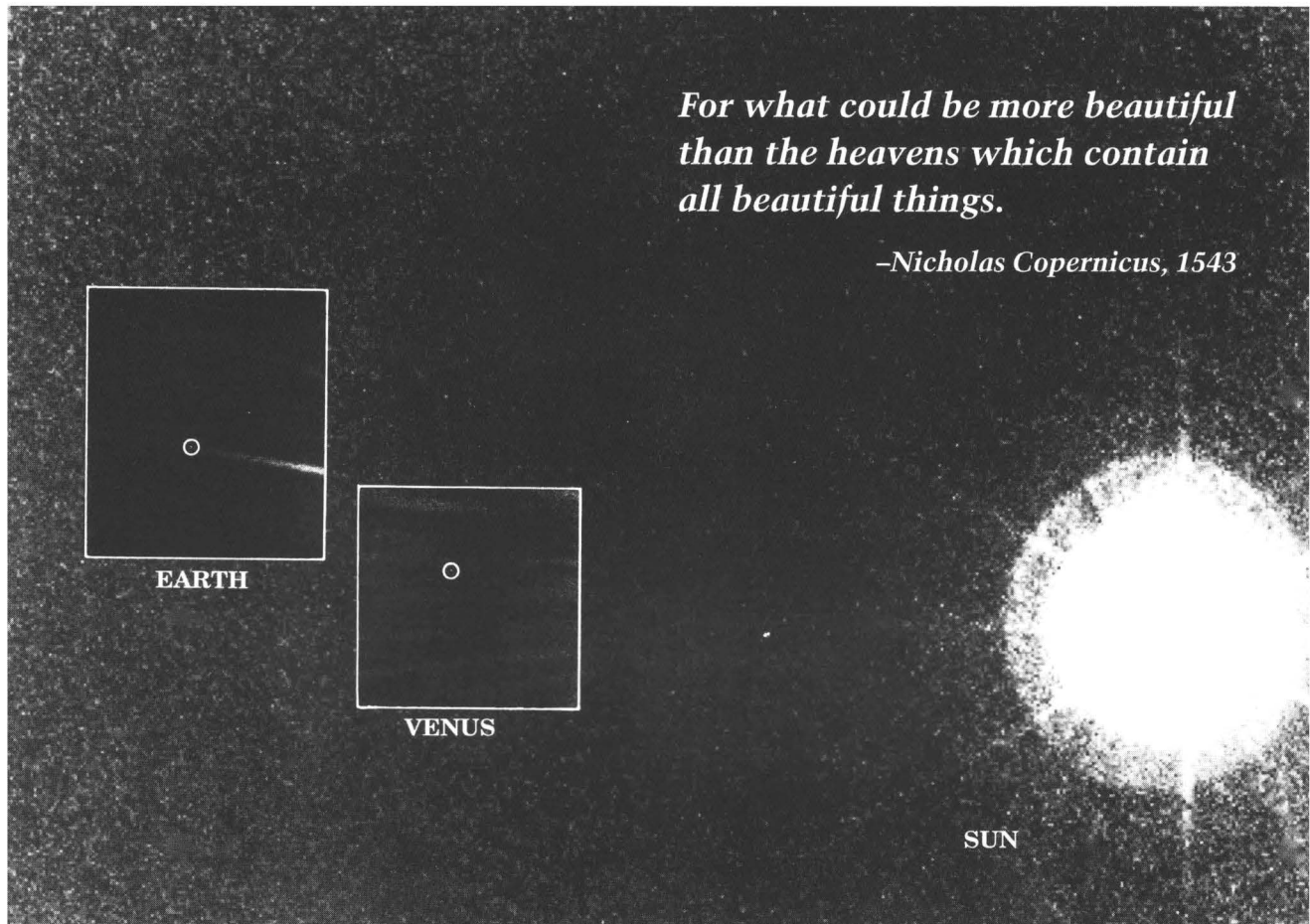


Voyager

B U L L E T I N

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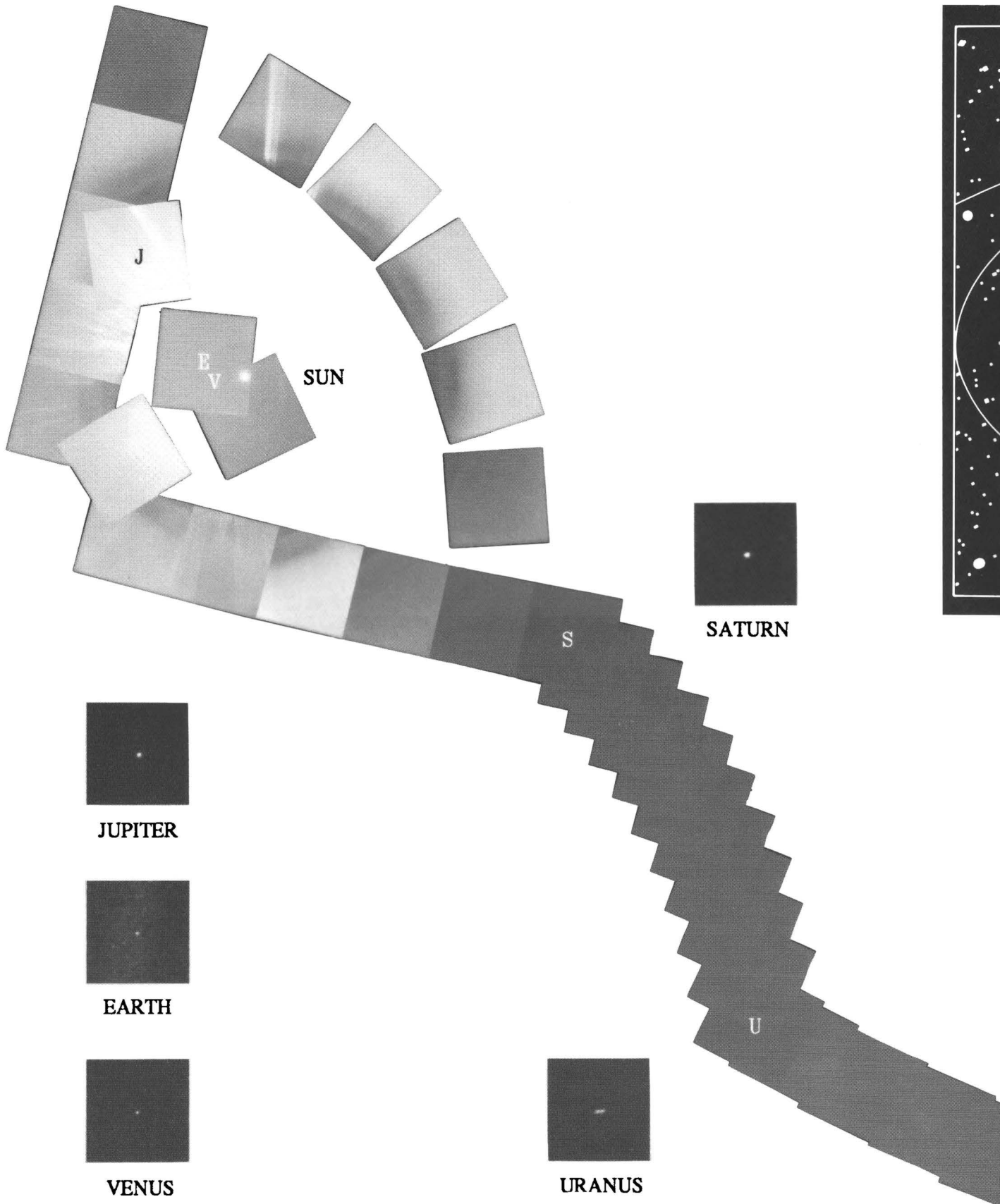
JUNE 6, 1990

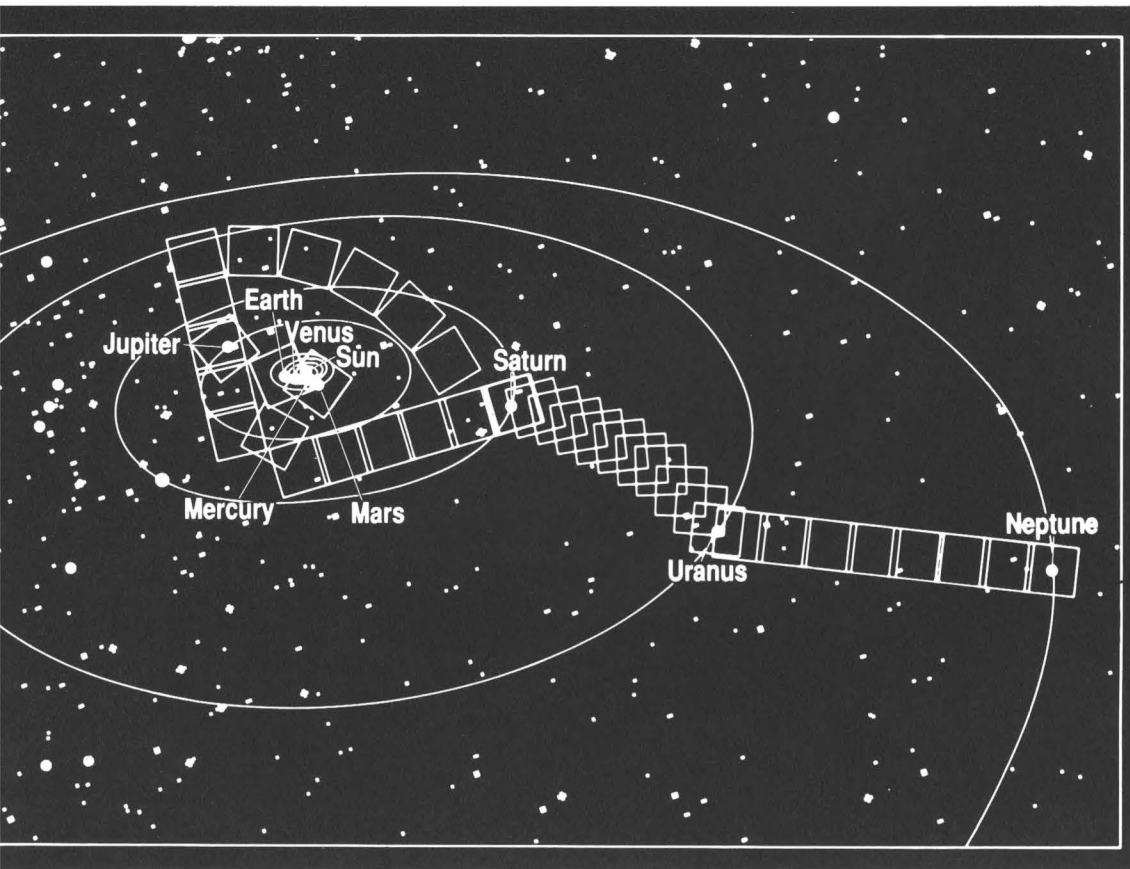


On February 14, 1990, Voyager 1 took advantage of a unique and historic opportunity to take a family portrait of nearly all of the planets in our solar system. Above, images of the Earth and Venus taken with Voyager 1's 1500-mm focal length narrow-angle camera

are superimposed in their relative positions at the appropriate scale on a portion of a wide-angle frame showing the Sun. (The focal length of the wide-angle camera is 200 mm). Due to its brightness, the Sun appears larger than the actual size of the solar disk; this also caused the ray patterns, which

are due to multiple reflections from the camera's optics. Earth's crescent is 0.12 pixel (picture element) in size and coincidentally lies in one of the scattered light rays. Venus is 0.11 pixel in size. (A Voyager imaging frame is 800 x 800 pixels.)

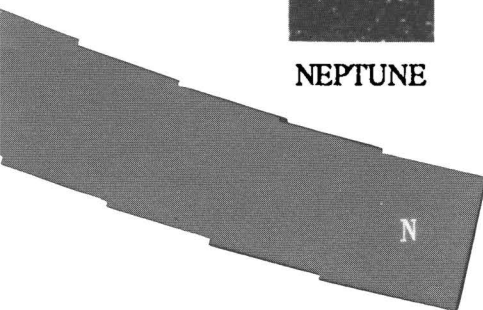




A mosaic of the 39 images taken by Voyager 1's wide-angle camera on February 14 links six of our solar system's nine planets; the insets are magnifications of the narrow-angle frames that were centered on the individual planets. Neptune, Uranus, Saturn, Jupiter, Earth, Venus, and the Sun are visible in this set of images. Mercury was masked by the Sun's glare, while the signal level in the Mars narrow-angle images was so low that the planet has not been positively identified. Pluto was too small, too dark, and too far away to be imaged. Detailed analysis suggests that Voyager 1 detected Earth's Moon, but it is too faint to be seen without special processing. The images close to the Sun contain scattered sunlight.



NEPTUNE



N

Jupiter's image is larger than a narrow-angle pixel and is clearly resolved, as is the image of Saturn with its rings. The images of Uranus and Neptune are smeared due to the space-

craft's motion during the long (15-second) exposures for these two images.

Voyager 1 was approximately 40 astronomical units or 3.7 billion miles from Earth when it took the images from about 32° above the ecliptic plane. The diagram shows the planets' locations in their orbits at the time the images were taken. The outermost planet shown, Neptune, is 30 times farther from the Sun than Earth is.

Primarily due to the Deep Space Network's tracking schedules, the images were recorded on board Voyager 1 and relayed to Earth in a series of playbacks in late March, in April, and in early May.

The wide-angle frames were taken through the clear filter, while three narrow-angle frames—using blue, violet and green filters—were taken of each planet so that color images could be reconstructed on Earth.

The mosaic was created by starting at Neptune, working in



to Uranus and Saturn, passing horizontally below and vertically to the left of the Sun, arcing above and to the right of the Sun, and finally jumping to the frames containing Mars, Jupiter, and Earth-Venus. These 60 frames—39 wide angles and 21 narrow angles—are the last of approximately 67,000 images taken by Voyagers 1 and 2 over the 12-1/2 years since their launches in late summer 1977. Voyager 1 flew by Jupiter (1979) and Saturn (1980), while Voyager 2 flew by Jupiter (1979), Saturn (1981), Uranus (1986), and Neptune (1989).

As Voyager 1 presents us with its last images, it seems appropriate to revisit one of the first images it sent us—the first and so far the only image of the Earth and the Moon together in a single frame, taken on September 18, 1977, thirteen days after Voyager 1 was launched. Voyager 1 was about 11.66 million kilometers (7.25 million miles) from Earth. The Moon is at the top of the picture and beyond the Earth, as viewed by Voyager. In the picture are eastern Asia, the western Pacific Ocean, and part of the Arctic. The photo was made from three images taken through blue, green, and orange filters. Because the Earth is many times brighter than the Moon, the Moon has been artificially brightened by a factor of five relative to Earth so that both bodies would show clearly.

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