Voyager Bulletin

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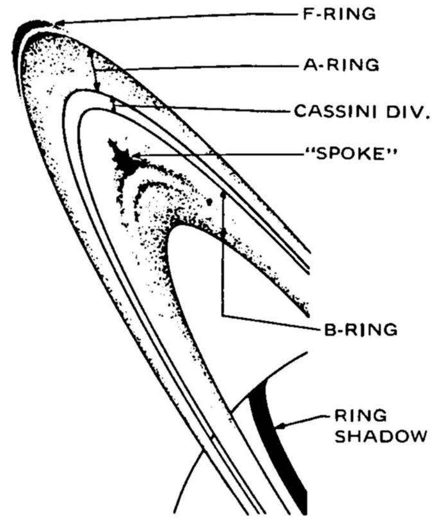

SATURN'S SPOKES — New features that have never been seen before appear in this photo of Saturn's rings taken by Voyager 1 on October 5, from a distance of 51 million kilometers (32 million miles). The photo has been computer-enhanced to bring out faint details in the rings. This and similar Voyager photos are the first pictures to show irregular patterns in the rings. Visible in the B-ring is a dark, fingerlike area that rotates around the planet like a spoke in a wheel. Studies of this and similar photos reveal many similar objects; some retain their identities for several hours, despite the fact that at the inner edge of the new features, ring particles orbit Saturn once in 9-1/2 hours, while particles at the outer edge take more than an hour longer. Consequently, spokelike features like this should be erased as the inner particles "race" ahead of the outer ones. However, some features have been observed that last three or more hours. Voyager's imaging team scientists have not yet solved the question of how the spokes develop or why they remain for hours. It is unlikely that the new features are composed of groups of particles. Rather, they are more likely to be regions where there are fewer particles, reflecting less light, than other parts of the rings.

(Small, square smudged areas are reseau marks engraved on the camera, and not features of Saturn or its rings.)

NASA
National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Voyager 1: Saturn Minus 20 Days
Voyager 2: Saturn Minus 306 Days

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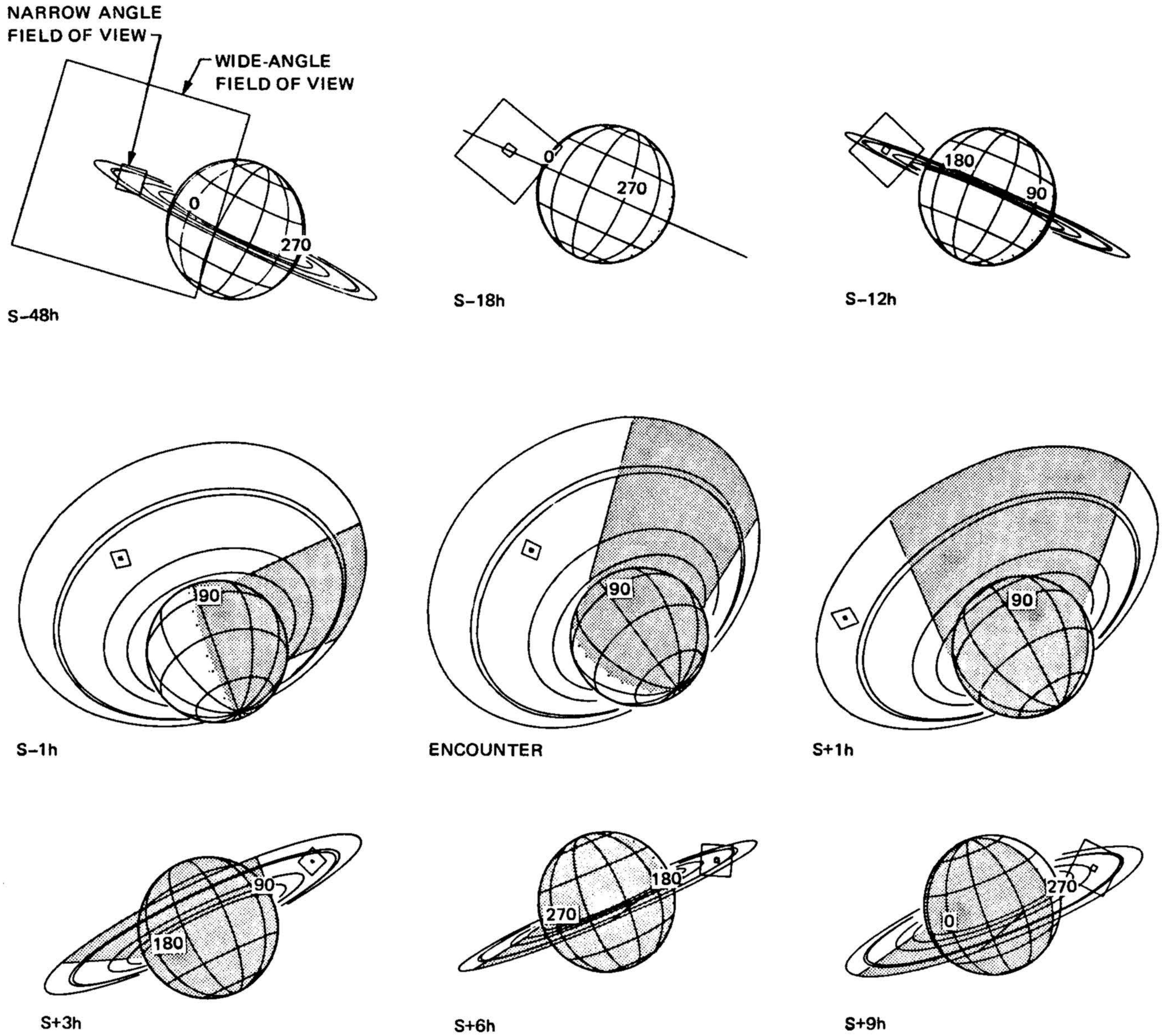


RING ASPECTS – These computer-generated plots show how Voyager 1's view of the rings will change as it flies past Saturn in November. The planet size is constant in these views to allow a comparison of Voyager's wide- and narrow-angle cameras' fields-of-view at various times (the locations of the fields-of-view shown here are not necessarily where the camera will be pointing at these times but are shown only for size comparison; the longitudes given are also for reference only). Two days before closest approach (S–48 hours), Voyager 1 will still be above the ring plane on its inbound journey. Shortly after closest approach to Titan, at about S–18 hours, the spacecraft will drop below the ring plane. Near closest approach, Voyager 1 will be above Saturn's shadowed southern hemisphere. Radio measurements of the rings will take place as the spacecraft passes behind the planet as seen from earth and all other science data will be tape recorded for about 4-1/2 hours while spacecraft telemetry is turned off. At S+4-1/2 hours, Voyager 1 will soar above the ring plane, crossing an area where the satellite Dione is thought to clear a path through the E-ring particles. Voyager 1 will continue its Saturn system observations through December 15, looking back at the receding planet.

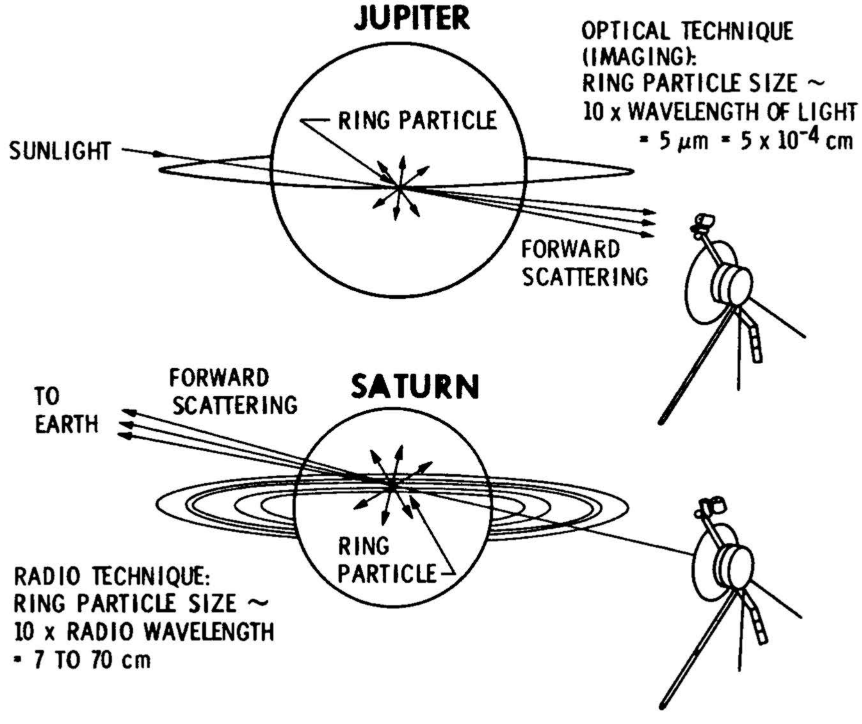
Update

Voyager 1 Enters Far Encounter Phase

On October 24, Voyager 1 will enter its next phase of Saturn observations. The narrow-angle cameras will take their last single frame images of the planet early on October 25, and then attention will be focussed on the rings for one complete planet rotation, followed immediately by images centered on Saturn for one complete rotation. For each of these sequences, narrow-angle images will be shuttered each 4.8 minutes. The rings will be photographed through the clear filter only, while all eight filters – clear (2), violet, blue, orange, green (2), and ultraviolet – will be used for the planet. These sequences will constitute the last "non-mosaicked" coverage of the planet. Regular coverage began August 22, but now one frame can no longer reliably capture the entire planet. Voyager 1 will be almost 23 million kilometers (14 million miles) and 17 days away from closest approach to Saturn when it begins the mosaics.

Once each day, the 2x2 three-color mosaics will be supplemented by three-color images on each of the two ring ansae (the outer edges of the rings), which, when combined with adjacent 2x2 mosaics, will provide 2x3 mosaics of Saturn and its rings. Infrared data will also be taken during the planet imaging.

Five narrow-angle pictures of Titan will be taken approximately every six hours. There will also be an attempt to photograph "Dione B", a tiny satellite believed



MEASURING THE RINGS — Several techniques will be used to measure the sizes of particles in Saturn's rings as the spacecraft passes behind the planet (as seen from earth). Forward scattering by ring particles is strongest when ring particles have diameters on the order of ten times the wavelength of the scattered light. The Jupiter ring, with particle diameters near 5 microns, scattered visible light effectively in a forward direction. The bulk of Saturnian ring particles are expected to have mean diameters of tens of centimeters; forward scattering of the longer-wavelength spacecraft radio signal is thus expected to be the best method of determining ring particle sizes. Attenuation of the radio signal strength and the amount of signal scattering during this period will help detect particles in the range of 7 to 70 centimeters diameter (3 to 28 inches). Optical measurements in the visible and infrared wavelengths will detect particles in the micron and millimeter-to-centimeter ranges, respectively.

to orbit at the same distance from Saturn as the intermediate-sized satellite Dione.

The ultraviolet spectrometer has been scanning the Saturn system from side to side of Titan's orbit, but now will concentrate on scans of smaller areas, gaining composition data on Saturn, Titan, the rings, and the five inner satellites. Celestial mechanics data will be extracted from the spacecraft's radio signals, while radio astronomy and plasma wave studies will continue. Several instrument calibrations will take place.

The second far encounter phase will begin November 2, ten days before closest approach. Voyager 1 will be 14 million kilometers (8.8 million miles) from Saturn.

At Saturn, Voyager will study the planet, the rings, the satellites, and the magnetosphere. Eleven science instruments fall into four broad categories: optical remote sensors, fields and particles remote sensors, fields and particles instruments, and the radio. The optical remote sensing instruments are grouped together on the scan platform perched at the edge of an 8-foot boom. These instruments — the wide- and narrow-angle cameras, the infrared interferometer/radiometer, the ultraviolet spectrometer, and the photopolarimeter — are aligned to look at about the same place so that their data may be compared. For example, the infrared instrument can provide information on the temperature of an area seen in a photograph, as it did with Io's volcanoes.

Two remote sensors measure the effects of fields and particles, studying planetary radio emissions and plasma waves. Fields and particles instruments measure magnetic fields, plasma, low-energy charged particles, and cosmic rays. These instruments also provide complementary data.

Thirdly, the spacecraft's radio signals provide essential information about atmospheric structure, planetary and satellite masses, ring particle size and density, and general relativity.

By the end of its Saturn observations in December 1980, Voyager 1 will have taken about 17,500 pictures of the Saturn system. The best resolution at the planet will be about 4 kilometers, and of some of the satellites, 2 kilometers. Many of the pictures will be mosaicked — fitted together like a jigsaw puzzle — to show an entire region. Satellite maps will be produced. Atmospheric features at Saturn and Titan will be tracked to learn about wind speeds, convection, currents, and other mechanics of their weather systems. The photographs will be compared with the infrared and ultraviolet data to produce temperature maps and compositional information.

NASA Associate Administrator Dies

Dr. Thomas A. (Tim) Mutch, NASA Associate Administrator for Space Science, was killed October 6 while leading a seven-man American team on a mountain-climbing expedition in the Himalayas.

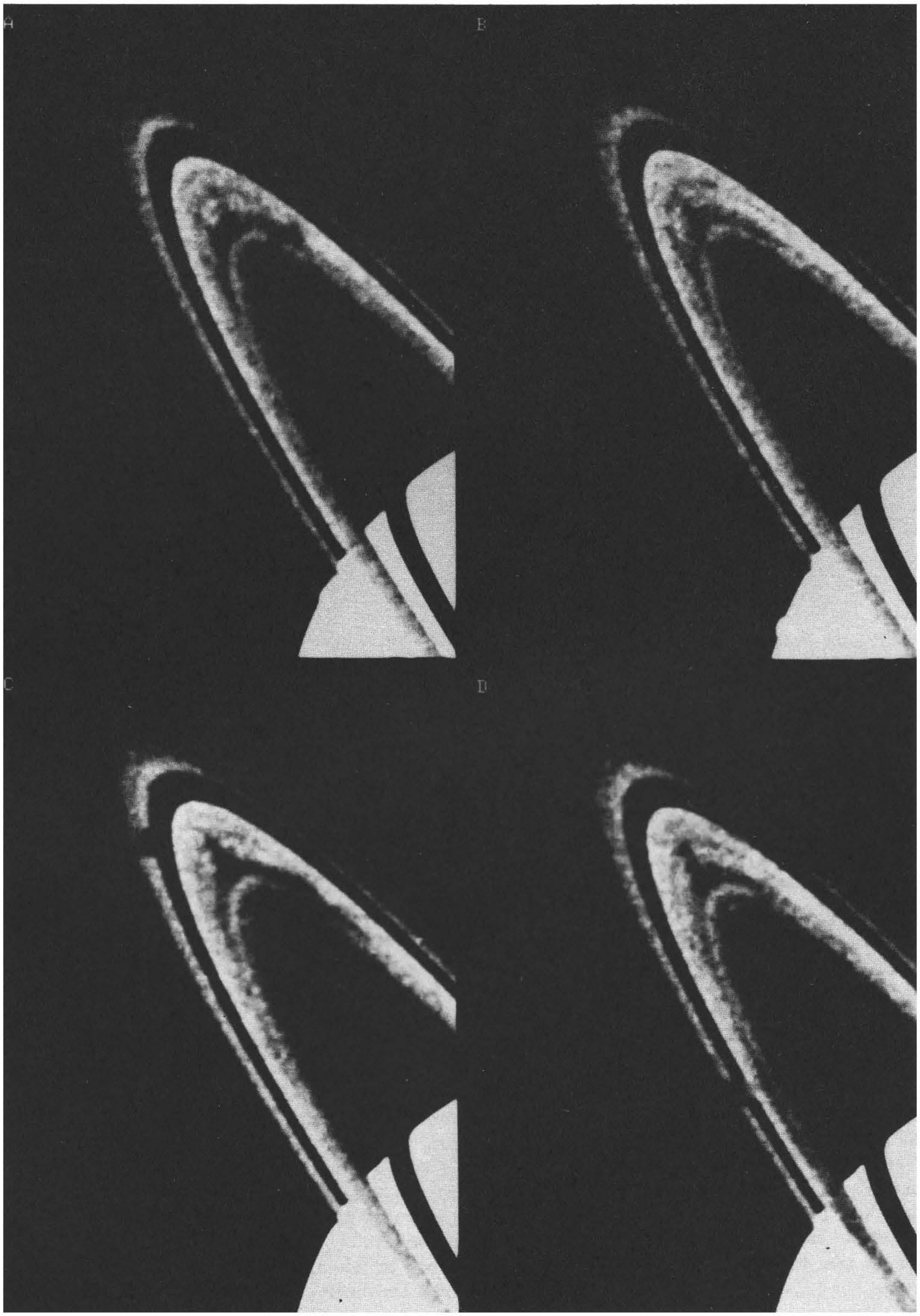
He is reported to have suffered a fatal fall on the descent from the summit of 23,410-foot Mount Nun in Kashmir, India, about 350 miles north of New Delhi.

Dr. Mutch became NASA's Associate Administrator for Space Science in 1979, and was responsible for the planning and direction of the agency's overall space science program. His enthusiasm for the space program ran high: "I feel very strongly about the space program. I feel it is vital for the nation, not just a few scientists. It's an exploration that's very much a part of our national spirit," he told an interviewer.

Prior to joining NASA, he was a professor of geology at Brown University, Providence, Rhode Island. During this time, he was a member of the Lunar Science Review Board (1969-1973), leader of the Viking Lander Imaging Science Team (1969-1977), and chairman of several NASA committees planning the post-Viking exploration of Mars. At NASA, he was involved with the Voyager and Pioneer missions.

NASA Administrator Dr. Robert A. Frosch said, "Tim Mutch was a valued friend and colleague. His contributions to the space science programs of the United States are many and earned for him an extraordinary reputation among his peers . . . His work has made significant contributions to the knowledge of our solar system"

A scholarship fund has been established at the Department of Geology, Brown University.



A BIG WHEEL? — Voyager 1 acquired these four photographs of Saturn's rings during a period of 12 hours on October 4 and 5, 1980. The photo at lower left is enlarged on the front page. The images have been computer-enhanced to emphasize detail in portions of the A- and B-rings, separated by the dark Cassini Division. Visible within the B-ring are patterns of dark, nearly radial features which have recently been discovered in the Voyager images. As illustrated by these examples, the shape and number of these features is quite variable. A time-lapse sequence of photographs shows that a few features retain their appearance for a period of several hours. Pre-Voyager photography has failed to show such radial structure, and most current theories predict that the rings will be uniform about their circumference, quite unlike the appearance shown here. These features probably represent regions where there are fewer particles, so that less sunlight is reflected. The origin of these variations in the density of particles is not yet understood; but they may be caused by the gravitational influence of nearby Saturn satellites.

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