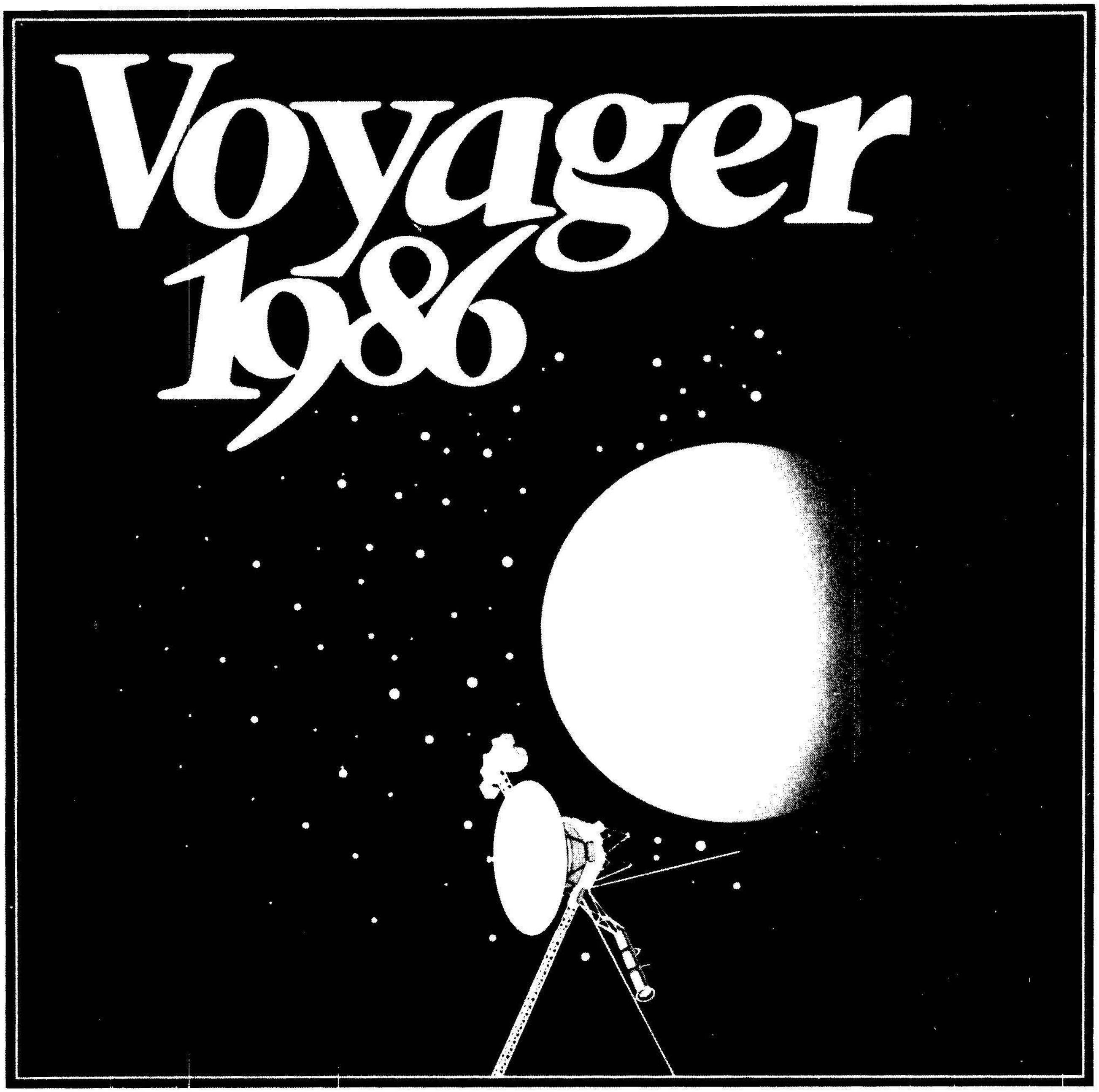
NASA
National Aeronautics and
Space Administration



Press Kit **January 1986**

RELEASE NO: 85-165 January 1986

CONTACTS

James F. Kukowski
Headquarters, Washington, D.C.
(Phone: 202/453-1548)

Frank E. Bristow
Jet Propulsion Laboratory, Pasadena, Calif.
(Phone: 818/354-5011)

Mary Beth Murrill
Jet Propulsion Laboratory, Pasadena, Calif.
(Phone: 818/354-5011)

RELEASE NO: 85-165 January 1986

CONTENTS

NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
AC 202-453-8400

For Release:

RELEASE NO: 85-165 IMMEDIATE

VOYAGER NEARS URANUS

NASA's Voyager 2 will make its closest approach to Uranus, flying 81,500 kilometers (50,600 miles) above the cloud tops of the seventh planet, at 1 p.m. EST, Jan. 24, 1986. It will be the first spacecraft to reach the planet, providing our first close look at this system.

The Voyager 2 Uranus encounter, which began Nov. 4, 1985, continues through Feb. 25, 1986. During that period, the spacecraft's 11 instruments will perform close-range studies of the planet, its five known satellites and nine rings. The spacecraft also will search for a planetary magnetic field, new satellites and new rings.

Encounter activity peaks during a 6-hour period on Jan. 24, 1986, when the highest-priority observations will take place. In about a quarter of a day, scientists will obtain more information about Uranus, its satellites and rings, than has been learned since Sir William Herschel discovered the planet March 13, 1781. Much of the data collected during the spacecraft's closest approach, however, will be recorded on the spacecraft for playback to Earth on following days.

Uranus will be the third planet visited by Voyager 2 since the spacecraft was launched from Earth on Aug. 20, 1977. Voyager 2 flew past Jupiter on July 9, 1979, and then Saturn on Aug. 25, 1981.

-more-

An identical spacecraft, Voyager 1, was launched Sept. 5, 1977, and flew past Jupiter on March 5, 1979, and Saturn on Nov. 12, 1980. Voyagers 1 and 2 returned to scientists an unprecedented amount of information on the two planets, their rings, moons and the interplanetary medium during the spacecraft cruise phases. More than 70,000 photos were taken of Jupiter and Saturn by Voyager 1 and 2.

Among the major discoveries at Jupiter were active volcanism on the satellite Io, thin rings of dust and ice encircling Jupiter, and three new satellites orbiting our solar system's largest planet.

The spacecraft found that Titan's (one of Saturn's moons) atmosphere is composed primarily of nitrogen, that it contains simple organic compounds, and has one and one-half times the pressure of Earth's. Several new Saturnian satellites were discovered. Most surprising, perhaps, was the discovery of unexpected phenomena in the planet's rings, including thousands of tiny wave-like features, some apparently caused by the gravitational influence of some of the satellites, and spoke-like features that may be electricially charged dust particles levitated above the main ring plane.

The Jupiter and Saturn data are still being studied by scientists.

Scientists and engineers at the Jet Propulsion Laboratory have been focusing on the Uranus encounter since Voyager 2 left Saturn behind in September 1981. All of Voyager's 11 science instruments are functioning and all will make observations of Uranus and its environment.

Because Uranus is about twice as far from Earth as Saturn, the rate at which Voyager will be able to transmit data to Earth is slower.

Normally, this would have seriously limited the number of photographic and other data that could be sent back to Earth, but engineers and scientists have programmed one of the spacecraft's computers to compress and encode the imaging data in order to return about 200 images a day. In addition, several antennas at each of NASA's Deep Space Network (DSN) sites will be electronically linked to increase their receiving power, allowing more of Voyager's faint radio signal to be captured. This technique, called arraying, greatly enhances the overall strength and quality of the signal received. Antenna arraying will be used at the Australia, Spain and California complexes.

Most of the key data obtained during the Uranus encounter and all of that during the closest approach will be received by the DSN's antenna complex in Canberra, Australia.

The Canberra complex, which also will be electronically linked with the Australian government's 64-m (210-ft) Parkes Radio Astronomy Observatory, is critical to the encounter for several reasons. The spacecraft track will be almost directly above the Australian complex during the encounter closest approach, allowing up to 12 hours of coverage of Voyager 2 daily. As a result of this geometric relationship, the spacecraft's signal quality will be enhanced because it will pass through a thinner slice of Earth's atmosphere than it will at the lower elevation at the antennas in California and Spain.

The Australian continent provides the added benefit of having large distances between antennas. The Parkes and Tidbinbilla antennas, for example, are 320 km (200 mi) apart. This reduces the risk that data at both stations might be subject to any degradation resulting from potentially simultaneous rain showers.

The Australian complex can accommodate a higher data rate than the other two DSN complexes both because of its advantageous viewing geometry in relation to the spacecraft, and because Voyager's signal quality will be improved by combining or arraying the output of several large antennas in Australia.

Antenna arraying also will be used at the California and Spain complexes.

Uranus is the third largest of the solar system's nine planets. Its polar axis lies nearly in the ecliptic plane rather than perpendicular to it, as most of the other solar system planets. Scientists do not know why Uranus is tipped 95 degrees from its vertical axis, but some speculate that early in its formation, Uranus was struck and the axis of rotation tipped by an object about the size of Earth.

Uranus orbits the sun once in 84 years, with one pole in sunlight for 42 years while the other pole is in darkness. When Voyager 2 approaches Uranus, the planet's south pole will be pointing toward the sun.

Because of the unique orientation of the Uranian system, the planet's polar region will dominate Voyager's view as the spacecraft approaches. The entire Uranian system will present a "bullseye" appearance to the spacecraft. Although Uranus will loom progressively larger in Voyager's field-of-view, the spacecraft's perspective on the planetary system essentially won't change until just hours before closest approach.

Uranus has five known satellites. They are considerably smaller than the Galilean moons of Jupiter, Saturn's Titan and Earth's moon, but they are still among the largest satellites in the solar system. Closest to the planet and smallest is Miranda, about 500 km (300 mi) in diameter. Next is Ariel, whose diameter is about 1,330 km (825 mi). Umbriel is the third satellite, with a diameter of about 1,110 km (690 mi).

Titania is fourth from Uranus and has a diameter of 1,600 km (995 mi). Outermost of the five is Oberon which, with a diameter of 1,630 km (1,010 mi), is the largest satellite of Uranus.

Very little is known about these moons. They could range in composition from being mostly rock to mostly ice. Scientists believe Uranus' satellites are probably similar to some of Saturn's.

They are about the same in size, but have water ice on their surfaces. They differ, however, in that they are darker. There is no evidence that they are uniformly gray -- they could display mottled dark and light surfaces like Jupiter's Callisto, or even show a surface as extreme as the black-and-white surface of Saturn's moon Iapetus.

Uranus is circled by at least nine thin rings that are among the darkest objects in the solar system -- as dark as charcoal. The outermost ring varies in size from 20 to 100 km (12 to 60 mi); two rings are about 10 km (6 mi) and two are about 3 km (2 mi). The widths of the other four are smaller, but have not been determined. Most are elliptical in shape. The rings' composition is not known, but some scientists believe that the ring particles may have contained methane which has decomposed into darker carbon materials.

Uranus is about 20 times farther from the sun than the Earth, four times farther than Jupiter and twice as far as Saturn. Uranus receives only one four-hundredth of the sunlight that Earth receives, one-sixteenth that of Jupiter and one-quarter that of Saturn.

Voyager's cameras therefore must take extremely long exposures in order to register images of the planet and its satellites.

To cope with these constraints on Voyager's photography, a special technique called image-motion compensation will be used to prevent smearing of images at these low light levels. The technique was successfully tested at Saturn.

It involves rotating the spacecraft (which is traveling more than 45,000 mph) while the camera's shutter is open, in much the same way a photographer moves his camera while taking a picture of a speeding object.

Without image-motion compensation, the best detail visible at Miranda would be 56 km (35 mi). Using the technique, the cameras can record detail of 0.6 km (one-third mi). The technique will improve resolution of details on Oberon's surface from 48 km (30 mi) to 12.5 km (7.75 mi). Detail visible in images of Ariel will be improved from 50 km (30 mi) to 2.3 km (1.4 mi).

Voyager 2's photopolarimeter will observe two ring occultations similar to observations made at Saturn. Three of Uranus' rings will pass in front of the star Sigma Sagitarrii (Nunki) and all the rings will pass in front of Beta Persei (Algol). Based on how much starlight passes through the rings, the photopolarimeter will provide information on the width and thickness of the rings and the material they contain.

Radio science measurements will complement and extend this data using information from the spacecraft signal passing through the ring material. Radio science data on Uranus atmospheres, and ionospheres will be obtained as the spacecaft enters and exits occultation periods.

In addition to two cameras, photopolarimeter and a spacecraft radio Voyager carries an infrared interferometer/spectrometer and radiometer, an ultraviolet spectrometer, a cosmic-ray detector, a plasma instrument, a low-energy charged-particle detector, magnetometers, planetary radio astronomy receiver, and a plasma-wave instrument.

The Voyager spacecraft are based on the highly successful Mariner design. Each Voyager weighs 825 kg (1,819 lbs) and is dominated by its 3.66-m (12-ft) antenna. Electric power is provided by three radioisotope thermoelectric generators (RTGs).

This system is required because solar cells could not receive sufficient solar energy for the power needed at the great distances that the spacecraft travel from the sun.

When the Uranus encounter ends in February 1986, Voyager 2 will be on a course that will take it to Neptune, its last planetary visit on Aug. 25, 1989 (GMT).

The Jet Propulsion Laboratory in Pasadena, Calif., manages the Voyager project for NASA's Office of Space Science and Applications. Earl Montoya is Voyager Program Manager at NASA Headquarters, and Dr. William Brunk, NASA Headquarters, is Voyager Program Scientist. Richard P. Laeser of JPL is Voyager Project Manager and Dr. Edward C. Stone of the California Institute of Technology is Voyager Project Scientist.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS)