



Mariner paints first picture

The first successful spacecraft to fly by Mars was NASA's Mariner 4 launched in 1964, Mars Mission Planner Wayne Lee said during his briefing at KSC.

That craft was able to collect images of about one percent of the Martian surface and showed a barren planet, full of craters but devoid of life.

Data from further Mariner missions contributed to a clearer picture of the mysterious planet:

- Mars is less than half the size of Earth with about a third of the Earth's mass.

- Its gravity is three-eighths that of Earth: an 80-kilogram astronaut would weigh about 30 kilograms on Mars.

- The planet is half again the distance from the Sun that the Earth is — about 1.5 astronomical units. An AU is the average distance of Earth from the Sun, 150 million kilometers. It takes two Earth years for Mars to orbit the Sun once.

- The ice caps at Mars' poles grow under a haze of cloud during winter in the planet's atmosphere. Summer ice caps are thought to be water ice but the winter caps are believed to contain frozen carbon dioxide.

- Impact craters, which may be more than 3 billion years old, dominate the southern hemisphere but are more thinly scattered over the mainly volcanic surface of the northern hemisphere.

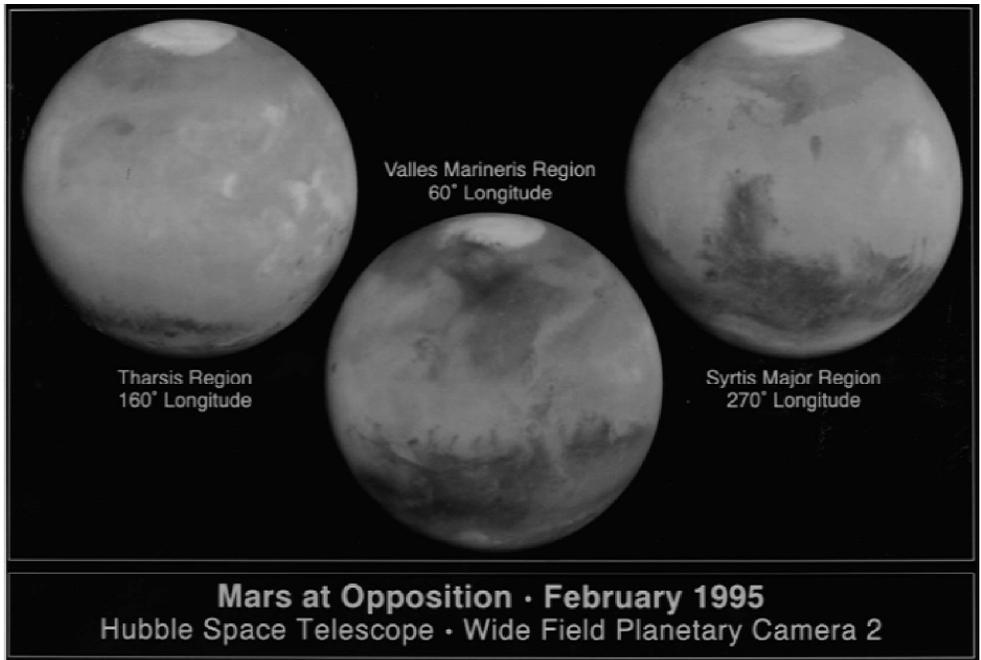
- Smaller valleys, or channels, up to 1,000 kilometers long, appear to have been formed by running water which may have come from rain.

Viking 1, 2 break new ground

Viking 1 and 2, each consisting of an orbiter and a lander, were launched within a month of each other in 1975 to attempt to learn more about the planet by providing a close-up examination of the surface. The landers set down in two widely separated areas of the north-

ern hemisphere. Data and images received from Viking painted a picture of subfreezing cold and dry desert — a terrain unsuitable for life. The Viking orbiters found dry beds of once-flowing channels and streams. It is believed floods may have originated in

backshell will then be fired to further slow the lander's descent. The parachute and an attached tether will be released and the lander will be engulfed by airbags which will dissipate energy by allowing it to bounce on the surface. Once the lander comes to a



THESE HUBBLE SPACE TELESCOPE images, taken February 25, 1995, provide the most detailed complete global coverage of Mars ever seen from Earth.

deep aquifers and surfaced during ancient periods of volcanic activity.

Surveyor to map surface

The Surveyor spacecraft is scheduled to arrive at the skid strip at CCAS Aug. 15, Lee said. After being launched at 1:30 p.m. Nov. 6, the craft is expected to reach Mars ten months later. Over a two-year period the Surveyor is geared to provide global maps of the Martian surface topography and mineral distribution and monitor global weather.

Pathfinder will land in flurry

The Pathfinder is set to provide a fireworks display unlike any other on July 4, 1997, when it will hurl through the Martian atmosphere like a meteor until a parachute is deployed at twice the speed of sound at 10 kilometers above the ground. Rockets inside the

complete rest, it will unfold three petals, designed to set the lander upright and provide a platform for the six-wheeled solar-powered robot rover the size of a microwave oven. The rover will carry instruments for investigating the structure of the Martian atmosphere, surface meteorology, surface geology, form and structure.

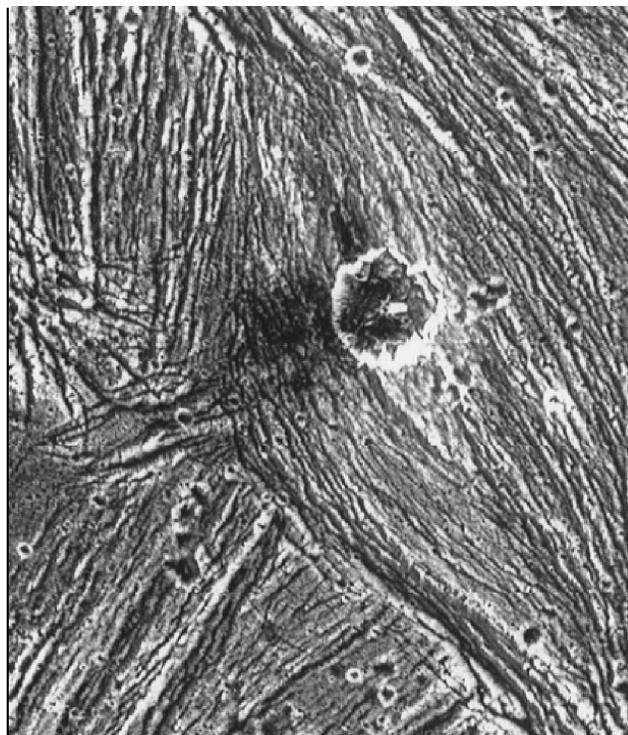
Future to build on experience

The experience of the Pathfinder will be capitalized on in 1998, 2001, 2003 and 2005 when additional landers are scheduled to be launched. Small orbiters launched in 1998 and 2003 will carry other instruments to serve as relay stations for later international missions.

A videotape of Wayne Lee's presentation on the Surveyor and the Pathfinder is available for checkout from the video library at Headquarters, Room 1451.



THIS PICTURE OF Jupiter was taken by Voyager 2 on June 10, 1979, from a distance of 24 million kilometers. The shadow of Ganymede, the largest of the Jovian satellites, is visible on top of the planet's cloud patterns at left. At right is Io, the innermost of the large satellites.



THE GALILEO spacecraft has provided this view of the surface of Ganymede. The moon, three-quarters the size of Mars, contains craters and basins, grooves and mountains. Additional images can be found on the World Wide Web at: <http://newproducts.jpl.nasa.gov/galileo/>.

Galileo captures new detail of Jupiter moon

The Galileo orbiter is providing the clearest images of Jupiter's largest moon ever seen on Earth.

The first images to be returned to Earth were released July 10 from the Jet Propulsion Laboratory, Pasadena, CA. Galileo flew by the large, icy moon Ganymede at 2:29 a.m. EDT on June 27, passing within 519 miles (835 kilometers) of Ganymede at a relative speed of about 17,448 miles per hour. That is 70 times closer than Voyager 2's closest approach in 1979 and 133 times closer than Voyager 1.

With a diameter of 3,269 miles (5,262 kilometers), Ganymede is the largest moon in the Solar System — bigger than Mercury and about three-quarters the size of Mars. It possesses a variety of familiar Earth-like geologic formations including craters and basins, grooves and mountains. The bulk of the satellite is believed to be about half water-ice and half rock. Portions of its surface are relatively bright, clean ice while the other regions are covered with darker "dirty" ice. The darker areas appear to be ancient and heavily cratered, while the lighter regions display evidence of tectonic activity that may have broken up the icy crust. Galileo entered orbit around Ju-

piter on Dec. 7, 1995.

Galileo's high-resolution images show features on Ganymede as small as 33 feet across. Instruments on board will assess Ganymede's surface chemistry and search for signs of an atmosphere around the big moon. Measurements will be made to characterize Ganymede's gravity field and to determine if it possesses a magnetic field.

Galileo's Ganymede encounter marks the start of a steady stream of data to be returned to Earth by Galileo's instruments throughout the course of its two-year tour of the Jovian system, which continues through December 1997.

Beginning this month, data return will include an average of two to three images per day.

The remainder of Galileo's mission is to complete 11 orbits of Jupiter, conducting multiple close flybys of the moons Ganymede, Europa and Callisto, with numerous, more distant studies of the moon Io also scheduled throughout the tour. Studies of Jupiter itself are planned throughout the tour, and nearly continuous studies of Jupiter's enormous radiation and magnetic fields will be conducted.

The fifth planet from the Sun is known

primarily for the banded appearance of its upper atmosphere and its centuries-old Great Red Spot, a massive, hurricane-like storm as big as three Earths. Jupiter generates the biggest and most powerful planetary magnetic field, and it radiates more heat from internal sources than it receives from the Sun.

Given its large size and its many natural satellites, Jupiter is often described as a miniature solar system. Jupiter has 318 times more mass and 1,400 times more volume than Earth, but is only one-fourth as dense, since it is composed primarily of hydrogen and helium. It is orbited by at least 16 moons (and Galileo — its first artificial satellite).

The 2-1/2-ton Galileo orbiter spacecraft was launched aboard Space Shuttle Atlantis on Oct. 18, 1989. It carries the most capable payload of scientific experiments ever sent to another planet.

NASA's Jet Propulsion Laboratory built the Galileo orbiter spacecraft and manages the overall mission.

Galileo's atmospheric probe, which plunged into the planet on Dec. 7, 1995, was managed by NASA's Ames Research Center, Mountain View, CA.

Hubble provides new perspective on stars

While Galileo has been gathering ground-breaking data about Jupiter and its moon, the Hubble Space Telescope has consistently been providing equally revolutionary information about stars.

Most recently the telescope has been used successfully to measure the diameters of a special class of pulsating stars called *Mira variables*, which rhythmically change size.

The results suggest these gigantic, old stars aren't round but egg-shaped.

Knowing more about these enigmatic stars is crucial to understanding how stars evolve, and may preview the fate of the Sun, five billion years from now.

Due to their distance, the stars are too small for their disks to be resolved in conventional pictures (taken in visible light), so astronomers used Hubble's Fine Guidance Sensors (FGS) to achieve visible light observations of the angular diameters (a measure of apparent width) of two *Mira variables*, R Leonis and W Hydrae.

These unique observations were made by Dr. Mario G. Lattanzi of Turin Observatory (Italy), Dr. M. Feast of Cape Town University (South Africa), Dr. U. Munari of Padova Observatory (Italy), and Dr. P. Whitelock with the South African Astronomical Observatory. The results are being submitted to the *Astrophysical Journal Letters* for publication.

Hubble's Fine Guidance Sensors are normally used for tracking astronomical targets that are observed with the other scientific instruments aboard Hubble. Instead of taking pictures, the FGSs make an interference pattern from incoming starlight.

The resulting bright and dark zones created by the interference pattern, which resemble ripples in a pond, can be used to measure extremely small angles on the sky of only 1/100 of an arcsecond across (the apparent width of a dime at about 200 miles away).

FGS measurements show that R Leonis' apparent diameter (in visible light) is 70 x 78 milliarcseconds (eight by nine hundred million miles at the star's distance of about 390 light years) along the star's long and short axis, respectively, and 76 by 91 milliarcseconds (with linear dimensions similar to those of R Leonis) for W Hydrae. If placed within our solar system, both of these stars would extend well beyond the orbit of the Earth and almost to that of Jupiter.



STS-79 MISSION Specialists Carl Walz, left, and Jay Apt examine the layout of the double Spacehab module. The double module configuration will be flown for the first time on Mission STS-79, the fourth docking of the U.S. Shuttle to the Russian Space Station Mir. Doubling the pressurized mini-laboratory allows more supplies and equipment to be taken to Mir, while still allowing room for scientific research.

Lockheed Martin selected to build X-33

Lockheed Martin has been selected to build the X-33 test vehicle, a one-half scale model of the Reusable Launch Vehicle (RLV) which will be used to demonstrate advanced technologies that will dramatically increase reliability and lower the costs of putting payloads into space.

Lockheed Martin will design, build and conduct the first test flight of the X-33 test vehicle by March 1999, and conduct at least fifteen flights by December 1999. NASA has budgeted \$941 million for the project through 1999. Lockheed Martin will invest \$220 million in its X-33 design.

Called "VentureStar," the Lockheed Martin design is based on a lifting body shape with a radical new aerospike engine and a rugged metallic thermal protection system which would be launched vertically like a rocket and land horizontally like an airplane.

"The RLV program is a radical departure from the way NASA has done business in the past," NASA Administrator Daniel S. Goldin said. "Our role is to develop the high risk technologies that industry cannot afford. But we won't build the vehicle, industry will. NASA will be a user, not an operator."

Goldin said the objective of the RLV technology program is simple. "We want to develop technologies that will allow industry to build a vehicle that takes days, not months, to turn-around; dozens, not thousands of people to operate; reliability ten times better than anything flying today; and

launch costs that are a tenth of what they are now. Our goal is a reusable launch vehicle that will cut the cost of a pound of payload to orbit from \$10,000 to \$1,000."

The X-33 will integrate and demonstrate all the technologies in a scale version that would be needed for industry to build a full-size RLV. "The X-33 will be about half the size of a full-scale RLV. It will be a remotely-piloted, sub-orbital vehicle, capable of altitudes up to 50 miles and speeds of Mach 15," said RLV Director Gary Payton.

The X-33 program is being conducted under a Cooperative Agreement, not a conventional customer/supplier contract.

Under this agreement, NASA defined the broad objectives and industry proposed an approach to meet the objectives.

"Cooperative agreements are performance-based," said Payton. "Payment is made only after the industry partner completes a pre-determined milestone."

"The X-33 test vehicle is the most advanced part of a three-pronged RLV program to develop and demonstrate the kinds of technologies required by industry to build a new launch system that will provide truly affordable and reliable access to space," Payton said. "The RLV approach is to design a little, build a little, test a little, fly a little."

Three industry teams competed for the X-33 vehicle. In addition to Lockheed Martin, proposals were submitted by McDonnell Douglas, Huntington Beach, CA, and Rockwell International, Downey, CA.

STS-79...

(Continued from Page 1)

the seepage is a new adhesive and cleaning fluid that is more environmentally friendly than the original.

While the crew of STS-78 was never in danger and the STS-79 boosters are safe to fly, managers want to better understand the J-joint problem and to improve the safety of the joint.

The extension requires some psychological re-grouping, Lucid acknowledged in a July 15 news conference. She had been pacing herself since her arrival on Mir March 24, and had reached a point where she was starting to count down the days to her return to Earth. There are other challenges as well: She is now going to miss two of her children's birthdays, and in August her two crewmates will depart and a new crew arrives.

But Lucid is tackling the new situation with the same customary good humor and positive spirits that she has shown throughout her stay on Mir. A Progress supply transport will fly up to the station July 24,



THE SPACE SHUTTLE ATLANTIS is rolled back from Launch Pad 39A to the Vehicle Assembly Building on July 10 in response to the threat of Hurricane Bertha. Although the storm eventually took a turn to the north and stayed well clear of the Florida coast, early indications were that the Category Two hurricane, with winds of 96-110 mph, was approaching the Space Coast, prompting a center-wide evacuation. A 250-member rideout team was activated to conduct hurricane operations throughout the night. Brevard County barrier islands were also evacuated. After the National Weather Service issued an all-clear at 5 a.m. July 11, KSC employees were allowed to return to work.

bringing some requested items for her such as more books to read. And while she will miss crew mates Yuri Onufrienko and Yuri Usachev, she looks forward to having another woman on board for a little while — one of the three new crew members is French woman Claudie Andre-

Deschays, whom Lucid met while training in Russia.

Asked what advice she has for John Blaha, the astronaut who will replace her on Mir, Lucid responded: "To relax and enjoy yourself and take each day as it comes." Lucid has relied on strong support from her family. She receives e-mail from them daily, which keeps her informed and makes her feel like she hasn't lost contact.

On July 15, Lucid broke the 115-day record for U.S. stay in space set last year by Norm Thagard. "I imagine we'll find something special to do" to commemorate the event, she said. "It doesn't take much for us to find a reason to celebrate."

ROLLBACKS

Atlantis' return to the VAB July 10 marks the 11th time a shuttle has been rolled back from the pad. Other rollbacks are:

1. STS-9, Columbia, October 1983, due to suspect exhaust nozzle on right solid rocket booster.
2. STS-41-D, Discovery, July 1984, after a pad abort.
3. STS 51-E/51-B, Challenger, March 1985, due to a timing problem with primary payload, Tracking and Data Relay Satellite-B.
4. STS-35, Columbia, 1st of 2 rollbacks, June 1990, due to hydrogen leak in the external tank/orbiter 17-inch umbilical.
5. STS-38, Atlantis, August 1990, due to hydrogen leak.
6. STS-35, Columbia, second rollback, October 1990, due to threat from Tropical Storm Klaus.
7. STS-39, Discovery, March 1991, because of cracks on lug hinges of external tank umbilical door drive mechanisms.
8. STS-68, Endeavour, August 1994, after pad abort.
9. STS-70, Discovery, June 1995, due to woodpecker damage on external tank.
10. STS-69, Endeavour, August 1995, due to Hurricane Erin.

Space Flight Awareness awards are presented

Six Silver Snoopies and a Space Flight Awareness Team Award were presented to Kennedy Space Center employees in June.

Astronaut Pam Melroy presented the prestigious Snoopy award to Chris Bowman of All World Travel and Gordon Chapp and Mark McBride of Rockwell International on June 5. On June 25, Astronaut Janet Kavandi presented the award to Wang Federal employee Richard Miron and Lockheed Space Operations employees (now United Space Alliance) Victor Toro and Mike Ramon.

On June 27, Cal Burch, NASA Protective Services Office, presented the five-member EG&G Facility Evacuation Committee with an award for generating increased awareness of fire-safety issues and



emergency evacuation procedures. The team developed a Facility Evacuation Preparedness handout and revised internal operating procedures, focusing on developing a pre-evacuation briefing for site manager, supervisors, and/or safety officials. Team members are: William Huffman, fire marshal, and Melany Baskin, Arthur McKinney, Lee Starrick and Carolyn Weisner, fire inspectors.



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