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VOYGER INTERSTELLAR MISSION (VIM)

JJ574450

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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)

Function	Aperture		Mandatory		Enhancement			
	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:

<u>System</u>	<u>Goldstone</u>	<u>Canberra</u>	<u>Madrid</u>
	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:

<u>System</u>	<u>Uplink (MHz)</u>	<u>Downlink (MHz)</u>	<u>Polarization</u>
<u>Voyager 1:</u>			
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
<u>Voyager 2:</u>			
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:

<u>Mission Phase</u>	<u>Support Responsibility</u>
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		Description/Purpose
	New Start	Launch Date	
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 cooperative 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		Description/Purpose
	New Start	Launch Date	
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		Description/Purpose
	New Start	Launch Date	
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		Description/Purpose
	New Start	Launch Date	
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.