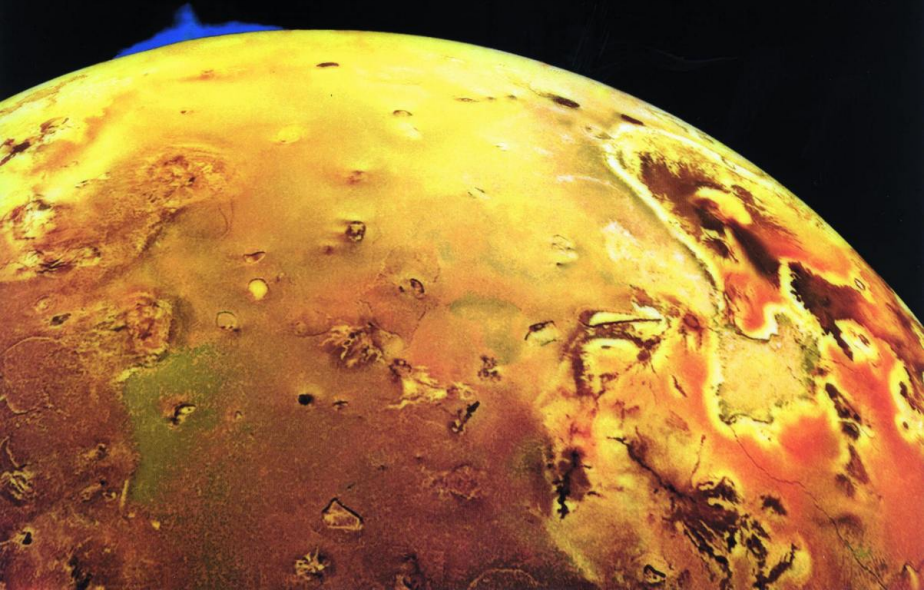


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Seeing the **Solar System** as Never Before

JFK: Loss and Legacy 40 Years Later
America's Ties to Troubled Liberia
Glass Act: The Composer at 66
Saving the Atchafalaya Swamp
Sylvia Plath's Life and Death
Mexico's Dream Weavers



CELESTIAL SIGHTSEEING

From Triton's active geysers to the sun's seething flares, newly enhanced images from U.S. and foreign space probes depict the solar system as never before

BY MICHAEL BENSON

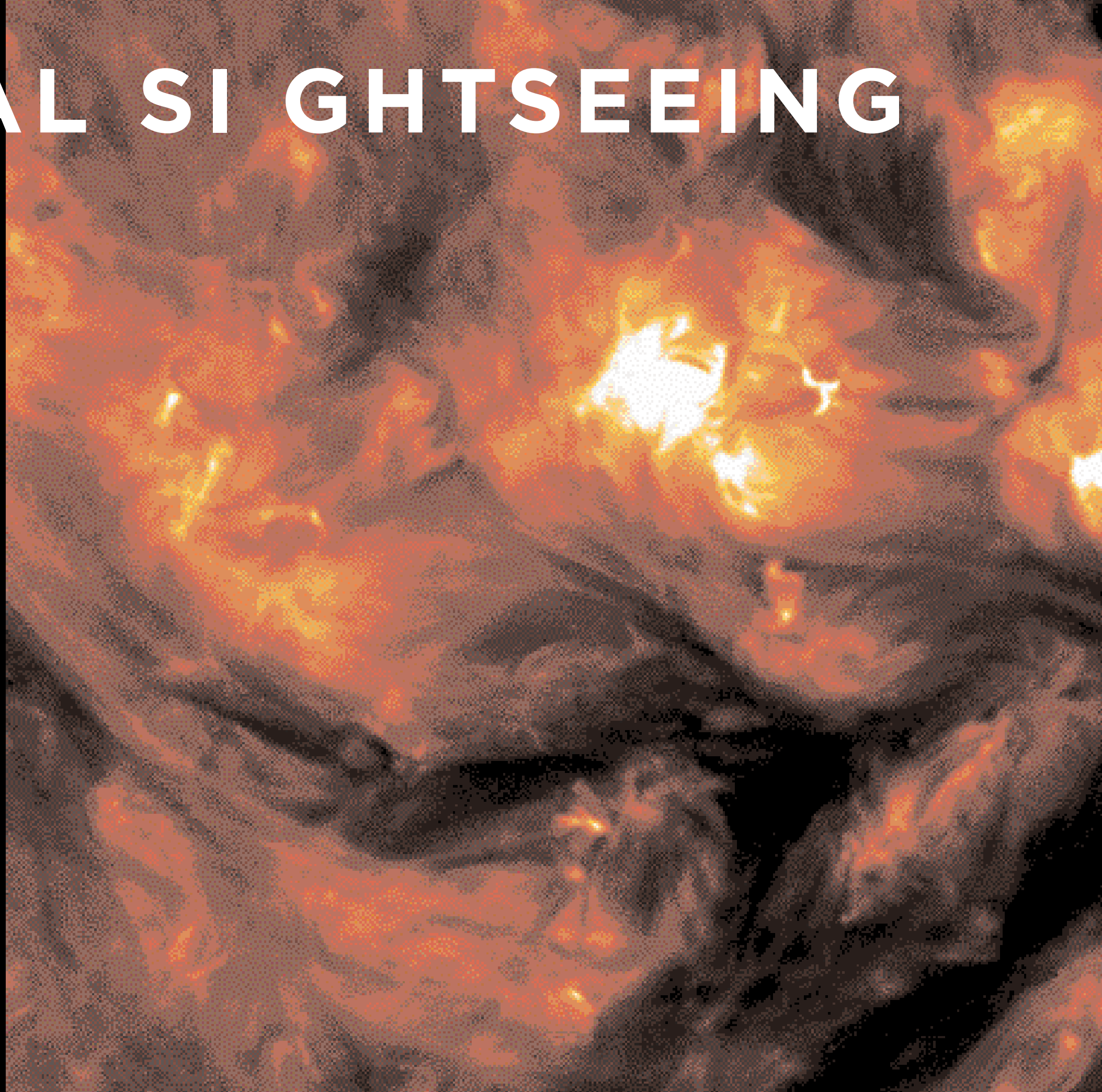
AFTER THE OBSERVATIONS of the ancients and the meticulous mathematical charting of Johannes Kepler, after the comet fresco of Giotto and the telescopic discoveries of Galileo Galilei, after *Sputnik*, *Ranger* and all the far-flung probes of more than four decades of spaceflight—we have the stark, spectacular beauty of the spheres themselves. They're suspended in space like weightless jewels. Of the planets, most have moons. Of the moons, some are bigger than planets. Both moons and planets can have tenuous atmospheres, or incredibly thick ones, or none at all.

Much of the solar system's awesome scenery has been photographed, scanned and parsed more than 46 years by over 100 robotic explorers from the United States, the former USSR and 16 other nations. The information we've acquired in the brief years of direct space exploration so far outstrips all previous human knowledge of the solar system as to make the comparison almost ridiculous—a library of encyclopedias next to a dime-thin pamphlet.

I've been monitoring the activity of solar system probes for much of the past decade, looking for deep-space photographs that inspire awe. I found myself going through many thousands of raw, unprocessed photographs from NASA's robotic explorations, fascinated to stumble on previously unnoticed views of alien topographies. Many of the pictures can be found on-line, on Web sites such as NASA's Planetary Photojournal (<http://photojournal.jpl.nasa.gov/>) and Views of the Solar System (www.solarviews.com). The most ravishing and eerie extraterrestrial landscapes I could find, including those on these pages, appear in my book, *Beyond: Visions of the Interplanetary Probes*, published this month by Harry N. Abrams Inc. Most of the images required digital enhancement. Some had never been rendered into color before. Others are composites. All are wondrous, at least to me.

Near the outer reaches of the solar system, the second largest planet hovers like a hallucination. The shimmering ring system of Saturn is 250,000 miles wide and

SUN This image of the Sun's outermost layer, or corona, was taken on June 10, 1998 by TRACE (Transition Region and Coronal Explorer). The earth-orbiting NASA spacecraft, launched two months earlier, has an unobstructed view the Sun eight months of the year. It is helping to solve the mystery of why the Sun's corona is so much hotter (3.6 million degrees Fahrenheit) than its surface (11,000 degrees Fahrenheit). The project is also shedding light on solar storms, which damage satellites and disrupt power transmissions.





EARTH The detail in this April 24, 1999, photograph of the Great Lakes, taken by the *OrbView-2* satellite, is so sharp that ice is visible on the northern shoreline of Lake Superior (the westernmost lake). On the right edge of the horizon, Cape Cod and Long Island can be discerned under a thin layer of the atmosphere. The privately-owned satellite provides daily color imagery, used for environmental monitoring, fishing and agricultural operations. The craft orbits over the poles, 440 miles above the Earth.

Jupiter, the largest orb by far, has flickering polar auroras, high-speed scudding clouds and massive whirling-dervish storm systems that define the gaseous planet's face. Jupiter's powerful gravity means that its innermost large moon, Io, is unstoppably volcanic and eerily lurid in its surface coloration. By contrast, a second Jovian moon, Europa, is cool and off-white, a frozen, giant cue ball. A third satellite, Callisto, has been so ravaged by eons of meteor impacts that it looks nothing like the other two Jovian moons. Their proximity to one another only accentuates the disparity. NASA's Galileo probe—which ended its 14-year mission by diving into Jupiter this past September—found the first moon of an asteroid and helped planetary geologists deduce that the spidery network of cracks on Europa almost certainly betrays the presence of a liquid-water ocean beneath the icy surface. This tantalizing prospect has renewed speculation that the Jovian moon may support life.

Closer to the familiar blue glow of our home world, cloud-shrouded Venus is a solid "terrestrial" planet, like Earth, Mercury, Mars and Pluto, whereas the others—Jupiter, Saturn, Uranus and Neptune—are gaseous. The baking surface of Venus ripples and heaves with strange, protuberant forms first discerned in the early 1990s by Magellan's unwavering radar eye. The phenomena were quickly dubbed "ticks" and "arachnids" by planetary scientists and are almost certainly the result of subsurface volcanic activity.

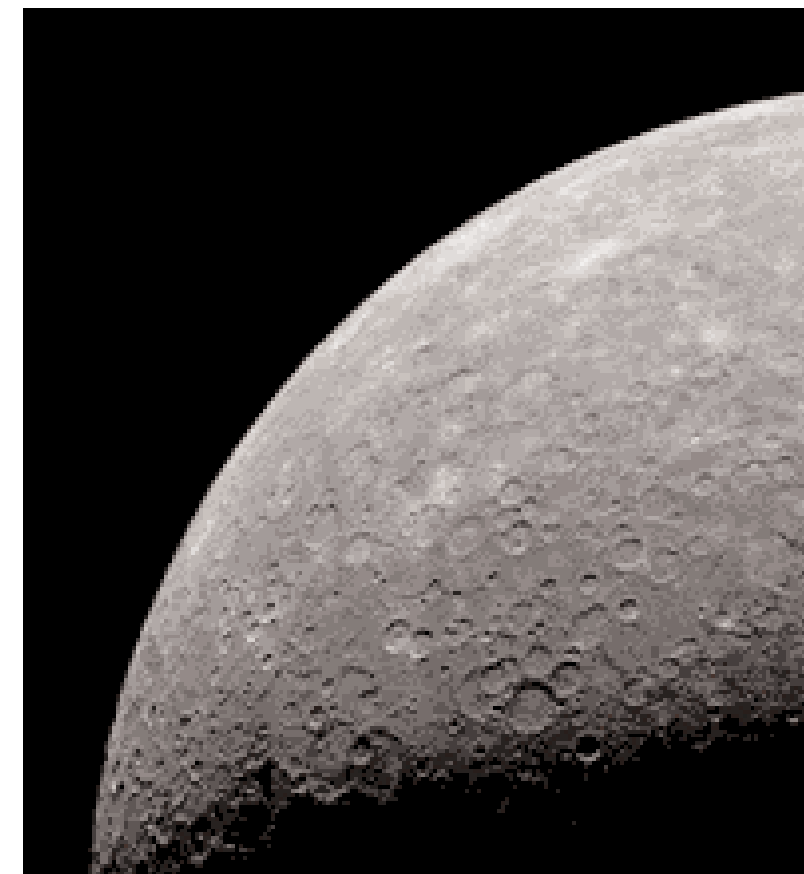
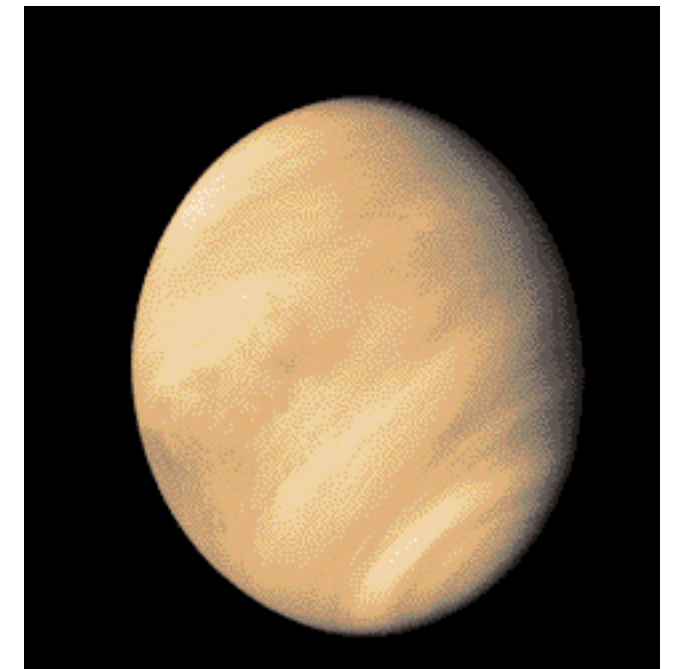
Our other next-door neighbor, Mars, sports seasonal dust devils that trace spidery calligraphic streaks across Valles Marineris, the grandest canyon in the entire solar system and as wide as the continental United States. This complex of vast and serrated desert walls was named after its discoverer, NASA's Mariner 9 probe, launched in 1971 and the first to orbit the planet. Two recent orbiting probes—the Mars Global Surveyor and the Mars Odyssey—revealed that the Red Planet's distinctive gullies, among other features, indicate the presence of water below the surface. Mars, too, the

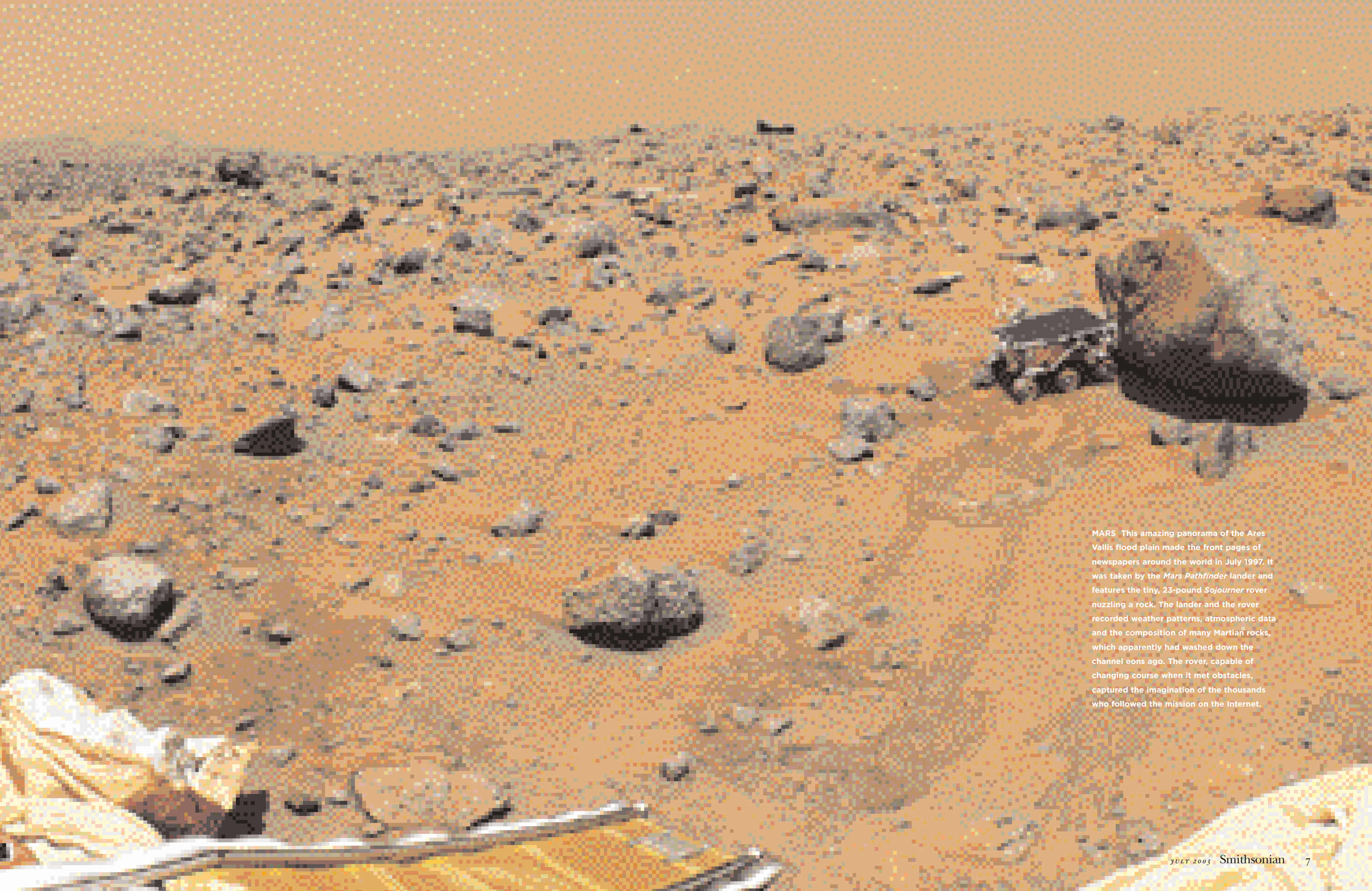
MICHAEL BENSON is a freelance writer and filmmaker whose 1995 "Predictions of Fire" won best documentary awards at both the Vancouver, Canada and St. Petersburg, Russia film festivals.

MERCURY True to its quicksilver name, Mercury speeds around the Sun every 88 days at nearly 31 miles per second, faster than any other planet. *Mariner 10* took this photo mosaic (right) on March 29, 1974, from a distance of 3,340,000 miles en route to Mercury from Venus. The photograph shows a planet scarred by meteor craters and looking a lot like our own moon, though Mercury is 40 percent larger and far denser. *Mariner 10* also revealed that Mercury has an overall magnetic field and an iron core, distinctions the first planet from the sun shares with Earth.

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VENUS *Mariner 10* took the ultraviolet view below during its February 5, 1974, flyby of the brightest planet. The mosaic of three images reveals that the planet has distinctive atmospheric patterns. Under heat-trapping clouds, temperatures can soar to about 900 degrees Fahrenheit, hotter even than Mercury, which is the closest planet to the Sun. In later expeditions, radar penetrated the thick cloud coverage to map the planet's surface. Its terrain is marked by numerous impact craters and volcanic formations.



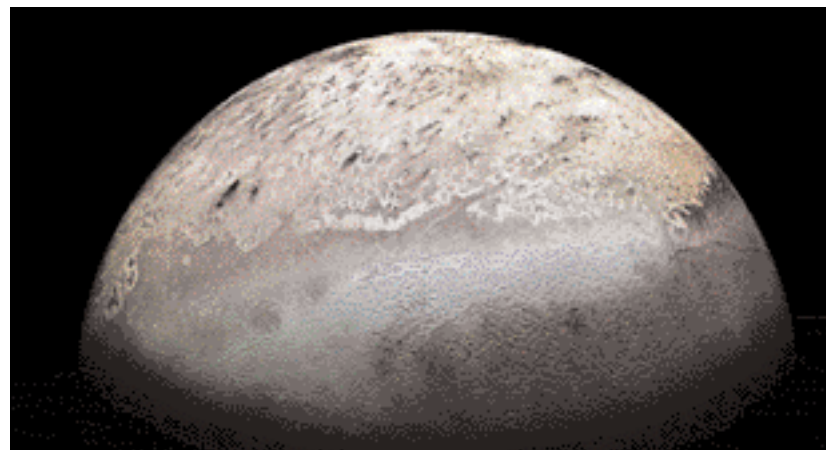


MARS This amazing panorama of the Ares Vallis flood plain made the front pages of newspapers around the world in July 1997. It was taken by the *Mars Pathfinder* lander and features the tiny, 23-pound *Sojourner* rover nuzzling a rock. The lander and the rover recorded weather patterns, atmospheric data and the composition of many Martian rocks, which apparently had washed down the channel eons ago. The rover, capable of changing course when it met obstacles, captured the imagination of the thousands who followed the mission on the Internet.



SATURN Made mostly of hydrogen and helium, Saturn's volume is 755 times greater than Earth's. This image, taken October 2000 by NASA's Earth-orbiting Hubble Space Telescope, captures a mysterious salmon color in Saturn's rings that hints at the presence of complex organic molecules. Analysis of the images also shows at least two unknown substances in the rings, which may have formed when an object veered too close to massive Saturn's gravity and broke up. It's hoped the *Cassini* mission in 2004 will provide answers.

NEPTUNE'S MOON TRITON After visiting Jupiter in 1979, Saturn in 1981 and Uranus in 1986, NASA's *Voyager 2* spacecraft reached Neptune in 1989, the first probe to observe the planet and its largest moon, Triton. In this August 25, 1989, photograph, *Voyager 2* surprised scientists by spotting signs of active geysers (the black streaks visible at the top of the image), believed to be burps of gaseous nitrogen and dark dust particles. Triton has the coldest known surface of any planet or moon—about minus 391 degrees Fahrenheit—in our solar system and the strongest winds (1200 miles per hour).



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JUPITER Before *Voyager 1* visited Jupiter in 1979, astronomers believed the solar system's largest planet had 13 moons; the probe increased the number to 14. Now, many observations later, the count stands at 61. Two moons appear to float above the planet's surface in this February 23, 1979, *Voyager 1* photograph: Io (lower left) is the innermost large satellite and Europa (upper right) has most likely a subsurface ocean. Many of the outermost moons are probably sojourning asteroids captured by Jupiter's gravity. The spacecraft also discovered a set of rings around the planet and lightning in cloud tops.

speculation goes, may have once hosted extraterrestrial life—and may still.

Despite NASA budget cuts and a crisis in the agency following the loss of the Space Shuttle *Columbia*, the flood of celestial revelations isn't about to stop anytime soon. In January 2004, four new probes—two rovers from NASA, one orbiter from the European Space Agency, which will release a lander, and another orbiter from Japan—will circle Mars or send instruments to the Martian surface. Those craft will join the two probes that are currently orbiting the planet, for an unprecedented seven spacecraft snooping on Earth's closest planetary neighbor simultaneously.

Also in 2004, one of the largest and most complex interplanetary spacecraft ever conceived, NASA's *Cassini*, will arrive at Saturn after a seven-year flight. The school-bus-size robot will study the planet's rings and deploy a European-built probe called *Huygens*, which will penetrate the clouds covering Saturn's mysterious moon Titan. That opaque brown sphere appears to be rich in some of the organic chemicals that presaged life on Earth; it may contain lakes, or even oceans, of liquid ethane or methane.

A small squadron of other space probes are in development, including NASA's *Messenger*, which will settle into orbit around Mercury in spring 2009, and its New Horizons Pluto-Kuiper Belt mission, scheduled for a 2006 launch to the solar system's remotest, smallest planet. After a reconnaissance of Pluto and its moon, Charon, it will venture on to the intriguing array of cometary snowballs at the dim edge of interstellar space, the Kuiper Belt.

When all those robots get where they're going, they will, like the explorer probes before them, help place us in space and time, change our sense of our position and our possibilities, and reveal glinting and unexpected new vistas under the dazzling Sun. ☉

