L/V	Range
GEOTAIL	(ISAS)	July 1992	NASA Medium ELV	ETR
WIND	(NASA)	December 1992	NASA Medium ELV	ETR
POLAR	(NASA)	July 1993	NASA Medium ELV	WTR
SOHO	(ESA)	March 1995	NASA Intermediate ELV	ETR
CLUSTER(4)	(ESA)	December 1995	Ariane	CSG

Project Responsibility: GSFC (NASA/ISAS/ESA Cooperative)

Source: GEOTAIL - SIRD March 1990

WIND and POLAR - SIRD Draft 2, May 1990

SOHO - Preliminary SIRD, Issue 2, August 1989

CLUSTER - Preliminary SIRD, August 1987

Sponsor: OSO/ISAS/ESA in pt,

A. PROGRAM DESCRIPTION

The International Solar Terrestrial Physics (ISTP) Program is a large, multi-national program involving three space agencies and up to eight spacecraft. NASA, together with the Institute of Space and Astronautical Science (ISAS) and the European Space Agency (ESA), has agreed in principle to coordinate their efforts in investigating the Sun and the Earth. Each agency is planning to construct and operate different spacecraft as part of this cooperative venture: Geotail provided by ISAS, Solar Heliospheric Observatory (Soho) and Cluster (four spacecraft) contributed by ESA, and Wind and Polar by NASA.

B. GENERAL DESCRIPTION

NASA contributions to the various ISTP missions are specified in two major initiatives:

(1) Collaborative Solar Terrestrial Research (COSTR) Initiative

(2) Global Geospace Science (GGS) Initiative

The COSTR Initiative will combine resources and scientific communities on an international scale to undertake the development of instruments and their appropriate support elements, along with ground-based theory investigations in the context of a comprehensive program of solar-terrestrial physics. This program will study the overall balance and nature of solar-terrestrial interaction of the GEOSPACE region. These joint NASA-ESA-ISAS missions will carry instruments operated by an international team of principal investigators. The missions will be launched by various launchers and supported by the international ground-based networks and systems.

Specifically, COSTR defines the NASA contribution in terms of instruments, launch vehicle, and launch tracking and operations support for the Geotail, Soho, and Cluster missions.

The objective of the GGS Initiative is to undertake the development of two spacecraft and their appropriate support elements, and ground-based and theoretical investigations in the context of a comprehensive program of solar-terrestrial physics. This program in solar-terrestrial physics research will measure, model, and quantitatively assess the processes in the Sun-Earth interaction chain by the use of simultaneous spacecraft placed in complementary orbits.

Specifically, GGS defines the complete requirements which will be filled by the Wind and Polar missions.

The ESA contributions to the ISTP are defined in the ESA Solar Terrestrial Science Programme (STSP).

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INTERNATIONAL SOLAR TERRESTRIAL PHYSICS (ISTP) GEOTAIL MISSION

JJ574450

TDS Mgr: J. P. Goodwin
NOPE: S. Wolf

Project Mgr: K. O. Sizemore (GSFC)
MOM: R. Sanford (GSFC)
L/V Range: Delta II 7925/ETR

Launch Date: July 1992
Projected SC Life/DSN Support: 24 months Prime (1-year ext.)/3 years

Project Responsibility: JPL Lead Network (ISAS Cooperative)

Source: SIRD (GSFC)
Sponsor: ISAS-OSO

A. GENERAL

The Geotail spacecraft will be provided by ISAS and will be a spin-stabilized cylindrical spacecraft 2.2 m in diameter and 2.3 m in height with a despun antenna. NASA will provide a Delta Launch Vehicle, tracking support by the Deep Space Network (DSN), and data processing support by the Goddard Space Flight Center (GSFC). In exchange, ISAS will reserve part of the payload for NASA instruments together with a certain number of investigators from the United States.

As the solar wind flows toward the Earth, some of the energy is modified by the Earth's magnetosphere, ionosphere, and upper atmosphere. This interaction causes the flow to be altered, creating a plasmasphere, plasma sheet, and ring currents in the Earth's Geomagnetic tail region. The result is a series of distinct regions which affect processes on the Earth. By traversing the tail region to a variety of depths, Geotail will be able to determine the size, position, and other properties of these regions. When correlated with information obtained from the other ISTP spacecraft, Geotail data should help to provide a more complete understanding of how the solar processes affect the Earth's environment.

B. FLIGHT PROFILE

The first launch of the COSTR Initiative will be the ISAS spacecraft Geotail. Presently, Geotail's launch will be in July 1992. The primary mission will have a duration of 24 months and an extended mission phase, lasting 1 year, can be expected. Two orbital phases are planned for Geotail.

In Phase 1, the Moon's gravity is used to control apogee, perigee, and orbital position in the magnetosphere by means of double lunar swingbys. Apogees will range from approximately 80 to 250 Re while perigees will vary between 5 and 10 Re. The orbital period during this phase will be 1-, 2-, and 3-month orbits, starting with the first lunar swingby in September 1992.

In Phase 2 Geotail will be moved to a lower geocentric orbit having dimensions of 8 x 30 Re. The orbital period during this phase will be approximately 4.9 days, starting in May 1994.

Orbits in both Phase 1 and Phase 2 will lie in or near the Moon's orbit plane.

C. COVERAGE

Primary ground station support will be from the USUDA 64-m station for 8 hours/day, 5 days/week. (S- and X-band).

DSN support will consist of receiving between three and four tape recorder data transfers per day, over two or three DSN stations. Each transfer of data takes 2 hours at 65 kb/s or 1 hour at 131 kb/s (S-band only). The bit rate will depend on the spacecraft range and whether support is from a 26- or 34-m station.

The 26-m stations are baselined for Geotail support. However, portions of the mission will be supported by the 34-m STD stations.

The support provided by the DSN is indicated in the following table:

System	Goldstone		Canberra		Madrid	
	12,14,15,16		42,43,45,46		61,63,66	
S-band TLM	B	P	B	P	B	P
S-band TRK	B	P	B	P	B	P

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)
S-band	2081.0	2259.91
X-band	----	8474.66 (contingency Telemetry support by DSN)

E. SUPPORT PARAMETERS

(1) Telemetry

Real time contingency 65.5 kb/s or 16.4 kb/s or	PCM(NRZ-S) Conv, BiOL, PM
Playback 131 kb/s or 65.5 kb/s	PCM(NRZ-S) Conv, BiOL, PM

(2) Command — Not Required

(3) Ranging (Not simultaneously with Telemetry) — DSN Standard

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Launch - L+2 weeks	DSN
Approx. 2 passes/month (around maneuvers)	DSN
Other than above	ISAS

The Geotail spacecraft will be operated from the Geotail POCC at ISAS. CMD will be via Usuda.

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INTERNATIONAL SOLAR TERRESTRIAL PHYSICS (ISTP) WIND MISSION

NC999967

TDS Mgr: J. P. Goodwin
NOPE: S. Wolf

Project Mgr: K. O. Sizemore (GSFC)
MOM: R. Sanford (GSFC)
L/V Range: Delta II 7925/ETR

Launch Date: December 1992
Projected SC Life/DSN Support: 24 months Prime (1-year ext.)/3 years

Project Responsibility: GSFC

Source: SIRD (GSFC) May 1990, Draft 2
Sponsor: ISAS-OSO

A. MISSION DESCRIPTION

The launch of the WIND spacecraft will place the satellite into a sun-side apogee double-lunar swing-by orbit for a period of one year, after which WIND may be transferred to a Sun-Earth L1 Halo orbit.

B. COVERAGE

The WIND spacecraft will carry a NASA standard users transponder and will normally communicate with the WIND ground facilities via a spacecraft Medium Gain Antenna (MGA) and the DSN S-band service. One 2.08-hour support interval each day will be required for receiving tape recorder playback data. Real-time telemetry for spacecraft and instrument-performance monitoring will be received on a subcarrier simultaneous with the tape recorder playback. Spacecraft commanding is required throughout this period with (TBD) minutes of ranging and range-rate support. The spacecraft requires that command support periods be no more than 36 hours apart during the prime mission.

The 26-meter DSN stations at Canberra, Goldstone, and Madrid are designated prime support stations, with the 34-meter standard subnet located at these facilities used for backup support, or when insufficient link margins exist in the mission orbit to acquire usable data.

The support provided by the DSN is indicated in the following table:

System	Goldstone		Canberra		Madrid	
	12,14,15,16		42,43,45,46		61,63,65,66	
S-band TLM	B	P	B	P	B	P
S-band CMD	B	P	B	P	B	P
S-band TRK	B	P	B	P	B	P

C. FREQUENCY ASSIGNMENTS AND DATA RATES

System	Uplink	Downlink
S-Band CMD	2094.896 MHz	---
S-Band TLM	---	2275.000 MHz
S-Band TRK	2094.896 MHz	2275.000 MHz

D. SUPPORT PARAMETERS

(1)	Telemetry		
	Real time	5.565 kb/s	PCM(NRZ-L), Conv, R-S, BiØL, PSK, PM
		11.3 kb/s	2 x RT at < 60 Re
	Subcarrier		
	Playback	64 kb/s or 32 kb/s	1.28 MHz sine wave PCM(NRZ-L), Conv, R-S, BiØL, PM
		128 kb/s	at < 60 Re
(2)	Command		
	Format		PCM/PSK/PM
	Bit rate		250 b/s
	Subcarrier Frequency		16 kHz
	Subcarrier Waveform		Sine
(3)	Ranging		DSN Standard

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INTERNATIONAL SOLAR TERRESTRIAL PHYSICS PROGRAM (ISTP) POLAR MISSION

NC999967

TDS Mgr: J. P. Goodwin
NOPE: S. Wolf

Project Mgr: K. O. Sizemore (GSFC)
MOM: R. Sanford (GSFC)
L/V Range: Delta II 7925/WTR

Launch Date: July 1993
Projected SC Life/DSN Support: 24 months Prime (1-year ext.)/3 years

Project Responsibility: GSFC

Source: Prelim. SIRD (GSFC) August 1987, and Draft 1 SIRD, August 1989
Sponsor: NASA-OSO

A. MISSION DESCRIPTION

The polar spacecraft will be launched from WTR into a 2 earth radii by 9 earth radii POLAR orbit, with apogee near the North Pole.

B. COVERAGE

The DSN will provide all ISTP/GGS support as specified below.

The POLAR spacecraft will carry a NASA standard users transponder, and will communicate in S-band with the POLAR ground facilities via a spacecraft HGA and the DSN S-band service. Four support intervals per day (approximately 45 minutes each in duration) will be required for receiving tape recorder playback data, and up to 12 hours per day for the first month and 3.6 hours per day thereafter will be needed for receiving real-time wide-band data. Real-time telemetry for spacecraft and instrument performance monitoring will be received on a subcarrier simultaneous with the tape recorder playback on the main carrier. Spacecraft commanding is required throughout this period with (TBD) of ranging and range-rate support.

The 26-meter subnet stations located at the DSN locations in Canberra, Goldstone, and Madrid are designated prime support stations, with the 34-meter facilities used for backup support.

C. FREQUENCY ASSIGNMENTS

System	Uplink	Downlink
S-Band CMD	2085.688 MHz	---
S-Band TLM	---	2265.0 MHz
S-Band TRK	2085.688 MHz	2265.0 MHz

D. SUPPORT PARAMETERS

(1) Telemetry

Real time	55.65 kb/s	PCM(NRZ-L), Conv, R-S, PSK, PM on a 1.28 MHz sinewave subcarrier
Subcarrier Playback	512 kb/s or 256 kb/s	PCM(NRZ-L), Conv, R-S, PM

(2) Command

Format	PCM/PSK/PM
Bit rate	1000 b/s
Subcarrier Frequency	16 kHz
Subcarrier Waveform	Sine

(3) Ranging DSN Standard

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LANDSAT 4 AND 5

NC999967

(Emergency)

TDS Mgr: N. A. Fanelli
NOPE: R. E. Nevarez

Project Mgr: L. Gonzales (GSFC)
MOM: W. Webb (GSFC)
LV/Range:

Launch Date: LANDSAT 4, July 16, 1982 - LANDSAT 5, March 1, 1984
Projected SC Life/DSN Support: 4th quarter 1989/4th quarter 1989

Project Responsibility: Goddard Space Flight Center (GSFC)

Source: SIRD/NSP
Sponsor: OSO

A. MISSION DESCRIPTION

The primary purpose of LANDSAT is to study Earth resources. Each satellite contains a Thematic Mapper (TM) and a Multispectral Scanner (MSS) imaging device plus mission unique hardware.

B. FLIGHT PROFILE

LANDSAT 4 is currently in a circular Sun-synchronous orbit with orbital parameters of 699 km x 701 km x 98 degrees inclination. The orbital period is 99 minutes. LANDSAT 5 was launched into a nearly identical orbit with parameters of 705 km x 705 km x 98.2 degrees.

C. COVERAGE

1. Coverage Goals

The DSN will support LANDSAT 4 or 5 during emergencies that would prevent satellite-to-Earth communications using the standard TDRSS-White Sands data link. The DSN 26-meter antenna subnetwork would support these emergency situations.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	E	E	E
S-band CMD	E	E	E
S-band TRK	E	E	E

NOTE: E = Emergency

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2287.5	RCP
S-band CMD	2106.4	--	RCP
S-band TRK	2106.4	2287.5	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM/PSK
Subcarrier Frequency	768 kHz RT/597 kHz PB
Bit Rates	1 kb/s RT/24 kb/s PB

(2) Command

Format	PCM/PSK/PM
Subcarrier Frequency	16 kHz
Bit Rate	2.0 kb/s

(3) Support

Uplink Power	16 W (Nominal)
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Required
Doppler Rates	Moderate
Range Format	SINE
Recording	
. Analog	Required
. Digital	Not required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Earth Orbit (Phase 1)	GSFC
Earth Orbit (Phase 2)	

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N92-13114

LASER GEODYNAMIC SATELLITE (LAGEOS II)

NC999967

TDS Mgr: M. Traxler	Project Mgr: W. G. Ousley Sr. (GSFC)
NOPE: T. Howe	MOM: C. Portelli, ASI
	LV/Range: Shuttle/KSC

Launch Date: August 31, 1992
Projected SC Life/DSN Support: Many years/Launch plus 4-10 days

Project Responsibility: GSFC (Italian Cooperative - CNR)

Source: SIRD Project Documentation
Sponsor: OSO

A. MISSION DESCRIPTION

The Laser Geodynamic Satellite II (LAGEOS II) is nearly identical to the LAGEOS I satellite, which was launched by NASA in 1976. However, LAGEOS II is completely passive, and is equipped with fused silian corner reflectors for ranging with ground-based lasers. The addition of LAGEOS II will provide the GSFC laser network with significantly increased satellite tracking opportunities, because LAGEOS I is at a 110-degree inclination and LAGEOS II will be at a 52-degree inclination.

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B. FLIGHT PROFILE

LAGEOS II will be launched from the Kennedy Space Center (KSC) on the Space Transportation system (STS) shuttle. The estimated orbit profile is as follows:

Shuttle: Circular orbit at 296 km.
Inclination at 28.5 degrees.

Transfer Orbit: Elliptical orbit of 300 km by 5900 km.
Inclination at 41 degrees.
(Italian Research Interim Stage (IRIS) will be ignited over Malindi or the Indian Ocean Station.)

Final Orbit: Circular orbit at 5900 km.
Inclination at 52 degrees.
(At first transfer orbit apogee, a MAGE-1 solid rocket motor will circularize the orbit and change the inclination.)

C. COVERAGE

1. Coverage Goals

The coverage will begin at release from shuttle and continue for approximately three days. The IRIS burn coverage station will provide real-time telemetry on the IRIS burn, and Goldstone, Canberra, Hawaii and Guam Station will provide real-time telemetry on the MAGE-1 burn. The DSN 26-m subnet will provide tracking data on the LAGEOS Apogee Stage for a period up to 3 days.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	P	P	S
S-band TRK (1-way)	P	P	P

NOTE: P = Prime
S = Secondary

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated as shown below:

IRIS Stage = 2227.0 MHz
MAGE-1 Stage = 2280.0 MHz
LAGEOS-2 S/C = NONE

E. SUPPORT PARAMETERS

The support parameters for the Telemetry and Tracking Systems are listed below:

		MAGE-IS Stage	IRIS Stage
(1)	Telemetry		
	Transmitter frequency	2280 MHz	2227.0 MHz
	Format	PSK/PCM/NRZ-L	PSK/PCM/NRZ-L
	Subcarrier frequency	512 kHz	1024 kHz
	Bit rate	2000 b/s	2000 b/s
	Record	Required	Required
(2)	Tracking		
	Transmitter	Beacon, S-band	N/A
	RF signal	0.3 W	5 W
(3)	Support		
	Antenna rate	Earth orbital	Earth Orbital
	Angle data	Required	Required
	Recording	Analog required	Analog Required
	DSN NAV	Required	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
STS Launch	TDRSS
Transfer and Final Burns Orbit	ESA/DSN/DOD
Final Orbit	DSN
Laser Ranging	GSFC

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MAGELLAN

JJ574450

TDS Mgr: A. Berman
NOPE: A. Short

Project Mgr: A. Spear (JPL)
Mission Dir: J. Scott
LV/Range: STS-TBS/ETR

Launch Date: May 4, 1989
Projected SC Life/DSN Support: 3 years/3 years

Project Responsibility: Jet Propulsion Laboratory (JPL)

Source: SIRD January 1987/NSP May 1988
Sponsor: OSO

A. MISSION DESCRIPTION

The Magellan mission consists of a single spacecraft to be placed in an elliptical orbit about Venus. The main objective of the mission is to perform radar imaging, altimetry, and reflectivity of 90% of the planet for one Venusian year (243 days).

B. FLIGHT PROFILE

The Magellan spacecraft and inertial upper stage (IUS) were deployed via the Space Transportation System (STS) on May 4, 1989. Following deployment, the IUS placed the spacecraft on a planetary injection trajectory for Venus. Venus Orbit Insertion (VOI) of the Magellan Spacecraft is scheduled for August 10, 1990.

C. COVERAGE

1. Coverage Goals

	Mission Phase	Period	Passes/Month	Antennas
(a)	Mission Phase	Period	Passes/Month	Antennas
(b)	Launch	4/89	3 9	26-m 34-m STD
	Early Cruise	5/89	80	34-m STD
	Cruise	6/89-6/90	12 60 12	34-m HEF 34-m STD 70-m
	Cruise	7/90	70	70-m
	VOI/IOC	8/90	90	70-m
	Mapping	9/90-12/90	45 90	34-HEF 70-m
	Mapping	1/91/-5/15/91	90 90	34-m HEF 34-m STD
	Extended Mission Mapping	5/15/91-1/95	90	34-m HEF

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone				Canberra				Madrid			
	12	14	15	16	42	43	45	46	61	63	65	66
S-band VLBI		P				P				P		
X-band VLBI		P	P			P	P			P	P	
S-band TLM	P	P		*	P	P		*	P	P		*
X-band TLM	P	P	P		P	P	P		P	P	P	
S-band CMD	P	P		*	P	P		*	P	P		*
X-band CMD			P	*			P				P	*
S-band TRK	P	P		*	P	P			P	P		*
X-band TRK	P	P	P		P	P	P		P	P	P	

NOTES: P = Prime
*Initial acquisition only.

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2297.9	LIN or RCP
X-band TLM	--	8425.8	RCP
S-band CMD	2116.0	--	LIN or RCP
X-band CMD	7171.5		RCP
S-band TRK	--	2297.9	LIN or RCP
X-band TRK	--	8425.8	RCP or LIN

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	2
Format	PCM (NRZ-L)/PSK/PM
Subcarrier Frequency	22.5. 360, 960 KHz
Bit Rate	40, 1200 b/s and 115.2, 268.8 kb/s
Record	Required

(2) Command

Format	PCM/PSK/PM
Bit Rate	7.8125 or 62.5 b/s
Subcarrier Frequency	16 KHz sinewave

(3) Support

Uplink Power	TBS
Antenna Rate	TBS
Antenna Angle Data	TBS
Antenna Autotrack	Not Required
Doppler Rates	TBS
Recording	
. Analog	TBS
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
STS Launch	TDRSS
IUS Deployment	TDRSS
Planetary Mission	DSN

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MARS OBSERVER

JJ574450

TDS Mgr: M. R. Traxler
NOPE: T. Howe

Project Mgr: D.D. Evans
Mission Mgr: S. Dallas

Launch Date: September 16, 1992
Projected SC Life/DSN Support: 5 years/5 years

Project Responsibility: Jet Propulsion Laboratory

Source: SIRD and Mission Plan
Sponsor: OSO

A. MISSION DESCRIPTION

The Mars Observer mission will deliver a single spacecraft to Mars for an extended orbital study of the planet surface, atmosphere, and gravitational and magnetic fields.

B. FLIGHT PROFILE

The spacecraft will be launched during the September-October 1992 Mars opportunity using a Titan-TOS launch vehicle. The best mass performance for the 1992 opportunity is obtained with a long interplanetary trajectory, with a transit time to Mars of approximately one year. Insertion of the spacecraft into orbit at Mars will be accomplished by a sequence of propulsive maneuvers. The mapping mission will be conducted from a mapping orbit that is nearly circular at low altitude (378 km) and sun synchronous at the desired solar orientation. Repetitive observations of the planet's surface and atmosphere will be conducted throughout the primary mission, which extends for one Martian year (687 days from start of Mapping Phase).

C. COVERAGE

1. Coverage Goals

Coverage goals for the launch, cruise, orbit insertion, and mapping phases are listed below:

Mission Phase	Period	Passes/ Month	Antennas
Launch Continuous Coverage 30 days	9/16/92 - 10/9/92	2 60	26m 34m HEF
Early Cruise	10/92 (15 days)	60 4	34m HEF 70m
Cruise	10/92 - 2/93	35 4	34m HEF 70m
Gravity Wave	3/93 - 4/93	60 4	34m HEF 70m
Approach Phase	5/93 - 6/93	60 15	34m HEF 70m
Close Approach Phase	7/93	90 30	34m HEF 70m
MOI	8/93	90 12	34m HEF 70m
Orbit Insertion	9/93 - 12/15/93	90	34m HEF
Mapping Phase	12/16/93 - 4/94	30 10	34m HEF 70m
Mapping Phase	5/94	58 28	34m HEF 70m HEF
Mapping Phase	6/94	40	34m HEF 70m
Mapping Phase	7/94 - 12/94	40	34m HEF
Mapping Phase	1/95	58 28	34m HEF 70m
Mapping Phase	2/95 - 9/24/95	40	34m HEF
MBR Phase	9/25/95 - 11/19/95	30 30	34m HEF 70m
Mars '94 Landed Packages	11/20/95 - 2/3/96	30	HEF

2. Network Support

The support provided by the DSN in the launch phase and in the early cruise phase is indicated in the following table:

System	Goldstone			Canberra			Madrid		
	14	15	16	43	45	46	63	65	66
X-band TLM		P			P			P	
X-band CMD & Radio Metric Data		P			P*			P	

NOTES: P = Prime
* 26-m X-band support for initial acquisition

The support provided by the DSN in the cruise phase through EOM is indicated in the following table:

System	Goldstone			Canberra			Madrid		
	14	15	16	43	45	46	63	65	66
X-band TLM	P	P		P	P		P	P	
X-band TLM (CP)	P			P			P		
X-band CMD & Tracking Data		P			P			P	
X-band TRK		P			P			P	

NOTES: P = Prime
(CP) = Critical Periods

3. Compatibility Tests

Compatibility testing will be supported by CTA 21 and MIL 71. Prelaunch support will be provided by MIL-71, starting at launch minus 5 months.

D. FREQUENCY ASSIGNMENTS

Frequencies assigned to the Mars Observer Spacecraft are given in the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
Command	X-band	--	RCP (low-gain antenna)/ (high-gain antenna)
Transponder	7164.624229	--	
Telemetry	--		RCP
Transponder	--	8417.716050	
USO		8423.148147	
Radio Metric	X-band	X-band	RCP
ΔDOR	--	8423.14814	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Modulation	PCM (NRZ-L)/PSK/PM
Subcarrier	320 kHz, 21.333 kHz
Science and engineering data plus Reed-Solomon encoding (Symobs/Sec)*	4, 8, 16, 21.3334, 32, 40, 42.6677, 64, 80, 85.3334 kb/s
Engineer data (bits/sec)	10, 250, 2000, 8000, 16,000, 32,000
Coding	Convolutional (R=1/2; K=7)
Mod Index	Selectable

*Convolutional coding is also added, which will double the symbols transmitted to the ground.

(2) Command

Modulation	PCM/PSK/PM
Subcarrier Frequency	16 kHz
Bit Rates	500, 250, 125 (Nominal), 62.5, 31.25, 15.6, or 7.8125 b/s (emergency)

(3) Support

DSN Transit Power	20 kW
Angular Rate	Planetary, except for initial near-Earth requirements and cruise
ΔDOR and ΔDOD	Yes
Radio Science	Planetary occultations (687 days) and mass gravity information from radio metric data

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Launch (Titan/TOS)	Launch Vehicle
Injection	DSN
Cruise/Planetary	DSN

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MUSES-A

T1476943

(Reimbursable)

TDS Mgr: N. Fanelli
NOPE: R. E. Nevarez

Project Mgr: T. Hayashi (ISAS)
MOM: T. Nishimura (ISAS)

Launch Date: January 24, 1990
Projected SC Life/DSN Support: 1 year/9 months

Project Responsibility: Institute of Space and Astronautical Science (ISAS)

Source: SIRD April 1989
Sponsor: ISAS

A. MISSION DESCRIPTION

The MUSES-A spacecraft mission objectives are to study the effect of a double lunar swingby technique, lunar orbital insertion, obtain experience using optical navigation equipment, measure mass and momentum of micrometeorids by using a particle dust counter, and to support a packet telemetry and Reed-Solomon coding experiment by using a newly developed fault tolerant onboard computer.

B. FLIGHT PROFILE

MUSES-A was launched on a MU-3II-5 launch vehicle from Kagoshima Space Center (KSC) in Uchinoura, Kagoshima Prefecture, Japan with a launch angle of 79 deg in elevation and 90 deg in azimuth. The burn of the 4th stage motor injects the spacecraft into the mission orbit of 200 km perigee, 350,000 km apogee, and 30 deg inclination. The spacecraft is spun up to 2 rev/s prior to injection. After separation, the RCS maneuver was performed reducing the spin rate to 20 rev/min. Prior to the first swingby maneuver a tiny satellite (12 kg), which is carried aloft on the top of the main spacecraft, was injected into lunar orbit.

C. COVERAGE

No DSN launch vehicle support was required. The DSN will support the Mission phase only.

1. Coverage Goals

The DSN supports the Mission phase, providing downlink telemetry recording at all stations until one of the stations completes its second contact with the spacecraft. The DSN also provides radiometric data acquisition and orbit determination for each lunar swingby maneuver. This will involve five or six passes of about 6 hours duration. There is no requirement for DSN commanding.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 65 66
S-band TLM	P	P	P
S-band CMD	N/A	N/A	N/A
S-band TRK	P	P	P

NOTES: P = Prime
B = Backup

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	N/A	2259.9	RCP
S-band CMD	N/A	N/A	N/A
S-band TRK	2081.0	2259.9	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM (NRZ-S)/BiØ/PM or PCM (NRZ-S)PSK/PM
Subcarrier Frequency	8192 Hz (256 b/s)
Bit Rates	256, 2048, and 8192 b/s
Record	Required

(2) Command

Format	PCM (PN/BiØ)PSK/PM
Subcarrier Frequency	8000 Hz
Bit Rate	1000 Hz

(3) Support

Uplink Power	1 to 10 kw
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Required (26-m only)
Doppler Rates	Modest
Range Formats	Tone (Prime) (500 kHz Major Tone) DSN Standard (Backup)
Recording	
. Analog	Required
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Prelaunch	ISAS
Launch	ISAS
Mission	DSN, ISAS

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N92-13118

NIMBUS-7

TDS Mgr: N. Fanelli
NOPE: R. Nevarez

Project Mgr: P. Pashby (GSFC)
MOM: M. Foreman (GSFC)

Launch Date: Oct. 24, 1978
Projected SC Life/DSN Support: 15 years/11 years

Project Responsibility: Goddard Space Flight Center (GSFC)

Source: SIRD August 1983/NSP
Sponsor: OSO

A. MISSION DESCRIPTION

The Nimbus program provides for the research and development of a series of large automated spacecraft for the flight test of advanced instruments for pollution, oceanographic, and meteorological applications. The basic spacecraft is attitude-stabilized in three axes, with the yaw axis always pointing towards the center of the Earth. The spacecraft provides a stable platform, power, command, and data handling support for active and passive sensors for daily global surveillance of the atmosphere, and for mapping details of the atmospheric structure and the Earth surface from satellite altitudes. The primary objectives of the Nimbus-7 mission are as follows:

(1) To observe gases or particulates in the troposphere to determine the feasibility of mapping sources, sinks, and dispersion mechanisms of atmospheric pollutants.

(2) To observe ocean color, temperature, and ice conditions, particularly in coastal zones, with sufficient spatial and spectral resolution to determine the feasibility of applications such as detecting pollutants on the water surface; determining the nature of materials suspended in the water; applying the observations to the mapping of sediments, biologically productive areas, and interactions between coastal effluents and open ocean water; and demonstrating improvement in ship route forecasting.

B. FLIGHT PROFILE

To provide daily global coverage, the Nimbus-7 spacecraft was launched October 24, 1978 into a nominally circular Sun-synchronous orbit at an altitude of approximately 955 km. The inclination of the orbit plane was established at a value (approximately 99 degrees) such that orbital precession keeps the local time of equator crossing at 1200 local time, northbound. The nominal altitude and time of equator crossing was selected to meet experiment requirements for geographical resolutions, coverage, and data acquisition.

C. COVERAGE

The DSN began support on February 1, 1985.

1. Coverage Goals

Coverage will be provided through end of mission and will consist of twelve 15-minute passes per day. (The minimum requirement is nine 15-minute passes per day.)

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	P	P	P
S-band CMD	P	P	P
S-band TRK	P	P	P

NOTE: P = Prime

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2211.0 (Link 1)	RCP
	--	2273.5 (Link 2)	RCP
S-band CMD	2093.5	--	RCP
S-band TRK	2093.5	2273.5	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams 3	
Format (Link 1)	PCM(SP-L)/FM
(Link 2)	PCM(SP-L)/PSK/PM and PCM(SP-L)/PM
Subcarrier Frequency (Link 2)	1560 kHz
Bit Rates (Link 1)	800 kb/s
(Link 2)	4 kb/s and 800 kb/s
Coding	None
Record	Required

(2) Command

Format	PCM(NRZ-L)/PSK-Summed/FM/PM
Subcarrier Frequency	2 kHz PSK, 70 kHz FM
Bit Rate	1000 b/s

(3) Support

Uplink Power 2 kW (nominal)	
Antenna Rate High	
Antenna Angle Data	TBD
Antenna Autotrack	Required
Doppler Rates	TBD
Range Format Tone on 70 kHz subcarrier	
Recording	
. Analog	Required
. Digital	Not required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Earth Orbit	STDN (through Jan. 1985) DSN (after Jan. 1985) STDN BLT (after Jan. 1985)

The international GPS global network consists of six stations, all of which are equipped with GPS receivers and their connections to communication links with the appropriate operations center. For this mission the operations center is at JPL. Three of the sites are at the existing deep space stations, namely Goldstone, California, Tidbinbilla, Australia, and Robledo, Spain. The additional three sites are at Usuda, Japan, which is the location of its 64-m deep space station; Hartebestock, South Africa, which operates by French network stations with headquarters in Toulouse, France. For this project the interface for the data from South Africa is at Toulouse. The third site is at the former STDN complex 35 miles north of Santiago, Chile. The three sites will be covered by memorandums of agreements between NASA and the indigenous agencies, namely Institute of Space & Astronautical Sciences, Tokyo, Japan; the French network (CNES), which will be responsible for acquiring the data in South Africa and transmitting it to NASA JPL; and the University of Chile in Santiago, which has acquired all of the NASA STDN facilities and will maintain and operate the NASA equipment on loan and transmit the data to NASA JPL.

The JPL DSN will assume the lead role as "GPS Network Coordinator," with responsibility to initiate, facilitate, negotiate, and otherwise successfully execute all joint network operational aspects, including planning, documentation, configuration, communications, and monitor and control, of the joint DSN-International Agencies GPS Six-Station Network.

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N92-13119

OCEAN TOPOGRAPHY EXPERIMENT (TOPEX/POSEIDON)

JJ574450

(Emergency Support)

TDS Mgr: A. L. Berman
NOPE: A. Short

Project Mgr: C. A. Yamarone
MOM: R. A. Stiver
LV/Range: Ariane/CSG

Launch Date: July 1, 1992
Projected SC Life/DSN Support: 5 years/5 years

Project Responsibility: Jet Propulsion Laboratory (JPL)

Source: SIRD Rev. A, January 1990/NSP late 1990
Sponsor: OSO

A. MISSION DESCRIPTION

The TOPEX Mission consists of a single TOPEX spacecraft which will be placed in a high Earth circular orbit, with an altitude of 1334 km and a 63-deg inclination. Earth tracks will repeat every 10 days. Using an altimeter, TOPEX will map the topography of the ocean's surface to obtain scientific data for use in determining global ocean circulation patterns.

Of particular interest to JPL is the Global Positioning Satellite (GPS) demonstration. Receivers and media calibration equipment at the DSS Media Calibration Subsystem at the three DSN complexes will augment the GPS system to provide a differential GPS data type, which will be used for precision orbit determination. With three DSN sites, 15-cm accuracy is anticipated. If three additional sites are acquired, >10-cm accuracy is expected.

B. FLIGHT PROFILE

The TOPEX spacecraft will be launched from the Centre Spatiales de Guiana in French Guiana on an Ariane launch vehicle.

C. COVERAGE

The DSN will support the transfer and drift orbit mission phases.

1. Coverage Goals

Emergency support will be provided by the DSN 26-m subnet as required for backup support of TDRS.

2. GPS Space Vehicle Coverage

The DSS Media Calibration Subsystem will provide continuous coverage of the constellation of GPS Space Vehicles (GPSss-SV). The constellation will have between 18 and 24 satellites.

3. TOPEX GPS Receiver Coverage

Radio metric data acquired by the GPS Receiver on TOPEX comes to JPL through the TDRS telemetry link.

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
GPS L2	--	1227.60	RCP
GPS L1	--	1575.4	RCP

All GPS Space Vehicles (SV) transmit on the same two frequencies. Each GPS SV is assigned unique orthogonal PN codes that modulate the carriers and allow a ground receiver to separate the signals from individual GPS SVs.

E. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Ariane Launch	GSG
High Earth orbit	TDRS
Emergency Support	DSN
GPS Demonstration Support	DSN

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N92-13120

PIONEER 6 THROUGH 8

NC 473657

TDS Mgr: A. Berman
NOPE: L. Shaw

Project Mgr: R. Fimmel (ARC)
MOM: D. Lozier (ARC)

Launch Date: Dec. 16, 1965 - Aug. 17, 1966 - Dec. 13, 1967
Projected SC Life/DSN Support: 10 years/through 1993

Project Responsibility: Ames Research Center (ARC)

Source: SIRD September 1983/NSP June 1984
Sponsor: OSO

A. MISSION DESCRIPTION

The primary objective of the Pioneer 6 through 8 missions is to collect scientific data relative to interplanetary phenomena within a range of approximately 0.8 to 1.2 astronomical units (AUs) from the sun. Phenomena of particular interest include the characteristics of electric and magnetic fields, electron density along the Earth-spacecraft path, and temporal and spatial distribution of plasma, cosmic rays, high-energy particles, and cosmic dust.

B. FLIGHT PROFILE

Each of the Pioneer spacecraft were launched into heliocentric orbit by Delta launch vehicles. Following injection, each spacecraft was oriented with its spin axis normal to the ecliptic plane so that the solar panels would be fully illuminated and the high-gain antenna pattern would be aligned with Earth's orbit.

C. COVERAGE

1. Coverage Goals

No routine coverage is planned. Special events of scientific interest are supported when time is available.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone				Canberra				Madrid		
	12	14	15	16	42	43	45	46	61	63	66
S-band TLM	B	P			B	P			B	P	
S-band CMD	B	P			B	P			B	P	
S-band TRK	B	P			B	P			B	P	

NOTE: P = Prime; DSSs 12, 42, and 61 are able to provide support during certain orbital periods.
B = Backup

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the table below.

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	-	2292.407407 2292.407407	Linear
S-band CMD	2110.925154/ 2110.584105	-	Linear
S-band TRK	2110.925154/ 2110.584105	2292.407407/ 2292.037037	Linear

Note: Pioneer 6: 2292.037037 and 2110.584105, only

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM(NRZ-L)/PSK/PM
Subcarrier Frequency	2048 Hz
Bit Rates	8, 16, 64, 256, 512 b/s
Record	Required
Coding	Convolutional, K = 25, R = 1/2

(2) Command

Format	PCM/FSK/PM
Bit Rate	1 b/s
Subcarrier Frequency	150 and 240 Hz

(3) Support

Uplink Power	20 kW
Antenna Rate	Sidereal
Antenna Angle Data	Not required
Antenna Auto Track	Not required
Doppler Rates	Moderate
Range Format	Not applicable
Recording	
· Analog	Not required
· Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Planetary	DSN

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PONEER 10 AND 11

NC473659

TDS Mgr: A. Berman
NOPE: A. Short

Project Mgr: R. Fimmel (ARC)
MOM: D. Lozier (ARC)

Launch Date: Pioneer 10 - March 2, 1972; Pioneer 11 - April 5, 1973
Projected SC Life/DSN Support: December 1996/December 1995

Project Responsibility: Ames Research Center (ARC)

Source: SIRD September 1983/NSP June 1984
Sponsor: OSO

A. MISSION DESCRIPTION

The primary objective of the Pioneer 10 and 11 missions is to investigate the interplanetary medium beyond the orbit of Saturn and, in particular, to gather data which may locate the heliopause as these spacecraft cruise out of the solar system to the extreme of their communication capabilities.

B. FLIGHT PROFILE

After it encountered Jupiter in 1973, Pioneer 10 began its departure from the solar system in the direction of the solar apex. Pioneer 11 encountered Jupiter in 1974 and Saturn in 1979; it also will leave the solar system, but in the opposite direction of Pioneer 10.

C. COVERAGE

1. Coverage Goals

Mission	Mission Phase	Period	Passes/Month	Antennas
Pioneer 10	Cruise	1/89-1/95	60	70m
Pioneer 11	Cruise	10/89-1/95	60	70-m

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone				Canberra				Madrid		
	12	14	15	16	42	43	45	46	61	63	66
S-band TLM	P	P			P	P			P	P	
S-band CMD	P	P			P	P			P	P	
S-band TRK	P	P			P	P			P	P	

NOTE: P = Prime

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	-	2292.407407 2292.407407	RCP
S-band CMD	2110.584/ 2110.925	-	RCP
S-band TRK	2110.584/ 2110.925	2292.037037/ 2292.407407	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM(NRZ-L)/PSK/PM
Subcarrier Frequency	32 kHz
Bit Rate	16, 32, 64, 128, 256, 512, 1024, 2048 b/s
Record	Required
Coding	Convolutional, K = 32 R = 1/2

(2) Command

Format	PCM/FSK/PM
Bit Rate	16 b/s (equivalent)
Subcarrier Frequencies	128.0, 204.8 Hz
Subcarrier Waveform	Sine

(3) Support

Uplink Power	10 to 20 kW
Antenna Rate	Sidereal
Antenna Angle Data	Not required
Antenna Autotrack	Not required
Doppler Rates	Moderate
Range Format	None
Recording	
. Analog	Not required
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Planetary	DSN

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N92-13122

PIONEER 12
(PN-12)

NC473657

TDS Mgr: A. Berman
NOPE: L. Shaw

Project Mgr: R. Fimmel (ARC)
MOM: D. Lozier (ARC)

Launch Date: May 20, 1978
Projected SC Life/DSN Support: August 1992/August 1992

Project Responsibility: Ames Research Center (ARC)

Source: SIRD September 1983/NSP June 1984
Sponsor: OSO

A. MISSION DESCRIPTION

The Pioneer 12 investigates the atmospheric characteristics of Venus and the region about the planet. Additionally, the spacecraft performs altimetry and planetary imaging.

B. FLIGHT PROFILE

The Pioneer 12 spacecraft is in a 24-hour elliptical orbit about Venus. Atmospheric and altimetry data are obtained mainly around periapsis, and planetary imaging is normally performed around apoapsis. The spacecraft is expected to enter the Venusian atmosphere in 1992.

C. COVERAGE

1. Coverage Goals

Mission Phase	Period	Passes/Month	Antennas
Orbit	1/89-8/92	60	34-m STD
	1/89-8/92	3	70-m

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone				Canberra				Madrid		
	12	14	15	16	42	43	45	46	61	63	66
S-band TLM			P	P	B	P	P		P	P	
S-band CMD			P		B	P			P	P	
S-band TRK			P		B	P			P	P	
X-band TRK			P		B	P			P	P	

NOTE: P = Prime; B = Backup

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	-	2293.888 or 2294.259	RCP/Linear
S-band CMD	2112.289 or 2112.630	-	RCP/Linear
S-band TRK	2112.289 or 2112.630	2293.888 or 2294.259	RCP/Linear
X-band TRK	-	8410.925 or 8412.283	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM(NRZ-L)/PSK/PM
Subcarrier Frequency	16 kHz
Bit Rate	8, 16, 32, 64, 128, 170.66, 256, 341.33, 512, 682.66, 1024, 2048 b/s
Record	Required

(2) Command

Format	PCM/FSK/PM
Bit Rate	4 b/s
Subcarrier Frequency	100, 250 Hz

(3) Support

Uplink Power	10 to 100 kW
Antenna Rate	Sidereal
Antenna Angle Data	Not required
Antenna Autotrack	Not required (Conscan for X-band)
Doppler	
. Range	+210 kHz
. Rate	50-150 Hz
Recording	
. Analog	Not required
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Planetary	DSN

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N92-13123

ROENTGENSATELLIT (ROSAT)

NC999967

TDS Mgr: M. Traxler
NOPE: T. Howe

Project Mgr: G. Ousley (GSFC)
MOM: F. Guckenbiehl (GSOC)
LV/Range: Delta II/CCAFS

Launch Date: June 1, 1990
Projected SC Life/DSN Support: 18 months/18 months

Project Responsibility: Goddard Space Flight Center (BMFT Cooperative)

Source: Project Plan (GSFC), dated October 1983, and other project documents
Sponsor: OSO

A. MISSION DESCRIPTION

The ROSAT is an international cooperative program between the National Aeronautics and Space Administration (NASA) and the Bundesministerium fuer Forschung and Technologie (BMFT) of the Federal Republic of Germany. Germany will develop and provide a spacecraft with an X-ray telescope featuring two instruments at the focal plane of the telescope, and a stand-alone Wide Field X-ray Camera (WFC) provided by the United Kingdom (U.K.). NASA will provide one instrument: a High Resolution X-ray Imager (HRI) for mounting in the focal plane similar to the High Energy Astronomy Observatory (HEAO)-2 HRI. NASA launched the satellite on a Delta II vehicle in June 1990.

ROSAT will make an all-sky survey of X-ray and extreme ultraviolet (EUV) sources, using redundant German Position Sensitive Proportional Counters (PSPCs) and the British WFC during the first six months of its orbital mission while in a scan mode. The next 12 months will be dedicated to detailed measurements of selected X-ray sources employing the U.S. HRI, the German PSPC, and the U.K WFC in a stationary or pointing mode of spacecraft operation.

In the scan mode, the spacecraft will maintain the telescope axis approximately normal to the Earth (i.e., one spacecraft rotation per orbit). In the pointing mode, the spacecraft will be three-axis stabilized with the telescope pointing to a particular X-ray source for long periods of time (10^3 to 10^4 seconds).

A Memorandum of Understanding (MOU) setting forth the international agreement between NASA and the BMFT for the joint accomplishment of the ROSAT program was signed on August 8, 1982.

B. FLIGHT PROFILE

The ROSAT was launched from the Cape Canaveral Air Force Station on a Delta 2 expendable launch vehicle and placed in a circular orbit at an altitude of 580 km, with a 53-deg inclination.

C. COVERAGE

1. Coverage Goals

The support planned by the DSN for ROSAT is provided in the following table:

Mission Phase	Period	Passes per Month	Antennas
Launch and S/C checkout	6/90	60	26m
DSN Emergency Support Phase	6/90 - 12/92	3	26m

2. Network Support

The DSN will provide prime support from spacecraft release from the Delta II through L + 28 days. The DSN will provide backup support to Weilheim for the duration of the mission. This support will normally be provided by the DSN 26-meter stations, and will only be provided as specifically required by the project, German Space Operations Center. The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	P/B	P/B	P/B
S-band CMD	P/B	P/B	P/B
S-band TRK	P/B	P/B	P/B

NOTE: P/B = Prime or backup depending on mission phase

D. FREQUENCY ASSIGNMENTS

The uplink and downlink frequencies are listed below:

Uplink : 2096.27 MHz
Downlink: 2276.50 MHz (RCP or LCP)

E. SUPPORT PARAMETERS

The support parameters for the Telemetry and Command Systems are listed below:

(1) Telemetry

Data Streams: 2 (8 kb/s only supported by DSN)

Modulation : PCM/BIØL/PM
Subcarrier : None (Directly on Carrier)
Bit Rates : 8 kb/s by DSN
1 Mb/s science data supported only by Weilhelm

(2) Command

Modulation : PCM/PSK/PM
Subcarrier Frequency: 16 kHz
Bit Rate : 1 kb/s

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Delta II Launch to Orbit	GSFC
Prime Spacecraft Mission Support	Weilheim/DSN*
Backup Spacecraft Mission Support	DSN

*Selected prime support for the first four weeks after launch.

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N92-13124

NC999967

SAMPEX

TDS Mgr: N. A. Fanelli
NOPE: R. E. Nevarez

Project Mgr: G. Colon
MOM: J. Catena
LV/Range: Scout/VAFB

Launch Date: June 1992
Projected SC Life/DSN Support: Prime mission 3 years plus 3 years extended mission/two 15 minute contacts per day, and backup to Wallops for high rate telemetry data dump.

Project Responsibility: Goddard Space Flight Center (GSFC)

Source: SIRD
Sponsor: OSO

A. MISSION DESCRIPTION

GSFC developed the SMEX program, managed by the Special Payloads Division (SPD) (Code 740), to provide frequent flight opportunities for highly focused and inexpensive space science missions. SMEX was conceived as a low-cost program with a short turnaround (3 years) from mission selection until launch. SAMPEX is the first mission of the SMEX program. Its primary scientific objectives are to measure the elemental and isotopic composition of solar energetic particles, anomalous cosmic rays, and galactic cosmic rays over the energy range from approximately 1 to several hundred MeV per nucleon. By determining the dependence of the fluxes on geomagnetic cutoff rigidity over the polar orbit, the ionization state of the anomalous component will be determined, along with the mean ionization state of solar energetic particles. The dependence of these fluxes on the solar activity cycle will be measured by carrying out continuous observations over an extended (3-year) portion of the current activity cycle. A further primary objective is to determine flux levels and local time dependence of relativistic precipitating magnetospheric electrons during a period of declining solar activity.

B. FLIGHT PROFILE

SAMPEX will be launched June 1992, using a four-stage Scout launch vehicle into a nominal elliptical orbit of 450 by 850 kilometers with an inclination of 82 degrees (not Sun-synchronous) from VAFB. There is no transfer orbit for the SAMPEX spacecraft.

Using this Scout configuration, the uncertainty in achieving the perigee and apogee are as follows for a (TBS) percent probability.

1. Period = 98 minutes

2. Contact time = 8 - 16 minutes

C. COVERAGE

1. Coverage Goals

DSN will support two contacts per day (12 hours apart), low rate TLM, command, and RMD. Provide backup support to Wallops for high rate TLM dumps.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone					Canberra				Madrid		
	12	14	15	16	17	42	43	45	46	61	63	66
S-band TLM				P	B				P			P
S-band CMD				P	B				P			P
S-band TRK				P	B				P			P

NOTE: P = Prime
B = Back-up

3. Compatibility Testing

Scheduled for August 15, 1991.

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM		2215.0	LCP
S-band CMD	2.039.65		LCP
S-band TRK		2215.0	LCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	3
Format	PCM/NRZ-L/CONVL K=7, R=1/2/BiØ-L/PM
Subcarrier	None (Directly on Carrier)
Bit Rates	4, 16, and 900 kb/s
Record	Digital

(2) Command

Format	PCM/NRZ-L/PSK/PM
Bit Rate	2.0 kb/s
Subcarrier Frequency	16 kHz/s

(3) Support

Uplink Power	2 kW Nominal
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Required
Doppler Rates	
Range Format	Tone (Sine)

Recording
- Digital

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Launch	GSFC
Mission	DSN
Emergency	DSN

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N92-13125

T147694 3

SOLAR-A

TDS Mgr: J. A. Goodwin
NOPE: R. E. Nevarez

Project Mgr: Y. Ogawara (ISAS)
MOM: K. Ninomiya (ISAS)

Launch Date: August 16, 1991
Projected SC Life/DSN Support: 3 years/2 years

Project Responsibility: Institute of Space and Astronautical Science (ISAS)

Source: Preliminary SIRD September 1990
Sponsor: ISAS

A. MISSION DESCRIPTION

The SOLAR-A spacecraft mission objectives are to investigate high energy phenomena of the Sun using X-ray telescopes and spectrometers during the maximum activity period of the solar cycle. Experiments are being supported by various Universities and Laboratories in Japan, England, and the United States.

B. FLIGHT PROFILE

The spacecraft will be launched from Kagoshima Space Center (KSC) in Uchinoura, Kagoshima Prefecture, Japan into a circular Earth orbit of approximately 500 km altitude and 31 deg inclination by a M3SII launch vehicle resulting in a 97-min orbit duration.

C. COVERAGE

No DSN launch vehicle support is required. The DSN will support the Mission phase only.

1. Coverage Goals

The DSN will record downlink telemetry and transmit the data in real time to ISAS. The project requirement is to support 10 contacts with the spacecraft per day during the first year of the prime mission. Support requirements will be assessed on a yearly basis after the first year. Station viewperiods will be 7 to 10 minutes.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	P	P	P
S-band CMD			
S-band TRK			

NOTE: P = Prime

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	N/A	TBS	RCP
S-band CMD	N/A	N/A	N/A
S-band TRK	N/A	N/A	N/A

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM(NRZ-S)BiØ/PM or PCM (NRZ-S)PSK/PM
Subcarrier Frequency	524000 Hz
Bit Rates	1024, 4096, and 32768 b/s (Real-time) 131072 coded and 262144 b/s uncoded (Playback)
Coding	Convolutional, K=7 R=1/2
Record	Required

(2) Command

Format	PCM (NRZ-L)/PSK/PM
Subcarrier Frequency	TBS
Bit Rate	4000 b/s

(3) Support

Uplink Power	1 to 10 kW
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Required (26-m only)
Doppler Rates	Modest
Range Formats	N/A
Recording	
. Analog	N/A
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Prelaunch	ISAS
Launch	ISAS
Mission	DSN, ISAS

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SPACE FLYER UNIT (SFU)

T1476943

(Reimbursable)

TDS Mgr: J. P. Goodwin
NOPE: R. Nevarez

Project Mgr: K. Kuriki (ISAS)
MOM: T. Ninomiya (ISAS)

Launch Date: January 1, 1994
Projected SC Life/DSN Support: Reusable/6 months

Project Responsibility: Institute of Space and Astronautical Science (ISAS)

Source: SIRD
Sponsor: ISAS

A. MISSION DESCRIPTION

The Space Flyer Unit (SFU) is an unmanned, reusable, and retrievable free-flying platform for multipurpose use. SFU is to be launched by an H-II launch vehicle into a low-Earth orbit of 400 to 500 km. The spacecraft will carry seven individual experiments to be completed during its mission period. Upon completion, the SFU spacecraft is to be recovered by the space shuttle (STS).

B. FLIGHT PROFILE

The SFU spacecraft will be launched on an H-II launch vehicle from Tanegashima Space Center (TASC) in southern Japan, a planned initial orbit of 400 km perigee, 500 km apogee.

C. COVERAGE

The DSN will support the Early Orbit phase and the Retrieval phase in support of the SFU project.

1. Coverage Goals

The DSN will use the 26-m subnet to support the Early Orbit and Recovery phases of the mission. Support will consist of telemetry, command, and ranging.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	P	P	P
S-band CMD	P	P	P
S-band TRK	P	P	P

NOTE: P = Prime

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	N/A	TBS	RCP
S-band CMD	TBS	N/A	RCP
S-band TRK	TBS	TBS	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	2
Format	PCM (BiØ-L)/PSK/PM
Subcarrier Frequency	1024 kHz (1000, 16000 Hz)
Bit Rates	1000, 16000, 128000 b/s
Coding	N/A
Record	Required

(2) Command

Format	PCM (NRZ-M)/PSK/PM
Subcarrier Frequency	16 kHz
Bit Rate	2000 b/s

(3) Support

Uplink Power	1 to 10 kW
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Required (26-m only)
Doppler Rates	Modest
Range Formats	Tone (Prime) (500 kHz Major Tones)
Recording	
. Analog	N/A
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Prelaunch	NASDA
Launch	NASDA
Mission	DSN, ISAS

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SPACE TRANSPORTATION SYSTEM (STS)

(Emergency Support)

NSM: N. Fanelli
NOPE: R. Nevarez

Project Mgr: L. Nicholson (JSC)
MSM: T. Janoski (GSFC)
LV/Range: STS/ETR
ND: G. Morse (GSFC)

ND185000

Launch Date: Ongoing (Operational Date - September 29, 1988)
Projected SC Life/DSN Support: 10 years/10 years

Project Responsibility: Johnson Space Center (JSC) (Flight)

Source: PID July 1979
Sponsor: NASA

A. MISSION DESCRIPTION

The Space Transportation System (STS) is a manned reusable launch vehicle (Shuttle) used to carry into space nearly all of the nation's payloads for military, private industry, universities, research organizations, and foreign governments and organizations.

B. FLIGHT PROFILE

The STS is launched from the Eastern Test Range (ETR). Solid launch rocket engines are separated and recovered downrange for reuse. Landings take place at the ETR or at Edwards Air Force Base.

C. COVERAGE

1. Coverage Goals

Coverage will be provided by the DSN for the STS during emergencies that would prevent communications between the shuttle and the White Sands TDRSS receiving station. Emergency support would be provided by the DSN's 26-meter subnetwork.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	E	E	E
S-band CMD	E	E	E
S-band TRK	E	E	E

NOTE: E = Emergency

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2041.9	
	--	2106.4	
S-band CMD	2217.5	--	
	2287.5	--	
S-band TRK	2217.5	2041.9	
	2106.4	2287.5	

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PM (FM P/B)
Subcarrier Frequency	N/A
Bit Rates	64, 96, 128, 192, 1024 kb/s
Record	1024 kb/s

(2) Command

Format	Baseband
Subcarrier Frequency	N/A
Bit Rate	72 kb/s, 32 kb/s

(3) Support

Uplink Power	2 kW
Antenna Rate	High
Antenna Angle Rate	Required
Antenna Autotrack	Required
Doppler Rates	Moderate
Range Format	Major tone
Recording	
. Analog	Required
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table.

Mission Phase	Support Responsibility
Launch and Landing	KSC
Flight	JSC/TDRS
TDRSS Emergency	DSN

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TELECOM 2-A (TC2A)

CL 469024

(Reimbursable)

TDS Mgr: N. Fanelli
NOPE: R. Nevarez

Project Mgr: J. Latour (CNES)
MOM: J. Dulac (CNES)

Launch Date: November 1991
Projected SC Life/DSN Support: 7 years/7 days

Project Responsibility: Center National d'Etudes Spatiales (CNES)

Source: SIRD July 20, 1990
Sponsor: CNES

A. MISSION DESCRIPTION

The Telecom 2-A (TC2A) mission will provide high-speed data link applications, telephone, and television service between France and overseas territories as a follow-on to the TC1A, TC1B, and TC1C. The satellite will be placed in a geostationary orbit at TBS deg east longtidue.

B. FLIGHT PROFILE

The TC2A will be launched from the Centre Spatial Guyanis in French Guiana on an Ariane launch vehicle. The mission follows the typical injection sequence; i.e., parking orbit, transfer orbit, and drift orbit. Attitude maneuvers wil be performed to orient the spcecraft prior to Apogee Kick Motor (AKM) firings. After the final AKM firing, drift phase orbital and attitude maneuvers will be performed to place the spacecraft in its final geostationary position.

C. COVERAGE

The DSN will support the transfer and drift orbit mission phases.

1. Coverage Goals

The coverage will consist of the 26-m antennas at Goldstone, Madrid, and Canberra as prime support for the transfer and drift orbits. Maximum support will consist of two 8-hour tracks per station for a 7-day period, plus 14 days of contingency support.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone				Canberra				Madrid		
	12	14	15	16	42	43	45	46	61	63	66
S-band TLM				P	B			P			P
S-band CMD				P	B			P			P
S-band TRK				P	B			P			P

NOTE: P = Prime
B = Backup

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	N/A	TBS	RCP/Linear
S-band CMD	TBS	N/A	RCP/Linear
S-band TRK	TBS	TBS	RCP/Linear

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM (SP-L)/PSK/PM
Subcarrier Frequency	40960 Hz
Bit Rates	160 b/s
Coding	N/A
Record	Required

(2) Command

Format	PCM (NRZ-L)/PSK/PM
Subcarrier Frequency	8000 Hz
Bit Rate	1000 Hz

(3) Support

Uplink Power	1 to 10 kW
Antenna Rate	Moderate
Antenna Angle Rate	Required
Antenna Autotrack	Required (26-m only)
Doppler Rates	Modest
Range Format	Tone (Prime) (100 kHz Major Tone) DSN Standard (Backup)
Recording	
. Analog	Required
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table.

Mission Phase	Support Responsibility
Ariane launch	CSG
Transfer/Drift Orbits	DSN
Geostationary Orbit	CNES

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TELECOM 2-B AND 2-C (TC2B AND TC2C)

CL 469024

(Reimbursable)

TDS Mgr: N. Fanelli
NOPE: R. Nevarez

Project Mgr: H. Alvarez (CNES)
MOM: J. Dulac (CNES)

Launch Date: March 1992; March 1993 or 1994
Projected SC Life/DSN Support: 7 years/10 days

Project Responsibility: Center National d'Etudes Spatiales (CNES)

Source: SIRD July 20, 1990
Sponsor: CNES

A. MISSION DESCRIPTION

The Telecom 2-B and 2-C (TC2B and TC2C) missions will provide high-speed data link applications, telephone, and television service between France and overseas territories as a follow-on to the TC2A. The satellite will be placed in a geostationary orbit at TBS deg east longtidue.

B. FLIGHT PROFILE

The TC2B and TC2C will be launched from the Centre Spatial Guyanis in French Guiana on an Ariane launch vehicle. The mission follows the typical injection sequence; i.e., parking orbit, transfer orbit, and drift orbit. Attitude maneuvers wil be performed to orient the spcecraft prior to Apogee Kick Motor (AKM) firings. After the final AKM firing, drift phase orbital and attitude maneuvers will be performed to place the spacecraft in its final geostationary position.

C. COVERAGE

The DSN will support the transfer and drift orbit mission phases.

1. Coverage Goals

The coverage will consist of the 26-m antennas at Goldstone, Madrid, and Canberra as prime support for the transfer and drift orbits. Maximum support will consist of two 8-hour tracks per station for a 7-day period, plus 14 days of contingency support.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone				Canberra				Madrid		
	12	14	15	16	42	43	45	46	61	63	66
S-band TLM				P	B			P			P
S-band CMD				P	B			P			P
S-band TRK				P	B			P			P

NOTE: P = Prime
B = Backup

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	N/A	TBS	RCP/Linear
S-band CMD	TBS	N/A	RCP/Linear
S-band TRK	TBS	TBS	RCP/Linear

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM (SP-L)/PSK/PM
Subcarrier Frequency	40960 Hz
Bit Rates	160 b/s
Coding	N/A
Record	Required

(2) Command

Format	PCM (NRZ-L)/PSK/PM
Subcarrier Frequency	8000 Hz
Bit Rate	1000 Hz

(3) Support

Uplink Power	1 to 10 kW
Antenna Rate	Moderate
Antenna Angle Rate	Required
Antenna Autotrack	Required (26-m only)
Doppler Rates	Modest
Range Format	Tone (Prime) (100 kHz Major Tone) DSN Standard (Backup)
Recording	
. Analog	N/A
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table.

Mission Phase	Support Responsibility
Ariane launch	CSG
Transfer/Drift Orbits	DSN
Geostationary Orbit	CNES

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TRACKING AND DATA RELAY SATELLITE SYSTEM (TDRSS)

NC999967

NSM: N. A. Fanelli
NOPE: R. E. Nevarez

Project Mgr: C. Vanek (GSFC)
MSM: J. McKenzie (GSFC)
LV/Range: STS-IUS/ETR

Launch Date: C - 29 September 1988; D - 13 March 1989; E - January 31, 1991; F - 19 November 1992
Projected SC Life/DSN Support: 10 years/10 years

Project Responsibility: Goddard Space Flight Center (GSFC)

Source: SIRD December 1982
Sponsor: OSSA

A. MISSION DESCRIPTION

The Tracking and Data Relay Satellite System (TDRSS) consists of four identical satellites in geosynchronous orbits and a dedicated ground station. The first two satellites (TDRS east and TDRS west) will form the operational TDRS service providing near-global real-time user satellite coverage. The third satellite will be an in-orbit spare.

The payload of each TDRS is a telecommunications service system that relays communication signals between low Earth-orbiting user spacecraft and the TDRSS ground terminal. This relay is accomplished by two types of communications links: (1) a multiple-access system, with one 30-element S-band phased-array antenna system; and (2) a single-access system, either S-band single-access or K-band single-access, with two 4.8-meter parabolic antennas, each operating at both S-band and K-band.

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B. FLIGHT PROFILE

Each TDRS will be placed into a geostationary orbit with an altitude of 35,800 km. At apogee, the satellites will arrive at 56, 79, 102, or 94 degrees west longitude corresponding to deployment and transfer from the Shuttle orbits of 8th descending, 9th descending, 10th descending, or 18th ascending nodes, respectively. From one of these initial locations, each TDRS will drift to its operational position, resulting in one TDRS at 41 degrees west longitude (TDRS east) and one at 171 degrees west longitude (TDRS west). Each spacecraft will have an inclination of 0 degree. The in-orbit spare will be located between 55 and 70 degrees west longitude at a 0-degree inclination to minimize the time needed to reach either geosynchronous station.

C. COVERAGE

1. Coverage Goals

The DSN is responsible for supporting launch and transfer orbits and providing emergency support from Goldstone and Madrid beginning in February 1985. The 26- or 34-m antenna will provide the emergency support. Follow-on launch and transfer orbit support will be required for replacement launches from all three complexes.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone				Canberra				Madrid		
	12	14	15	16	42	43	45	46	61	63	66
S-band TLM	B			P	B			P	B		P
S-band CMD	B			P	B			P	B		P
S-band TRK	B			P	B			P	B		P

NOTE: B = Backup; P = Prime (Launch support to ON stations)

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2211.0	RCP
S-band CMD	2035.96	--	RCP
S-band TRK	2035.96	2211.0	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1
Format	PCM(NRZ-L)/PSK/PM
Subcarrier Frequency	1024 kHz
Bit Rate	250 or 1000 b/s
Record	Required

(2) Command

Format	PCM/PSK/PM
Bit Rate	2000 b/s
Subcarrier Frequency	16 kHz

(3) Support

Uplink Power	2 kW or 16 kW
Antenna Rate	Nil
Antenna Angle Data	Not required
Antenna Autotrack	Required
Doppler Rate	Nil
Range Format	Tone (Prime), DSN standard (Backup)
Recording	
. Analog	Required
. Digital	Required for radio metric data in 34-m backup mode

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
STS Launch	STDN
Geostationary Orbit	WSGT
Emergency Support	DSN

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ULYSSES

TDS Mgr: D. Enari
NOPE: R. L. Rose

Project Mgr: W. Meeks
MOM: P. Beech (ESOC)
LV/Range: STS-IUS-PAM-S/ETR

Launch Date: October 6, 1990

Projected SC Life/DSN Support: 8 years/5 years

Project Responsibility: Jet Propulsion Laboratory (JPL)/European Space Agency (ESA)

Source: SIRD December 1983
Sponsor: ESA/NASA
Program Manager: R. Murray

A. MISSION DESCRIPTION

The primary objectives of Ulysses are to extend scientific knowledge and understanding through exploration of the Sun and its environment, and to investigate possible mechanisms coupling solar variability to terrestrial weather and climate by studying the Sun's structure and emission as a function of latitude from the solar equator to the solar poles.

B. FLIGHT PROFILE

Ulysses consists of a single European Space Agency (ESA) spacecraft. The spacecraft will be launched in 1990 from Kennedy Space Center (KSC) by a Space Transportation System (STS) vehicle using an Inertial Upper Stage (IUS) and a Propulsion Assist Module (PAM-S) to inject the spacecraft into an interplanetary orbit toward Jupiter. After Jupiter flyby, the spacecraft travels in a heliocentric, out-of-ecliptic orbit with high heliographic inclination. The mission terminates in September 1995 at the end of the second polar pass. The highest priority portion of the mission occurs when the spacecraft is greater than 70 degrees heliographic latitude during solar passes.

C. COVERAGE

1. Coverage Goals

The antenna coverage profile provided below supports the Ulysses SIRD, JPL D-292, dated April 24, 1989. There have not been any additions or deletions to the SIRD since launch, October 1990. The requirements are expected to increase only when the project cannot obtain minimal support to retrieve data from its on-board tape recorder to complete daily 24-hour coverage throughout the prime mission phase.

The DSN expects to meet the coverage goals except when other spacecraft emergencies occur or in the case of other interruptions which are beyond the control of the DSN.

Mission Phase	Period	(30 days) Passes/Month	Antennas
Launch	10/5/90 - 10/23/90	6	26-m
(TCMs, S/C checkout, and	90	34 STD	
science turn-on, calibrations)		8	70-m
DOR during overlaps only		27	34 HEF
L +41 to L +50			
Routine	12/90	30	34 STD
First Opposition (70-m last week of Dec/ first week of Jan)	12/90 - 01/91	27	70-m
Routine	01/91 - 05/91	30	34 STD
First Conjunction	06/91 - 11/91	30	34 STD
	06/91	30	34 HEF
	07/91	30	70-m
	08/91	45	70-m
	09/91	30	70-m
Routine	12/91 - 01/92	30	34 STD

Mission Phase	Period	(30 days) Passes/Month	Antennas
Jupiter Flyby	02/92	90	34 STD
	02/92	30	70-m
Second Opposition Gravitational Wave Exp.	03/92	90	34 STD
	03/92	90	34 HEF
Routine	04/92 - 05/92	30	34 STD
Second Conjunction	06/91 - 08/92	13	34 STD
	06/92 - 08/92	17	70-m
	09/92	30	70-m
	10/92 - 11/92	13	34 STD
	10/92 - 11/92	17	70-m
Routine	12/92 - 02/93 (to mid Feb)	30	34 STD
Third Opposition Gravitational Wave Exp.	02/93 - 03/93 (from mid Feb)	90	34 STD
	02/93 - 03/93	90	34 HEF
Routine	04/93 - 05/94	30	34 STD
Solar Pass 1	06/94 - 08/94	30	34 STD
Routine	09/94 - 05/95	30	34 STD
Solar Pass 2	06/95 - 09/95	30	34 STD
EOM	10/95		

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone				Canberra				Madrid			
	12	14	15	16	42	43	45	46	61	63	65	66
S-band TLM	P	P		*	P	P		*	P	P		*
X-band TLM	P	P	P		P	P	P		P	P	P	

	System	Goldstone			Canberra			Madrid		
Cruise	S-band CMD	P	P	*	P	P	*	P	P	*
	S-band TRK	P	P	*	P	P	*	P	P	*
	X-band TRK	P	P		P	P		P	P	

NOTES: P = Prime; * = 26-m S-band support for initial acquisition or backup

During the first solar pass (May 1994 - October 1994) and the second solar pass (May 1995 - September 1995), the spacecraft will be in nearly continuous view of the southern hemisphere station, and then it will be in nearly continuous view of the northern hemisphere station.

	System	Goldstone				Canberra				Madrid			
		12	14	15	16	42	43	45	46	61	63	65	66
	S/X-band TLM	P	P	P		P	P	P		P	P	P	
Critical Events	S-band CMD	P	P			P	P			P	P		
	S/X-band TRK	P	P			P	P			P	P		

NOTE: P = Prime

3. Compatibility Testing

MIL 71 and the compatibility test van will support compatibility and other project re-tests beginning in April 1990.

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2293.148148	RCP
X-band TLM	--	8408.209876	RCP
S-band CMD	2111.607253	--	RCP
S-band TRK	2111.607253	2293.148148	RCP
X-band TRK	--	8408.209876	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	1 (S- or X-band)
Format	PCM(NRZ-L)/PSK/PM
Subcarrier Frequency	65.536 kHz for 64, 128, 256, 512,
Bit Rate	1024, 2048, 4096, 8192 b/s
Record	131.072 kHz for 2048 to 8192 b/s
	DODR required

(2) Command

Format	PCM/PSK/PM
Bit Rate	15.6250 b/s
Subcarrier Frequency	16 kHz

(3) Support

Uplink Power	Up to 20 kW (34-m), 100 kW (70-m)
Antenna Rate	Sidereal, except at launch
Antenna Angle Data	Not required
Antenna Autotrack	First pass (26-m, only)
Doppler Rates	Moderate, except first pass
Range Format	Standard DSN
Recording	
. Analog	Not required
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
STS Launch	TDRSS
IUS/PAM-S Injection	TDRSS/USAF
Cruise/Encounter/Solar Passes	DSN

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NC999967

UPPER ATMOSPHERE RESEARCH SATELLITE (UARS)

(Emergency Support)

TDS Mgr: N. A. Fanelli
NOPE: R. E. Nevarez

Project Mgr: V. Moore (GSFC)
MOM: S. Osler (GSFC)
LV/Range: STS/ETR

Launch Date: September 26, 1991
Projected SC Life/DSN Support: 1.5 years/1.5 years

Project Responsibility: Goddard Space Flight Center (GSFC)

Source: SIRD June 1983
Sponsor: OSO

A. MISSION DESCRIPTION

The UARS project is designed to study the Earth's middle and upper atmosphere.

B. FLIGHT PROFILE

The UARS satellite will be launched from the ETR in 1991 via the STS shuttle. It will be placed directly into a circular orbit of 600 km x 600 km x 57 degrees. Its period will equal 97 minutes.

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C. COVERAGE

1. Coverage Goals

Coverage will be provided by the DSN for UARS emergencies that would prevent communications via the normal channel of TDRSS to White Sands. Emergency support would be provided by the DSN 26-meter subnetwork of stations.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone	Canberra	Madrid
	12 14 15 16	42 43 45 46	61 63 66
S-band TLM	E	E	E
S-band CMD	E	E	E
S-band TRK	E	E	E

NOTE: E = Emergency

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
S-band TLM	--	2287.5	
S-band CMD	2106.4	--	
S-band TRK	2106.4	2287.5	

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	2
Format	
Subcarrier Frequency	
Bit Rates	1, 32, or 512 kb/s
Coding	
Record	

(2) Command

Format	PCM(NRZ-L)PSK/PM
Bit Rate	1 kb/s, 0.125 kb/s
Subcarrier Frequency	16,000 Hz

(3) Support

Uplink Power	TBD
Antenna Rate	Moderate
Antenna Angle Data	Required
Antenna Autotrack	Required
Doppler Rates	Moderate
Range Format	TBD
Recording	
. Analog	Required
. Digital	

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N92-13133

VOYGER INTERSTELLAR MISSION (VIM)

JJ574450

TDS Mgr: H. Cox
NOPE: L. Shaw

Project Mgr: G. Textor
Mission Director: R. Rudd

Launch Date: VGR-1 Sept. 5, 1977; - VGR-2 Aug. 20, 1977

Projected SC Life/DSN Support: 2019

Project Responsibility: Jet Propulsion Laboratory (JPL)

Source: Draft SIRD November 1989
Sponsor: OSO

A. MISSION DESCRIPTION

The continuation of the Voyager Project beyond the outer planets is called the Voyager Interstellar Mission and utilizes both Voyager spacecraft for the period from January 1, 1990 through December 31, 2019.

B. FLIGHT PROFILE

The Voyager Interstellar Mission objectives will be accomplished by extending operation of both Voyager 1 and Voyager 2 throughout the approved mission period.

The general mission objectives of the VIM are:

(a) To investigate the interplanetary and interstellar media, and to characterize the interaction between the two.

(b) To continue the successful Voyager program of ultraviolet astronomy.

C. COVERAGE

1. Coverage Goals

The Project requires a minimum of 16 hours per day of tracking coverage for each spacecraft in order to obtain science telemetry data. The total station coverage requirements (both spacecraft combined) are set forth in Table 1. When the heliopause is reached (possibly in 2010), continued 70-m coverage of both spacecraft is required for the duration of the investigation.

Table 1
Ground Aperture Coverage Requirements
(passes/week, both spacecraft combined)

Aperture	Mandatory				Enhancement			
Function	STD	HEF		array	STD	HEF		array
	34mb	34mb	70m	34/70	34ma	34ma	70m	34/70
Telemetry, Doppler Ranging, Command, and VGR-2 BLF	3	0	1.3	0	1	0	1	0
Telemetry Only	7	10	1	4 yr	1	2	0	1 yr

a. Assumes 10 hours per pass, exclusive of pre- and post-pass calibrations.
b. 70m passes may be substituted.

2. Network Support

The support provided by the DSN is indicated in the following table:

System	Goldstone			Canberra			Madrid		
	12	14	15	42	43	45	61	63	65
S-/X-band TLM	P	P	P	P	P	P	P	P	P
S-band CMD	P	P		P	P		P	P	
S-/X-band TRK	P	P		P	P		P	P	

NOTES: 1. P = Prime
2. DSS 12, 42, 61 tracking data are Doppler only, no ranging.

D. FREQUENCY ASSIGNMENTS

Frequencies are allocated according to the following table:

System	Uplink (MHz)	Downlink (MHz)	Polarization
Voyager 1:			
S-band TLM	-	2296.481481	RCP
X-band TLM	-	8420.432097	LCP
S-band CMD	2114.676697	-	RCP
S-band TRK	2114.676697	2296.481481	RCP
X-band TRK	-	8420.432097	LCP
Voyager 2:			
S-band TLM	-	2295.000000	RCP
X-band TLM	-	8415.000000	RCP
S-band CMD	2113.312500	-	RCP
S-band TRK	2113.312500	2295.000000	RCP
X-band TRK	-	8415.000000	RCP

E. SUPPORT PARAMETERS

The support parameters for the Telemetry, Command, and Support Systems are listed below:

(1) Telemetry

Data Streams	
Voyager 1	1 X-band, continuous and 1 S-band, selected periods
Voyager 2	1 X-band, continuous and 1 S-band, selected periods
Format	PCM(NRZ-L)/PSK/PM
Subcarrier Frequency	22.5, 360 kHz
Bit Rate	40, 46.6, 80, 160, 600, 1200, 1400, 2800, 3600, 4800, and 7200 b/s
Record	Dual telemetry ODRs required for critical passes, single ODRs otherwise
Coding	Convolutional, K = 7 R = 1/2

(2) Command

Format	PCM (Manchester encoded)/PSK/PM
Bit Rate	16 b/s
Subcarrier Frequency	512 Hz

(3) Support

Uplink Power	20 to 400 kW (400 kW for emergencies)
Antenna Rate	Sidereal
Antenna Angle Data	Not required
Antenna Autotrack	Not required
Doppler Rates	Moderate
Range Format	Standard DSN
Recording	
. Analog	Not required
. Digital	Required

F. TRACKING SUPPORT RESPONSIBILITY

The allocation of responsibilities for tracking support is listed in the following table:

Mission Phase	Support Responsibility
Interstellar	DSN

APPENDIX A

DSN ADVANCED PLANNING MISSION SET

Table A-1 is a compilation of potential future missions and is for information purposes only. Mission titles, new start dates, and launch dates are projected only.

Table A-1. Potential Future Missions

Mission Title	Projected New Start	Projected Launch Date	Description/Purpose
Main Belt Asteroid Rendezvous	FY TBD	Late 1996	Asteroid Rendezvous would occur in late 2001. This mission should be supportable from the 34-meter HEF and 70-meter subnets.
Lunar Geoscience Observer (LGO)	FY TBD	Late 1995	The spacecraft will be placed into a circular lunar polar orbit obtaining telemetry via tape recorders. Primary orbital operations will last one year followed by extended mission operations. DSN 34-meter STD support is required.
Magnetic Field Explorer/Magnolia	FY TBD	1994	The purpose of the NASA/CNES coorperative mission is to measure the changes in the Earth's magnetic field. Near circular, 86-degrees inclination orbit around Earth at altitude of 600 km. Five-year lifetime. S-band NASA standard transponder. Tape recorder data dumps twice per day to 26-meter subnet. Command, telemetry, and radiometric data required.

Table A-1. Potential Future Missions (Continued)

Mission Title	Projected New Start	Projected Launch Date	Description/Purpose
Orbiting VLBI (TDRSS Experiment)	FY TBD	1995	The experiment would utilize some spare time on a TDRSS satellite to look at a quasar simultaneously with an Earth-based telescope.
Cluster (ISTP - Multipoint)	FY TBD	Dec. 1995	This ESA mission consists of four spacecraft in an eccentric polar orbit to provide a three-dimensional study of plasma turbulence surrounding the earth. Support would be from the ESA 15-meter and DSN 26-meter subnets.
Infrared Space Observatory (ISO)	FY TBD	1993 3rd Quarter	The Infrared Space Observatory (ISO) mission is scheduled for an Ariane 4 launch in the 3rd quarter of 1993. The spacecraft will be placed in a 70,000-km by 1000-km orbit (24-hour orbit) and will be three-axis stabilized. The instruments will be cooled to approximately 3 K with liquid helium. The expected lifetime is 18 months (the amount of time to deplete the liquid helium to the point where the instruments become inoperable). The spacecraft has no on-board recording, and therefore the spacecraft must be tracked continuously to recover the science data in real

Table A-1. Potential Future Missions (Continued)

Mission Title	Projected: New Start	Projected: Launch Date	Description/Purpose
ISO (Continued)			time. The data rate is 32 kbps, convolutionally coded at rate 1/2 and with a constraint length of 7. Goldstone is the only DSN location required, and the expected coverage from the Goldstone 26-m tracking station is requested at a level of 8 to 10 hours per day. Two-way Doppler and range are the metric data requirements.
Orbiting Maneuver Vehicle (OMV)	Mid-1990s	TBD	The OMV project is sponsored by Marshall Space Flight Center (MSFC). The purpose of this project is to augment the capabilities of the Shuttle and the space station by providing a remotely piloted space structure that deploys, services, and/or retains orbital objects for the manned vehicle.
Radioastron	FY 89	April 1995	Radioastron is a proposed cooperative mission with the Soviet space agency IKI. The spacecraft is to be placed in a high elliptical orbit and is designed to perform space-based VLBI in conjunction with Earth-based radio telescopes. Mission life time is expected to be two years.

Table A-1. Potential Future Missions (Continued)

Mission Title	Projected New Start	Projected Launch Date	Description/Purpose
VSOP (MUSES-B)	FY 90	Mid 1995	VSOP is a proposed cooperative orbiting VLBI mission conducted by the Japanese Space agency ISAS. The mission is planned as a three-phase mission with a joint Japan-U.S. phase, a Japanese stand-alone phase, and a U.S. standalone phase. The VLBA network is expected to participate.

OMIT TO END

APPENDIX B

GLOSSARY

AKM	Apogee Kick Motor
ANC	Automatic Nutation Control
APS	Attitude Propulsion System
AU	Astronomical Unit
CCE	Charge Composition Explorer
CDPF	Command and Data Processing Facility
CDSCC	Canberra Deep Space Communications Complex
GDSCC	Goldstone Deep Space Communications Complex
GT	Geomagnetic Tail
IKI	Institute of Cosmic Research (USSR)
IMP	Interplanetary Monitoring Platform
IRM	Ion Release Module
IUS	Inertial Upper Stage
KSC	Kagashima Space Center (ISAS Launch Site, Japan)
LEOP	Launch and Early Orbit Phase
MDSCC	Madrid Deep Space Communications Complex
MOM	Mission Operations Manager
MSM	Mission Support Manager
ND	Network Director
NSM	Network Support Manager
SPIF	Shuttle POCC Interface Facility
TaSC	Tanegashima Space Center (NASDA launch site, Japan)
TLM	Telemetry
TRK	Tracking
TT&C	Telemetry, Tracking, and Command

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APPENDIX C

DEFINITIONS OF TERMS

The definitions listed here are in the order of mission development.

Approved Mission	A mission established as having new-start approval or having been appropriately obligated.
Reimbursable Mission	Mission for which DSN support costs are reimbursed to NASA by various users (e.g., U.S. private corporations, other foreign and domestic agencies).
Compatibility Testing	To demonstrate compatibility of spacecraft systems with supporting network elements.
Launch and Early Orbit	a. For geosynchronous missions, launch through the completion of AKM firing, with sufficient time to compute the resulting orbital parameters. b. For nongeosynchronous missions, launch until orbital parameters have been computed, not to exceed 24 hours.
Parking Orbit	A preliminary orbit into which a spacecraft is injected prior to maneuvers placing the spacecraft into its mission orbit or intermediate orbit.
Transfer Orbit	An intermediate orbit into which a spacecraft is placed prior to its final mission orbit. Generally, this orbit is to raise the spacecraft apogee.
Drift Orbit	An orbit with an orbital period of slightly more or less than one sidereal day and which allows for a spacecraft longitudinal position to be changed.
Mission Orbit	That orbit into which a spacecraft is placed for the purpose of meeting mission objectives.
Halo Orbit	A special type of periodic orbit about an equilibrium point between two celestial bodies in a plane generally normal to the plane of the line of sight between the two bodies.

DEFINITIONS OF TERMS (cont)

Geosynchronous/ Geostationary Satellite	A spacecraft in Earth orbit with a period of one sidereal day is considered geosynchronous. If its eccentricity and inclination approach zero, the satellite is further defined as geostationary.
Sun-synchronous	A type of orbital condition, typically between 80 and 120 degrees inclination, where the ascending node crosses the equator daily at a specified local Sun time.
Contingency Support	A support situation, which Network resources may be scheduled on short notice to provide support requirements in case of spacecraft functional or mission operational anomaly.
Backup Support	A support readiness condition in which stations may be scheduled to assume mission support responsbilities should assigned primary support elements require augmentation or replacement.

APPENDIX D

FACILITY IDENTIFIERS

Goldstone

DSS 12	34-m S-/X-band antenna
DSS 14	70-m S-/X-band antenna
DSS 15	34-m S-/X-band high-efficiency antenna
DSS 16	26-m S-band antenna
DSS 17	9-m S-band antenna

Canberra

DSS 42	34-m S-/X-band antenna
DSS 43	70-m S-/X-band antenna
DSS 45	34-m S-/X-band high-efficiency antenna
DSS 46	26-m S-band antenna

Madrid

DSS 61	34-m S-/X-band antenna
DSS 63	70-m S-/X-band antenna
DSS 65	34-m S-/X-band high-efficiency antenna
DSS 66	26-m S-band antenna

CDSCC	Canberra Deep Space Communications Complex, Australia
GDSCC	Goldstone Deep Space Communications Complex, California
MDSCC	Madrid Deep Space Communications Complex, Spain
CTA-21	Compatibility Test Area
MIL-71	Merritt Island Launch
NOCC	Network Operations Control Center

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