

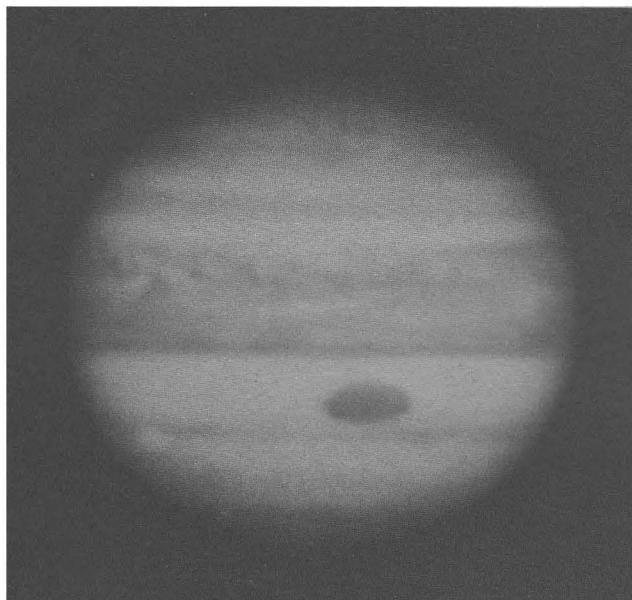
## MISSION STATUS BULLETIN



# VOYAGER

September 5, 1978

No. 23



**ATMOSPHERIC CHANGES AT JUPITER.** These photos, one ground-based and one from Voyager 1, show the dramatic changes in the giant planet's dynamic atmosphere in four years. The composite photograph on the left was taken August 18, 1974 with a 155-centimeter (5-foot) reflecting telescope at the Catalina Observatory, Lunar and Planetary Laboratory, University of Arizona-Tucson. Note the broad, bright band in the southern hemispheric area of the Great Red Spot. The photo on the right was taken with a violet filter on May 19, 1978, by Voyager 1's narrow angle camera, at a distance of 295 million kilometers. (The narrow angle aperture size is about 19 centimeters, focal length is 1500 millimeters.) The Great Red Spot is now surrounded by only a narrow bright band, flanked by darker bands above and below it, while the broadest bright band is now in the northern hemisphere. Some Jupiter observations will be retargeted toward the northern hemisphere to look more closely at the bright band. Red Spot observations will not be affected by these changes.

### SUMMARY

On September 5, one year after its launch, Voyager 1 is 723 million kilometers (449 million miles) from Earth, travelling with a heliocentric velocity of 16 kilometers per second (38,555 miles per hour). The arc (total) distance travelled at this point is 781 million kilometers (485 million miles). Jupiter lies 179 million kilometers (110 million miles) off the starboard bow, at about 5.2 AU\*. Voyager 1

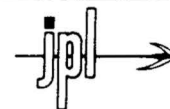
\*1 AU (astronomical unit) is the average distance between the Sun and the Earth, about 150 million kilometers (93 million miles).

is at about 4.07 AU, and one-way light time is 40 minutes 11 seconds.

On the first anniversary of its launch, August 20, Voyager 2 was 693 million kilometers (431 million miles) from Earth, travelling with a heliocentric velocity of 15.2 kilometers per second (34,058 miles per hour). The arc (total) distance travelled at that point was 778 million kilometers (484 million miles). Jupiter was 234 million kilometers (146 million miles) distant. At 3.7 AU from the Sun, one-way light time to Voyager 2 is 39 minutes 33 seconds.

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## ONE YEAR IN SPACE...

It has been a full year since the Voyagers set off to explore the cosmic ocean, and while the sailing has not always been smooth, the ships are currently healthy and functioning well.

It has been a busy cruise phase. Several instruments aboard Voyager 1 have already made contact with the first major island — Jupiter — while others continue to sample the interplanetary medium. The imaging system has returned several series of good resolution photographs of Jupiter and various stars, and the planetary radio astronomy (PRA) experiment has "sighted" the giant planet in its radio spectrum noise.

As a sidelight, one experiment, the plasma wave subsystem (PWS), has even sent us sounds of the spacecraft itself. The PWS measures waves of charged particles moving in space, and records data in several ranges, including the audio range from about 15 Hz to 20 kHz. When the spacecraft's thrusters fire, the hydrazine gas is decomposed by a catalyst, and expelled into space. The addition of this matter to the relatively low-density local area of the spacecraft is recorded by the PWS, and when the data is played at an audio frequency, the sound is somewhat like a 5-gallon can being hit with a leather-wrapped mallet.

### Calibrations

The major tasks of the months of cruise, however, have been the numerous tests and calibrations, all aimed at assuring the best possible science return from the Encounter periods. The experimenters need to know the engineering parameters dealing with various measurements, to aid later data interpretation. For the scan platform instruments, they need to know the sensitivity variation across each instrument's field-of-view (FOV), and the exact pointing position of each instrument relative to the others to determine the amount of overlap in their fields-of-view. This latter point is particularly important to determine the region of space or surface of the planet seen by each instrument relative to the others, so data from the various instruments can be correlated.

Accurate pointing information is particularly important for the ultraviolet spectrometer (UVS) in which the viewing slit is only 0.3 degrees — leaving little margin for error. The UVS will view the Sun as it sets behind the disks of Jupiter and Saturn, measuring the atmospheric gases. These solar occultations are high-priority goals of the mission.

Intensity calibrations are also important tasks for the UVS and photopolarimeter (PPS) to determine if their sensitivities remain at pre-launch laboratory test levels.

### Scan Platform

All constraints on Voyager 1's scan platform slewing were removed after testing in late May-early June found no irregularities in moving through the area in which the platform hung up in late February.

The suspected cause of that problem is debris, initially found in the output gear and subsequently in the second last gear. It is believed that the debris has been crushed by the gears, and no further difficulty is expected.

The debris appeared to consist of soft, compliant material pieces which could have come from several sources during assembly of the unit.

### AACS Patch

Both spacecraft have now had their attitude and articulation control subsystem (AACS) software modified. The changes, sent August 14 to Voyager 1 and August 28 to Voyager 2, include automatic thruster compensation for rate changes induced by the digital tape recorder starts and stops, the ability to fine-tune the rate to position gain, and the ability to independently command gyro drift turns.

### Propellant Consumption

Propellant consumption continues to be closely monitored, as Voyager's sailors learn the appetite of the spacecraft. Increased hydrazine usage can be expected during maneuvers and tests involving the thrusters, AACS, and trajectory corrections. Actual data from past maneuvers are being used for budget planning for the mission.

Of an initial 105 kilograms (232 pounds), Voyager 1 has used almost 13 kilograms (29 pounds) of hydrazine in the past year, with about 92 kilograms (203 pounds) remaining. About 6.4 kilograms (12 pounds) of fuel is expected to be used from the start of Jupiter observations on January 4, 1979 through the end of the first encounter on April 9, 1979. Eighty percent of the hydrazine usage during the 39 hours of the near encounter phase on March 5 will be to compensate for slews of the science platform, as the craft swivels its instruments frequently to alternate views of Jupiter and the Galilean satellites.

Voyager 2 has used about 10 percent of its propellant, or about 11 kilograms (24 pounds). Ninety-four kilograms (207 pounds) remain.