Voyager

BULLETIN

MISSION STATUS REPORT NO. 88 JULY 12, 1989

Add a New Neptunian Moon

A new moon has been discovered orbiting Neptune. Temporarily designated 1989 N1, the new moon was initially seen in images transmitted to Earth by Voyager 2 in mid-June. Its existence was confirmed upon examination of other images after the moon's orbital motion had been calculated and its position could be predicted.

The new Neptunian satellite could range in diameter from 200 to 600 kilometers (about 125 to 400 miles) and orbits in a very nearly circular and equatorial orbit about 92,700 kilometers (about 57,600 miles) from the planet's cloud tops (or about 117,500 kilometers (73,000 miles) from the planet's center).

A permanent name will be given to the moon at a later date by the International Astronomical Union (IAU).

According to Dr. Stephen P. Synnott, a Voyager imaging team scientist at JPL, the satellite appeared as a small, bright smudge in Voyager pictures due to the long (46-second) exposure. At this point, the moon is too indistinct to appear in photographic prints made from the Voyager images. Pictures taken in coming weeks will show the moon more clearly.

1989 N1 cannot be seen from Earth because the moon is so close to Neptune that the brightness of the planet itself masks the tiny point of light. Voyager 2 will continue to study the moon and will conduct searches for others on approach to the planet. Neptune has two other known moons: Triton, discovered in 1846, and Nereid, discovered in 1949. Triton is between 2,500 and 4,000 kilometers (1,500 to 2,500 miles) in diameter; Nereid probably is somewhere between 300 and 1,100 kilometers (200 to 700 miles) in diameter.

The moon orbits well outside the orbits of the postulated ring arcs. Its existence lessens concerns about radiation hazards to the spacecraft near the planet, since the moon probably sweeps charged particles out of the area as it orbits Neptune.

What do the Hieroglyphics Mean?

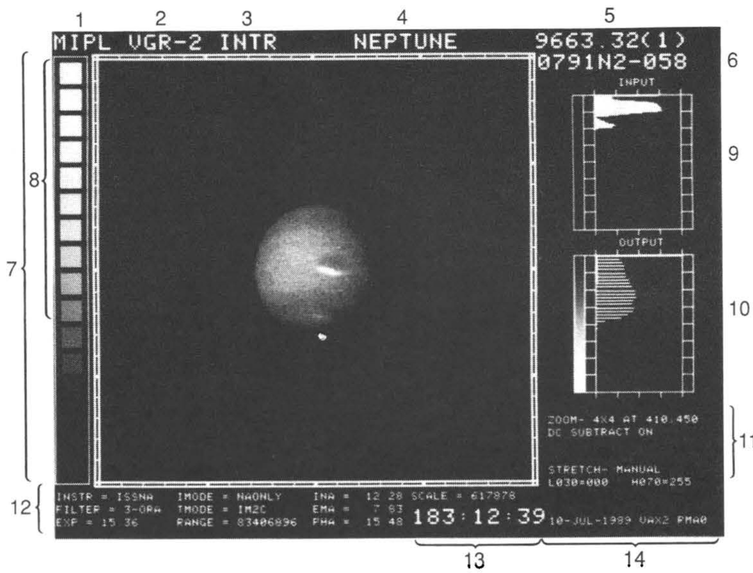
Images and some of the other data received at JPL from the two Voyager spacecraft are sent to display devices at JPL from the computers in JPL's Multimission Image Processing System. A subset of these data, primarily images, is being broadcast on the NASA Select TV channel by the GE Satcom F2R satellite. Currently, there is a one-hour broadcast every Tuesday through August 8. Broadcasts will probably be more frequent as Voyager 2 nears its closest approach to Neptune on August 25.

The frames that appear on the monitors are black and white only and include basic identification information for the image being displayed, as well as information about the processing that has been applied to that image. Data from the Planetary Radio Astronomy and Plasma Wave investigations can also be displayed on video devices. The following is a brief summary of the information shown for imaging, PRA, and PWS frames.

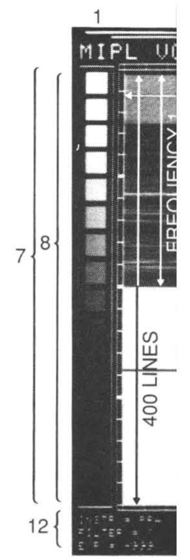
Imaging Frames

Each Voyager spacecraft carries two imaging cameras: a 200-mm, f/3.5 wide-angle camera using a refracting telescope and a 1500-mm f/8.5 narrow-angle (telephoto) camera using a reflecting telescope. Each camera uses a one-inch selenium-sulfur vidicon to convert an optical scene into electrical signals. Each frame consists of 640,000 picture elements (pixels), each of which is expressed as a level of grey on a scale from 0 (black) to 255 (white). Color scenes are reconstructed on Earth by electronically combining images taken through different filters. The sensitivity of the filters ranges from 3460 (ultraviolet) to 6184 angstroms (red-orange). (The human eye can see in the range from 4000 to 7000 angstroms.)

The elements of the displayed imaging frames are described below.



Imaging frame



PRA frame

1. MIPL Multimission Image Processing System (a JPL facility)

2. Spacecraft Identifier (VGR-1 = Voyager 1; VGR-2 = Voyager 2)

3. System Source:

RLTM Real Time. The data is displayed from telemetry as soon as the data arrives at JPL; this data may be only 4 hours old (as long as it took for the data to travel from the spacecraft to Earth); it may have been taken earlier, recorded on the spacecraft's digital tape recorder, and played back to Earth at an optimum time; or it may have been stored at the Data Capture and Staging computer and read from there later. (See item 13, to learn when the data was received at Earth.)

INTR Interactive. Image is displayed from a work station where a scientist or analyst is interactively enhancing the data.

RPLA Replay, for NASA Select TV, of data received earlier.

4. Target Body (Neptune, Triton, Nereid, rings, etc.)

5. FDS Count. Image identification in units of spacecraft clock time (the spacecraft's clock is in the spacecraft's Flight Data Subsystem computers).

6. Frame identification in units of picture number (picno), planet, spacecraft, and days from encounter.

7. Frame. The data are displayed at half resolution. As displayed, the image area is 400 lines by 400 rows of picture elements. A full Voyager image frame is 800 lines of 800 picture elements, but since the display devices can display only 640x480 picture elements, every other pixel of every other line is displayed.

8. Reference Grey Scale.

9. Histogram (frequency distribution) of number of bits at each of the grey levels in the incoming image.

10. Histogram of number of bits at each of the grey levels in the image as displayed at left. (Note: the histograms are an aid in evaluating the quality of the displayed image; e.g., how bright was the image, how good was the exposure, etc.).

11. Describes processing that has been done to transform the input image to the output image; e.g., magnification factor, dark current subtraction, contrast enhancement.

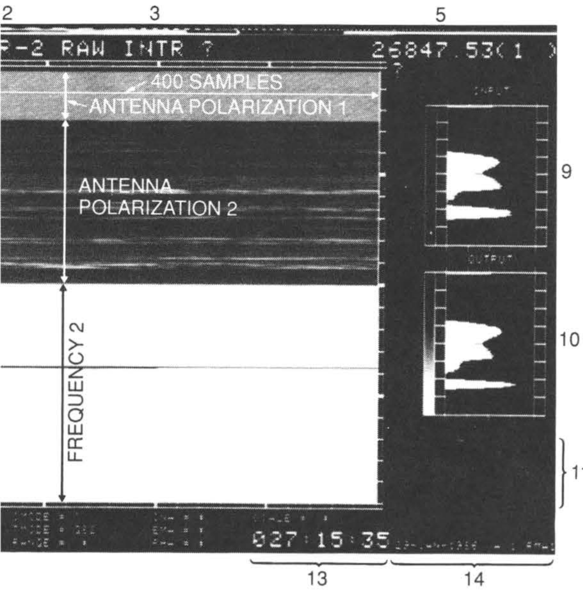
12. Identification information:

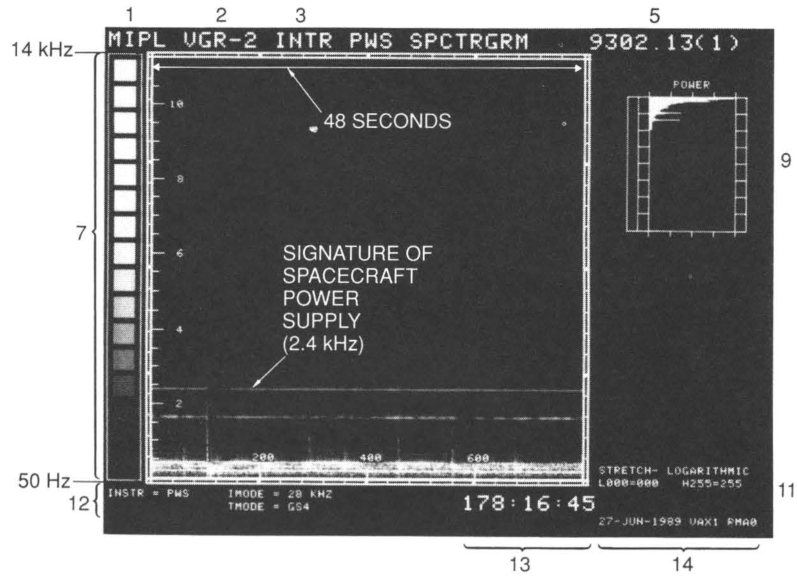
INSTR Instrument:
- **ISSWA** Imaging camera, Wide angle;
- **ISSNA** Imaging camera, Narrow angle

FILTER Clear, green, orange, blue, violet, ultraviolet, methane (6910 or 5410 angstroms), or sodium.

EXP Exposure time (seconds).

IMODE Shutter mode:
- **NAONLY** Narrow angle only.
- **WAONLY** Wide angle only.
- **BOTALT** Wide and narrow angle shuttered alternately.





PWS frame

BOTSIM Both wide and narrow shuttered simultaneously.

BODARK Neither wide nor narrow shuttered (used to calibrate background noise [or "dark current"]).

NOSHUT Neither wide nor narrow read out.

TMODE Spacecraft telemetry mode at which data is read out (e.g., compressed, edited, slow scan, etc.).

RANGE Distance from spacecraft to center of target body, in kilometers.

INA Lighting angle (incidence angle of sunlight striking target).

EMA Viewing angle (emission angle of sunlight reflected from target).

PHA Phase angle (angle between incoming sunlight and emitted or reflected light from target).

SCALE Distance across frame (at the target body).

13. Time signal was received at Earth (day of year: hour: minute) in Universal Time Coordinated (UTC).

14. Calendar day (JPL local time), MIPS computer ID, display device ID.

Planetary Radio Astronomy (PRA)

The planetary radio astronomy experiment uses two 10-meter (33-foot) whip antennas to listen for radio emissions from the Sun, planets, and lightning in planetary atmospheres over a range from 1.2 kHz to 40.5 MHz. The PRA high-rate receiver gives high time resolution at two fixed frequencies that will be selected by the PRA science team when the spacecraft is a few weeks away from the planet. At Uranus the frequencies were 35.9424 MHz and 1.230 MHz.

Data from the PRA is sometimes displayed on the video devices. The following discussion indicates information that differs from the imaging frames.

7. Frame. A high-rate PRA frame contains 48 seconds of data formatted as 800 lines, each containing 800 8-bit samples. The total time per line is 0.06 second. Only one-fourth of the PRA data is displayed in the video conversion of the frame. The first 24 seconds of the displayed frame represent signals at the first fixed frequency, at two antenna polarizations. The last 24 seconds show only one polarization at the second fixed frequency. "Real" signals show as horizontal white (or light) streaks running across the frame. (The example above shows lightning-like electrical discharges at Uranus.)

The pattern observed in each line represents the "loudness" as a function of time, of an "audio" noise signal in a narrow band centered on the receiver frequency. Real data increases the "loudness" of the signal, just like extra static in a home radio. The amount and type of noise gives information about what causes it.

9. Histogram of signal intensity as received (input).

10. Histogram of signal intensity values as displayed (output).

12. Only **Instru** and **TMODE** have any meaning for PRA and PWS frames.

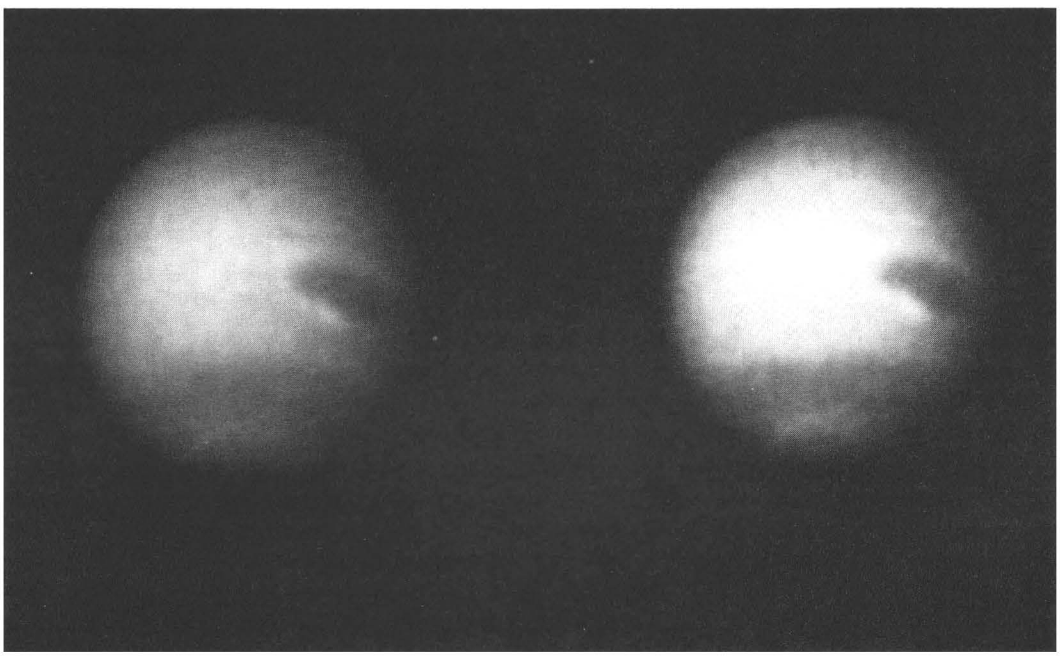
Plasma Waves (PWS)

Plasma waves are low-frequency oscillations in the plasmas in interplanetary space and in planetary magnetospheres. The plasma wave instrument detects and measures plasma wave interactions in planetary magnetospheres and detects interactions between a planetary magnetosphere and the solar wind. It can detect particles in the ring plane and measure their impact rate on the spacecraft. The PWS shares the two whip antennas with the PRA investigation to provide the equivalent of a single 7-meter antenna. PWS covers the frequency range from 10 Hz to 56.2 kHz.

The PWS high-rate receiver is a very sensitive audio amplifier. In the display of a Fourier transform of the data, the horizontal axis is time (one 48-second frame) and the vertical axis is frequency. Plasma wave scientists interpret the signal patterns in terms of various mechanisms involving the interactions of charged particles and electromagnetic waves. Steady frequencies generally are associated with interference signals from other subsystems on the spacecraft; for example, the 2.4 kHz hum of the spacecraft's power supply is pointed out on the sample frame.

Some Space Science Summer Anniversaries

July 9	1979	Voyager 2 encounters Jupiter
July 20	1969	Apollo 11 crew become first men on the Moon
	1976	Viking 1 lands on Mars
August 8	1976	Viking 2 lands on Mars
	1978	Pioneer 13 multiprobe launches to Venus
August 12	1978	ISEE 3 launches (later renamed International Cometary Explorer)
August 20	1975	Viking 1 launches to Mars
	1977	Voyager 2 launches to Jupiter and Saturn
August 25	1981	Voyager 2 encounters Saturn
September 5	1977	Voyager 1 launches to Jupiter and Saturn
September 9	1975	Viking 2 launches to Mars
	1978	Venera 11 launches to Venus
September 11	1985	International Cometary Explorer rendezvous with Comet Giacobini-Zinner
September 14	1978	Venera 14 launches to Venus



Neptune's dark oval cloud system, which is bigger than the entire planet Mars, and a dusky collar—actually a double ring—around the south pole are the first major discoveries by Voyager 2 at Neptune. The image on the right is an enhanced version of the image on the left. (P-34375)

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