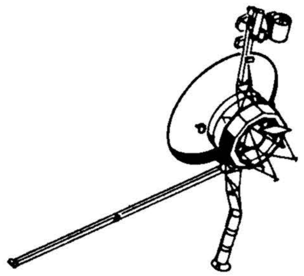


MISSION STATUS BULLETIN

VOYAGER

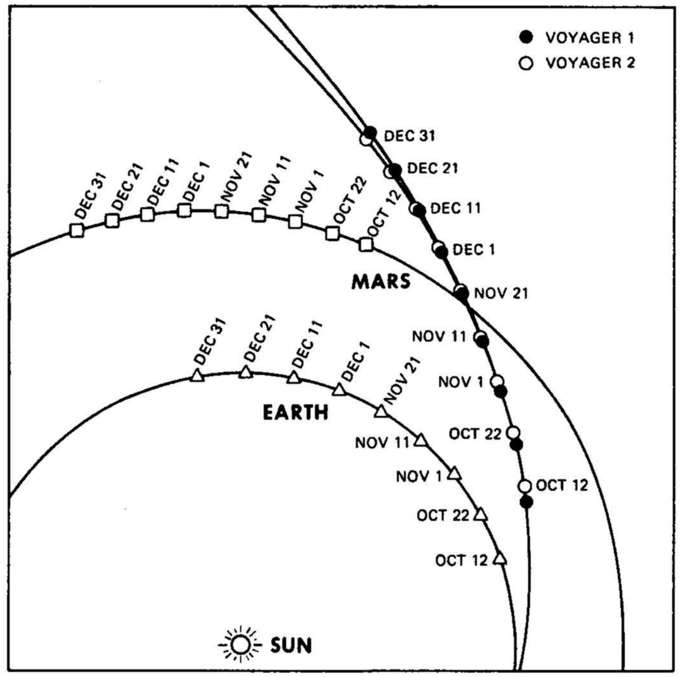
November 29, 1977 **No. 12**

SUMMARY

Eighty-five days after launch, Voyager 1 is healthy and operating well. Cruising at 21 kilometers (13 miles) per second, the craft is over 92 million kilometers (57 million miles) from Earth. One-way communication time is about 5 minutes 6 seconds.

Voyager 2, 101 days after launch, continues to operate well, with no major problems. Its velocity is 19.7 kilometers (12 miles) per second. At nearly 95 million kilometers (59 million miles) from Earth, one-way communication time is about 5 minutes 12 seconds.

Voyager 1 is closing the gap between itself and its earlier-launched, but slower, companion, and will soon overtake it. Last week, the two craft crossed the orbit of Mars and flew by the Red Planet itself at a distance of 139 million kilometers (86 million miles) for Voyager 1 and 137 million kilometers (85 million miles) for Voyager 2.



"CATCH-UP". In this computer simulation, the positions of both spacecraft, Earth, and Mars are plotted at ten-day intervals. The spacecraft crossed the orbit of Mars about November 21, and Voyager 1 will overtake Voyager 2 in late December, almost 127 million kilometers (79 million miles) from Earth.

UPDATE

VOYAGER 1

Voyager 1 continues its cruise, returning data at 2560 bits per second (bps). Spacecraft activities include numerous instrument calibrations, including the sun sensors, magnetometers, photopolarimeter, plasma, and periodic engineering and science calibrations (PESCALs).

While Voyager 1 has a fuel margin of about 25 kilograms (55 pounds), fuel saving measures are being implemented on this craft as well as on Voyager 2. On Voyager 1, the sensitivity of the sun sensors has been altered slightly to reduce propellant consumption caused by thruster firings to maintain the Sun in the sensors' fields of view.

All science instruments aboard Voyager 1 are in good condition and operating properly when turned on. Periodic slews of the scan platform to various stars and planets continue for the photopolarimeter and ultraviolet spectrometer experiments.

VOYAGER 2

Voyager 2 also continues in cruise mode, returning data at 2560 bps, with similar spacecraft activities occurring as on Voyager 1.

Satisfactory progress is being made in analyzing and solving for spacecraft problems.

The photopolarimeter (PPS) analyzer wheel remains stuck in position 2, but resolution of the problem is not urgent. The apparent cause is a failure in the multiplexer chip which selects the wheel position, and is under investigation.

NASA
National Aeronautics and Space Administration

Recorded Mission Status (213) 354-7237
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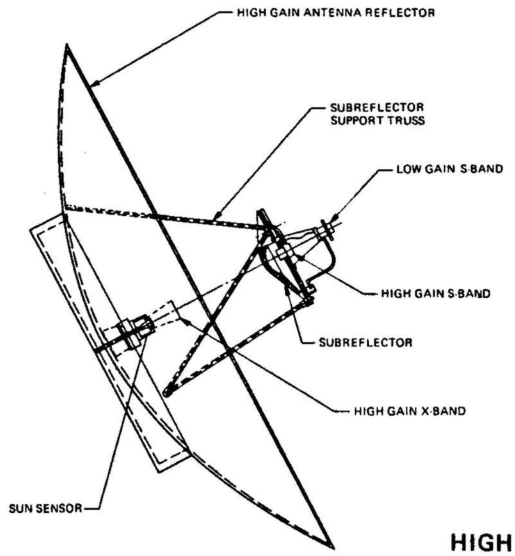
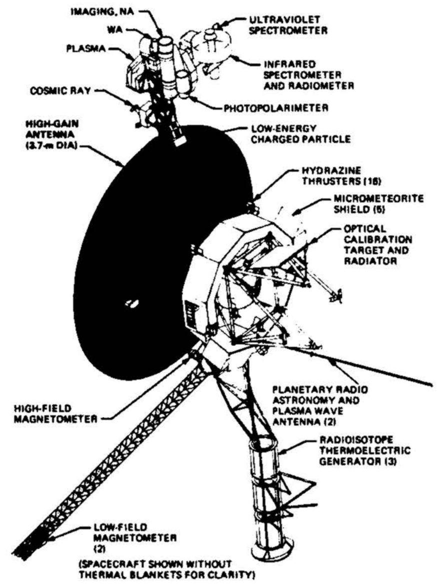
The low-energy charged particle (LECP) instrument is operating again after being turned off when a higher than acceptable temperature was noted on November 2. The overheating appears to correspond with turn-on of the X-band antenna, and is under study. A series resistor in the stepper motor may have been damaged by the high temperature, but the instrument is currently operating properly.

Several strategies have been devised and implemented to conserve fuel aboard Voyager 2, and studies indicate that there is an adequate supply – in fact a 9-kilogram (20-pound) margin – to support a Uranus encounter in January 1986. Although some attitude control functions and the trajectory correction maneuvers use hydrazine at rates greater than predicted, propellant savings resulted from (or will result from) the very stable propulsion module burn which boosted the spacecraft out of Earth orbit, the accurate Jupiter-bound trajectory, and the relocation of the post-Jupiter trajectory correction maneuver to 11 days after closest approach (including a small adjustment in the aiming point for the Ganymede flyby).

THE VOYAGER SPACECRAFT





HIGH GAIN ANTENNA ASSEMBLY

(This is the second in a planned series of brief explanatory notes on the spacecraft and its subsystems.)

Part 2 – High Gain Antenna

At first glance, Voyager's high-gain antenna dish is the most prominent feature of the spacecraft – in fact, a VW could park under its 3.66-meter (12-foot) diameter white umbrella.

Supported above the bus by a tubular trusswork, the dish is a reflector made of an aluminum honeycomb core surfaced on both sides with graphite epoxy-laminated skins – a lightweight yet durable combination to withstand the stresses of launch and the rigors of deep space.

The high-gain antenna assembly includes the sun sensors and the low-gain antenna as well. The sun sensors protrude through a cutout in the antenna dish.

The high-gain antenna is so-called because of its higher transmitting power, compared with the low-gain antenna. The high-gain antenna transmits and receives at two frequencies: the lower S-band and the higher X-band, while the low-gain antenna transmits and receives only at S-band.

The high-gain antenna, therefore, has two "feed horns", one for transmitting and receiving at S-band, and one for transmitting and receiving at X-band. The X-band feed horn is at the center of the dish. The S-band feed horns for the high-gain and low-gain antennas are mounted back-to-back on a three-legged truss work supported above the main dish. A smaller, secondary reflecting dish is mounted on the trusswork below the two S-band feed horns.

Communications during launch, near-Earth, and the early cruise phases of the mission were confined to the S-band and low-gain antenna. After the first 80 days of the mission, all communications – both S-band and X-band – are via the high-gain antenna, except for periodic science maneuvers and trajectory correction maneuvers when the low-gain antenna S-band will be used.

Why all the combinations of S- and X-band? There are several considerations. For example, different phases of the mission require different telemetry rates for the returning data; only the 64-meter antennas of the Deep Space Network can receive the X-band signals from the spacecraft.

Table 1 shows the relationships between the spacecraft and Earth-based antenna.

Table 1. Spacecraft-to-Earth Antenna Relationships

Antenna		Transmit	Receive
Spacecraft	Low Gain	S-band (2295 ±5 MHz)	S-band (2115 ±5 MHz)
	High Gain	S-band (2295 ±5 MHz) X-band (8422 ±20 MHz)	S-band (2115 ±5 MHz)
Earth (Deep Space Network)	26-meter (6)	S-band (2115 ±5 MHz)	S-band (2295 ±5 MHz)
	64-meter (3)	S-band (2115 ±5 MHz)	S-band (2295 ±5 MHz) X-band (8422 ±20 MHz)