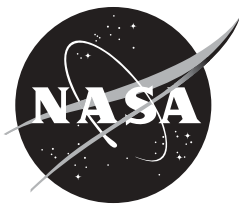
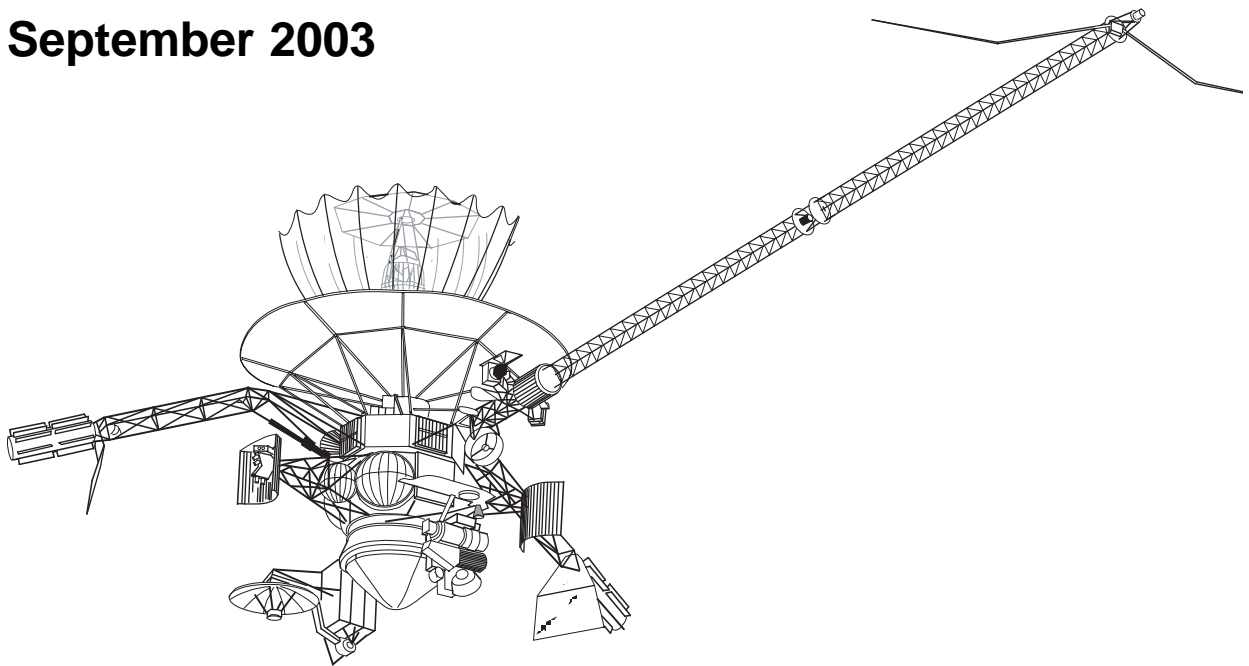


NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Galileo

End of Mission

Press Kit
September 2003



Media Contacts

Donald Savage Headquarters, Washington, D.C.	Policy/Program Management	202/358-1727 donald.savage@hq.nasa.gov
Carolina Martinez Jet Propulsion Laboratory, Pasadena, CA	Galileo Mission	818/354-9382 carolina.martinez@jpl.nasa.gov
D.C. Agle Jet Propulsion Laboratory, Pasadena, CA	Galileo Mission	818/393-9011 david.c.agle@jpl.nasa.gov

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GENERAL RELEASE:

GALILEO TO TASTE JUPITER BEFORE TAKING FINAL PLUNGE

In the end, the Galileo spacecraft will get a taste of Jupiter before taking a final plunge into the planet's crushing atmosphere, ending the mission on Sunday, Sept. 21. The team expects the spacecraft to transmit a few hours of science data in real time leading up to impact.

The spacecraft has been purposely put on a collision course with Jupiter to eliminate any chance of an unwanted impact between the spacecraft and Jupiter's moon Europa, which Galileo discovered is likely to have a subsurface ocean. The long-planned impact is necessary now that the onboard propellant is nearly depleted. Without propellant, the spacecraft would not be able to point its antenna toward Earth nor adjust its trajectory, so controlling the spacecraft would no longer be possible.

"It has been a fabulous mission for planetary science, and it is hard to see it come to an end," said Dr. Claudia Alexander, Galileo project manager at NASA's Jet Propulsion Laboratory, Pasadena, Calif. "After traversing almost 3 billion miles and being our watchful eyes and ears around Jupiter, we're keeping our fingers crossed that even in its final hour, Galileo will still give us new information about Jupiter's environment."

Although scientists are hopeful to get every bit of data back for analysis, the likelihood of getting anything is unknown because the spacecraft has already endured more than four times the cumulative dose of harmful jovian radiation it was designed to withstand. The spacecraft will enter an especially high-radiation region again as it approaches Jupiter.

Launched in the cargo bay of Space Shuttle Atlantis in 1989, the mission has produced a string of discoveries while circling the solar system's largest planet, Jupiter, 34 times. Galileo was the first mission to measure Jupiter's atmosphere directly with a descent probe and the first to conduct long-term observations of the jovian system from orbit. It found evidence of subsurface liquid layers of saltwater on Europa, Ganymede and Callisto and it examined a diversity of volcanic activity on Io. Galileo is the first spacecraft to fly by an asteroid and the first to discover a moon of an asteroid.

The prime mission ended six years ago, after two years of orbiting Jupiter. NASA extended the mission three times to continue taking advantage of Galileo's unique capabilities for accomplishing valuable science. The mission was possible because it drew its power from two long-lasting radioisotope thermoelectric generators provided by the Department of Energy.

From launch to impact, the spacecraft has traveled 4,631,778,000 kilometers (about 2.8 billion miles).

Its entry point into the giant planet's atmosphere is about 1/4 degree south of Jupiter's equator. If there were observers floating along at the cloud tops, they would see Galileo streaming in from a point about 22 degrees above the local horizon. Streaming in could also be described as screaming in, as the speed of the craft relative to those observers would be 48.2 kilometers per second (nearly 108,000 miles per hour). That is the equivalent of traveling from Los Angeles to New York City in 82 seconds. In comparison, the Galileo atmospheric probe, aerodynamically designed to slow down when entering, and parachute gently through the clouds, first reached the atmosphere at a slightly more modest 47.6 kilometers per second (106,500 miles per hour).

"This is a very exciting time for us as we draw to a close on this historic mission and look back at its science discoveries. Galileo taught us so much about Jupiter but there is still much to be learned and for that we look with promise to future missions," said Dr. Charles Elachi, director of JPL.

JPL, a division of the California Institute of Technology in Pasadena, manages the Galileo mission for NASA's Office of Space Science, Washington, D.C.

Additional information about the mission and its discoveries is available online at <http://galileo.jpl.nasa.gov> .

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Media Services Information

NASA Television Transmission

NASA Television is broadcast on AMC-9, transponder 9C, C Band, 85 degrees west longitude, frequency 3880.0 MHz, vertical polarization, audio monaural at 6.8 MHz. The schedule for television transmission of video animations, B-roll and live-interview opportunities will be available from the Jet Propulsion Laboratory, Pasadena, Calif., and NASA Headquarters, Washington, D.C.

News Releases

The Jet Propulsion Laboratory's Media Relations Office will issue news releases on the Galileo end of mission. They may be accessed online as noted below.

Briefings

A space science update about the Galileo end of mission will be held at NASA Headquarters in Washington, D.C., on Sept. 17, 2003. Additional details about the update will be available from NASA Headquarters and the Jet Propulsion Laboratory.

Internet Information

Extensive information about the Galileo mission, including an electronic copy of this press kit, press releases, fact sheets, status reports and images, is available from the Jet Propulsion Laboratory's World Wide Web home page at <http://www.jpl.nasa.gov> . Signup for e-mail subscriptions to news releases is available at the home page.

Additional information on Galileo is available at <http://galileo.jpl.nasa.gov> .

Quick Facts

Spacecraft

Dimensions: 5.3 meters (17 feet) high; magnetometer boom extends 11 meters (36 feet) to one side

Weight: 2,223 kilograms (2½ tons, or 4,902 pounds), including 118 kilograms (260 pounds) of science instruments and 925 kilograms (2040 pounds) of propellant

Power: 570 watts (at launch) from radioisotope thermoelectric generators

Science instruments: Solid-state imaging camera, near-infrared mapping spectrometer, ultraviolet spectrometer, photopolarimeter radiometer, magnetometer, energetic particles detector, plasma investigation, plasma wave subsystem, dust detector, heavy ion counter

Atmospheric Probe

Size: 127 centimeters (50 inches) diameter, 91 centimeters (36 inches) high

Weight: 339 kilograms (750 pounds)

Science instruments: Atmospheric structure, neutral mass spectrometer, helium abundance, nephelometer, net flux radiometer, lightning/energetic particles, doppler wind experiment

Mission

Launch: Oct. 18, 1989 from Kennedy Space Center, Fla., on space shuttle Atlantis on mission STS-34

Primary mission: October 1989 to December 1997

Extended missions: Three, from 1997 to 2003

Venus flyby: Feb. 10, 1990, at altitude of 16,000 km (10,000 mi)

Earth flybys: Dec. 8, 1990, at altitude of 960 km (597 mi); Dec. 8, 1992 at altitude of 303 km (188 mi)

Asteroid Gaspra flyby: Oct. 29, 1991, at 1,601 km (1,000 mi)

Comet Shoemaker-Levy 9: Impacts of comet fragments into Jupiter observed while en route in July 1994

Asteroid Ida flyby: Aug. 28, 1993, at 2,400 km (1,400 mi)

Atmospheric probe release: July 12, 1995

Probe speed into Jupiter's atmosphere: 47.6 km per second (106,000 mi per hour)

Jupiter arrival and orbit insertion: Dec. 7, 1995

Probe atmospheric entry and relay: Dec. 7, 1995

Number of Jupiter orbits during entire mission: 34

Number of flybys of Jupiter moons: Io 7, Callisto 8, Ganymede 8, Europa 11, Amalthea 1

Total distance traveled from launch to final impact: 4,631,778,000 kilometers (approx. 2.8 billion miles)

Speed of spacecraft at time of impact: 48.2 kilometers per second (nearly 108,000 miles per hour)

Program

Cost: Total from start of planning through end of mission is \$1.39 billion. International contribution estimated at an additional \$110 million

Partners: More than 100 scientists from United States, Great Britain, Germany, France, Canada and Sweden carried out Galileo's experiments. NASA's Ames Research Center, Mountain View, Calif., responsible for atmosphere probe, built by Hughes Aircraft Company, El Segundo, Calif. Radioisotope thermoelectric generators designed and built by General Electric Co. for the U.S. Department of Energy

Approximate number of people who worked on some portion of the Galileo mission: 800

Top 10 Science Results

1. The descent probe measured atmospheric elements and found that their relative abundances were different than on the Sun, indicating Jupiter's evolution since the planet formed out of the solar nebula.
2. Galileo made a first observation of ammonia clouds in another planet's atmosphere. The atmosphere seems to create ammonia ice particles of material from lower depths, but only in "fresh" clouds.
3. Io's extensive volcanic activity may be 100 times greater than that found on Earth's. The heat and frequency of eruption are reminiscent of early Earth.
4. Io's complex plasma interactions in Io's atmosphere include support for currents and coupling to Jupiter's atmosphere.
5. Evidence supports a theory that liquid oceans exist under Europa's icy surface.
6. Ganymede is the first satellite known to possess a magnetic field.
7. Galileo magnetic data provide evidence that Europa, Ganymede and Callisto have a liquid-saltwater layer.
8. Europa, Ganymede, and Callisto all provide evidence of a thin atmospheric layer known as a 'surface-bound exosphere'.
9. Jupiter's ring system is formed by dust kicked up as interplanetary meteoroids smash into the planet's four small inner moons. The outermost ring is actually two rings, one embedded with the other.
10. Galileo was the first spacecraft to dwell in a giant planet magnetosphere long enough to identify its global structure and to investigate its dynamics.

Technical Firsts

- First flyby and imaging of an asteroid (Gaspia and later, Ida).
- Discovered first moon around an asteroid (the moon Dactyl orbits asteroid Ida).
- Only direct observation of Comet Shoemaker-Levy 9's impact into Jupiter's atmosphere.
- First spacecraft to deploy an entry probe into an outer planet's atmosphere. The descent probe measured the atmospheric composition and structure of Jupiter's atmosphere and provided clues to the origin of Jupiter and giant planets in other star systems.
- First and so far the only spacecraft to orbit an outer planet. (Cassini at Saturn in 2004 will become the second spacecraft to enter orbit around one of the outer planets.)

Mission Overview

NASA's Galileo spacecraft was designed to study the large, gaseous planet Jupiter, its moons and its surrounding magnetosphere, which is a magnetic bubble surrounding the planet. The craft was named for the Italian Renaissance scientist who discovered Jupiter's major moons in 1610.

The primary mission at Jupiter began when the spacecraft entered orbit in December 1995 and its descent probe, which had been released five months earlier, dove into the giant planet's atmosphere. Its primary mission included a 23-month, 11-orbit tour of the jovian system, including 10 close encounters of Jupiter's major moons.

Although the primary mission was completed in December 1997, the mission has been extended three times since then. Galileo had 35 encounters of Jupiter's major moons – 11 with Europa, 8 with Callisto, 8 with Ganymede, 7 with Io and 1 with Amalthea. The mission will end when the spacecraft impacts Jupiter on Sunday, Sept. 21, 2003.

Launch

The Galileo spacecraft and its two-stage Inertial Upper Stage were carried into Earth orbit on October 18, 1989 by space shuttle Atlantis on mission STS-34. The two-stage Inertial Upper Stage solid rocket then accelerated the spacecraft out of Earth orbit toward the planet Venus for the first of three planetary "gravity assists" designed to boost Galileo toward Jupiter. In a gravity assist, the spacecraft flies close enough to a planet to be propelled by its gravity, creating a "slingshot" effect for the spacecraft. The Galileo mission had originally been designed for a direct flight of about three and a half years to Jupiter, using a three-stage Inertial Upper Stage. When that booster was canceled, plans were changed to a Centaur upper stage, and ultimately to the two-stage Inertial Upper Stage, which precluded a direct trajectory. To save the project, Galileo engineers designed a flight path using planetary gravity assists.

Venus and Earth Flybys

After flying past Venus at an altitude of 16,000 kilometers (nearly 10,000 miles) on February 10, 1990, the spacecraft swung past Earth at an altitude of 960 kilometers (597 miles) on December 8, 1990. That flyby increased Galileo's speed enough to send it on a two-year elliptical orbit around the Sun. The spacecraft returned for a second Earth swingby on December 8, 1992, at an altitude of 303 kilometers (188 miles). With this, Galileo left Earth for the third and final time and headed toward Jupiter.

The flight path provided opportunities for scientific observations. Scientists obtained the first views of mid-level clouds on Venus and confirmed the presence of lightning on that planet. They also made many Earth observations, mapped the surface of Earth's Moon, and observed its north polar regions.

Because of the modification in Galileo's trajectory, the spacecraft was exposed to a hotter environment than originally planned. To protect it from the Sun, project engineers devised a set of sunshades and pointed the top of the spacecraft toward the Sun, with the umbrella-like high-gain antenna furled until well after the first Earth flyby in December 1990. Flight controllers stayed in touch with the spacecraft through a pair of low-gain antennas, which send and receive data at a much slower rate.

High-Gain Antenna

The spacecraft was scheduled to deploy its 4.8-meter-diameter (16-foot) high-gain antenna in April 1991 as Galileo moved away from the Sun and the risk of overheating ended. The antenna, however, failed to deploy fully.

A special team performed extensive tests and determined that a few (probably three) of the antenna's 18 ribs were held by friction in the closed position. Despite exhaustive efforts to free the ribs, the antenna would not deploy. From 1993 to 1996, extensive new flight and ground software was developed, and ground stations of NASA's Deep Space Network were enhanced in order to perform the mission using the spacecraft's low-gain antennas.

Asteroid Flybys

Galileo became the first spacecraft ever to encounter an asteroid when it passed Gaspra on October 29, 1991. It flew within just 1,601 kilometers (1,000 miles) of the stony asteroid's center at a relative speed of about 8 kilometers per second (18,000 miles per hour). Pictures and other data revealed a cratered, complex, irregular body about 20 by 12 by 11 kilometers (12.4 by 7.4 by 6.8 miles), with a thin covering of dust and rubble.

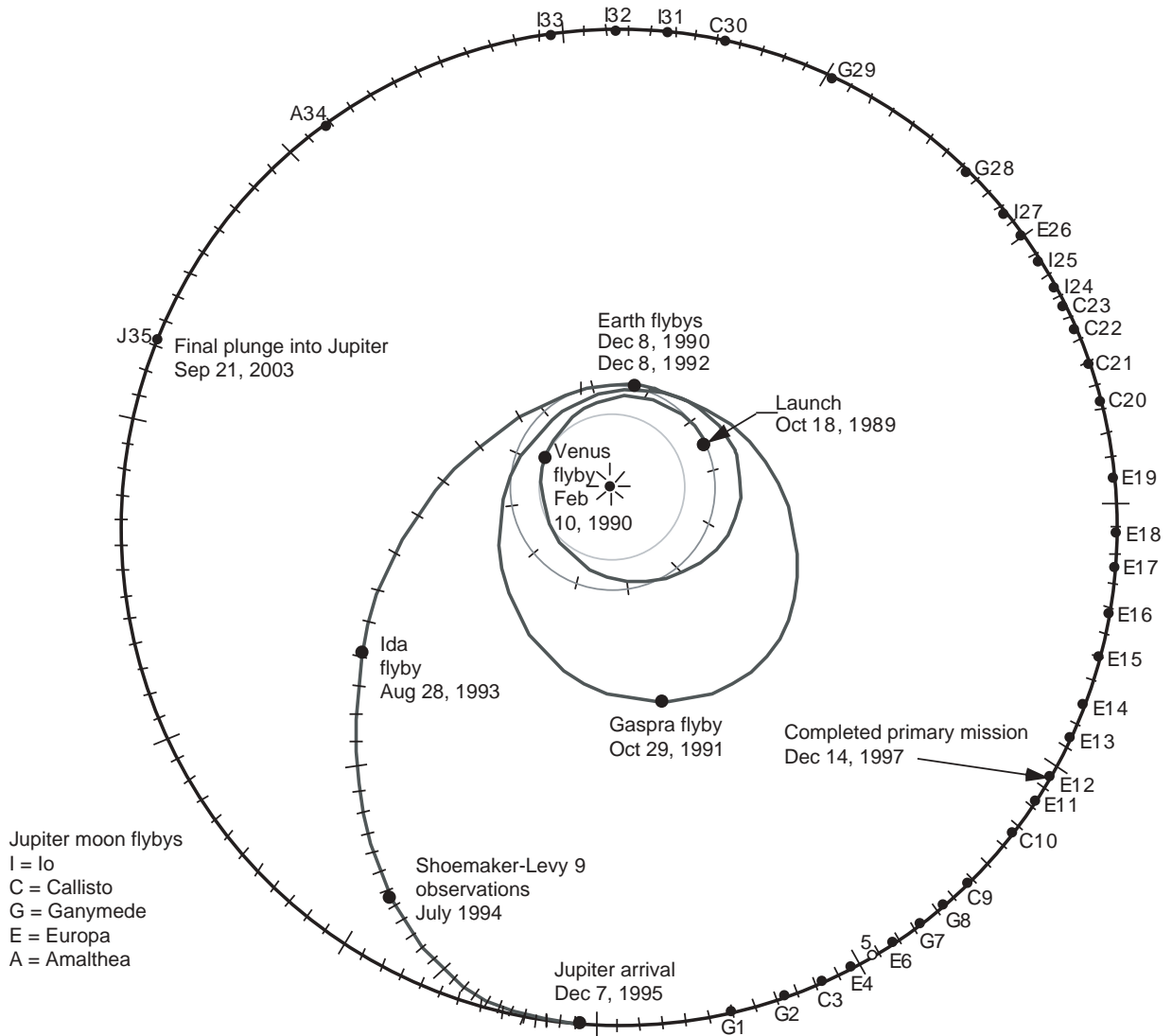
On August 28, 1993, Galileo carried out a second asteroid encounter, this time with a larger, more distant asteroid named Ida. Ida is about 55 kilometers (34 miles) long and 24 kilometers (15 miles) wide. Observations indicated that both Ida and Gaspra have magnetic fields, although Ida is older and its surface is covered with craters. Scientists discovered that Ida boasts its own moon, making it the first asteroid known to have a natural satellite. The tiny moon, named Dactyl, has a diameter of only about 1.5 kilometers (less than a mile). By determining Dactyl's orbit, scientists estimated Ida's density.

Comet Shoemaker-Levy

The discovery of Comet Shoemaker-Levy 9 in March 1993 provided an exciting opportunity for Galileo's science teams and other astronomers. The comet was breaking up as it orbited Jupiter, and was headed to dive into the giant planet's atmosphere in July 1994.

Galileo Encounters at Jupiter

Orbit	Target	Date	Altitude
0	Io	Dec. 7, 1995	897 km (558 mi)
1	Ganymede	June 27, 1996	835 km (519 mi)
2	Ganymede	Sept. 6, 1996	261 km (162 mi)
3	Callisto	Nov. 4, 1996	1136 km (706 mi)
4	Europa	Dec. 19, 1996	692 km (430 mi)
5	[none]		
6	Europa	Feb. 20, 1997	586 km (364 mi)
7	Ganymede	April 5, 1997	3102 km (1928 mi)
8	Ganymede	May 7, 1997	1603 km (996 mi)
9	Callisto	June 25, 1997	418 km (260 mi)
10	Callisto	Sept. 17, 1997	535 km (333 mi)
11	Europa	Nov. 6, 1997	2043 km (1270 mi)
12	Europa	Dec. 16, 1997	201 km (125 mi)
13	[none]		
14	Europa	March 29, 1998	1644 km (1022 mi)
15	Europa	May 31, 1998	2515 km (1562 mi)
16	Europa	July 21, 1998	1834 km (1140 mi)
17	Europa	Sept. 26, 1998	3582 km (2226 mi)
18	Europa	Nov. 22, 1998	2271 km (1411 mi)
19	Europa	Feb. 1, 1999	1439 km (894 mi)
20	Callisto	May 5, 1999	1321 km (821 mi)
21	Callisto	June 30, 1999	1048 km (651 mi)
22	Callisto	Aug. 14, 1999	2299 km (1429 mi)
23	Callisto	Sept. 16, 1999	1052 km (654 mi)
24	Io	Oct. 11, 1999	611 km (380 mi)
25	Io	Nov. 26, 1999	301 km (187 mi)
26	Europa	Jan. 3, 2000	351 km (218 mi)
27	Io	Feb. 22, 2000	198 km (123 mi)
28	Ganymede	May 20, 2000	809 km (502 mi)
29	Ganymede	Dec. 28, 2000	2338 km (1452 mi)
30	Callisto	May 25, 2001	138 km (86 mi)
31	Io	Aug. 6, 2001	194 km (120 mi)
32	Io	Oct. 16, 2001	184 km (114 mi)
33	Io	Jan. 17, 2002	102 km (63 mi)
34	Amalthea	Nov. 5, 2002	160 km (99 mi)
35	Jupiter	Sept. 21, 2003	[impact]



Trajectory and key mission events

The Galileo spacecraft, approaching Jupiter, was the only observation platform with a direct view of the comet's impact area on Jupiter's far side. Despite the uncertainty of the predicted impact times, Galileo team members pre-programmed the spacecraft's science instruments to collect data and were able to obtain spectacular images of the comet impacts.

Jupiter Arrival

On July 13, 1995, Galileo's descent probe, which had been carried aboard the parent spacecraft, was released and began a five-month freefall toward Jupiter. The probe had no engine or thrusters, so its flight path was established by pointing of the Galileo orbiter before the probe was released. Two weeks later, Galileo used its main rocket

engine for the first time as it readjusted its flight path to arrive at the proper point at Jupiter.

Arrival day on December 7, 1995, turned out to be an extremely busy 24-hour period. When Galileo first reached Jupiter and while the probe was still approaching the planet, the orbiter flew by two of Jupiter's major moons – Europa and Io. Galileo passed Europa at an altitude of about 33,000 kilometers (20,000 miles), while the Io approach was at an altitude of about 900 kilometers (600 miles).

About four hours after leaving Io, the orbiter made its closest approach to Jupiter, encountering 25 times more radiation than the level considered deadly for humans.

Descent Probe

Eight minutes later, the orbiter started receiving data from the descent probe, which slammed into the top of the Jovian atmosphere at a comet-like speed of 170,000 kilometers per hour (106,000 miles per hour). In the process, the probe withstood temperatures twice as hot as the Sun's surface. The probe slowed by aerodynamic braking for about two minutes before deploying its parachute and dropping a heat shield.

The wok-shaped probe floated down about 200 kilometers (125 miles) through the clouds, transmitting data to the orbiter on sunlight and heat flux, pressure, temperature, winds, lightning and atmospheric composition. Fifty-eight minutes into its descent, high temperatures silenced the probe's transmitters. The probe sent data from a depth with a pressure 23 times that of the average on Earth's surface, more than twice the mission requirement.

An hour after receiving the last transmission from the probe, at a point about 200,000 kilometers (130,000 miles) above the planet, the Galileo spacecraft fired its main engine to brake into orbit around Jupiter.

This first orbit lasted about seven months. Galileo fired its thrusters at its farthest point in the orbit to keep it from coming so close to the giant planet on later orbits. This adjustment helped mitigate possible damage to spacecraft sensors and computer chips from Jupiter's intense radiation environment.

During this first orbit, new software was installed which gave the orbiter extensive new onboard data processing capabilities. It permitted data compression, enabling the spacecraft to transmit up to 10 times the number of pictures and other measurements that would have been possible otherwise.

In addition, hardware changes on the ground and adjustments to the spacecraft-to-Earth communication system increased the average telemetry rate tenfold. Although the problem with the high-gain antenna prevented some of the mission's original objectives from being met, the great majority were. So many new objectives were achieved

that scientists feel Galileo has produced considerably more science than ever envisioned at the project's start 20 years ago.

Orbital Tour

During its primary mission orbital tour, Galileo's itinerary included four flybys of Jupiter's moon Ganymede, three of Callisto and three of Europa. These encounters were about 100 to 1,000 times closer than those performed by NASA's Voyager 1 and 2 spacecraft during their Jupiter flybys in 1979. Galileo's instruments scanned and scrutinized the surface and features of each moon. After about a week of intensive observation, with its tape recorder full of data, the spacecraft spent the next one to two months-until the next encounter in orbital "cruise"-playing back the information in transmissions to Earth.

Extended Missions

A two-year extension, the Galileo Europa Mission, began in December 1997 and included intensive study of Europa through eight consecutive close encounters. The flybys added to knowledge about Europa's frozen surface and the intriguing prospect that liquid oceans may lie underneath. The Galileo Europa Mission provided a valuable opportunity to make additional flybys of the volcanic moon Io. The prime mission provided only one opportunity for close-up study of Io. Galileo had two encounters of Io during the Europa Mission, gathering new information on Io's volcanic activity. In addition, Galileo studied Callisto in four flybys. The Galileo Millennium Mission added another year of operations, including more flybys of Io and Ganymede, plus joint studies with the Cassini spacecraft as it passed Jupiter in December 2000 for a gravity assist toward Saturn.

Spacecraft

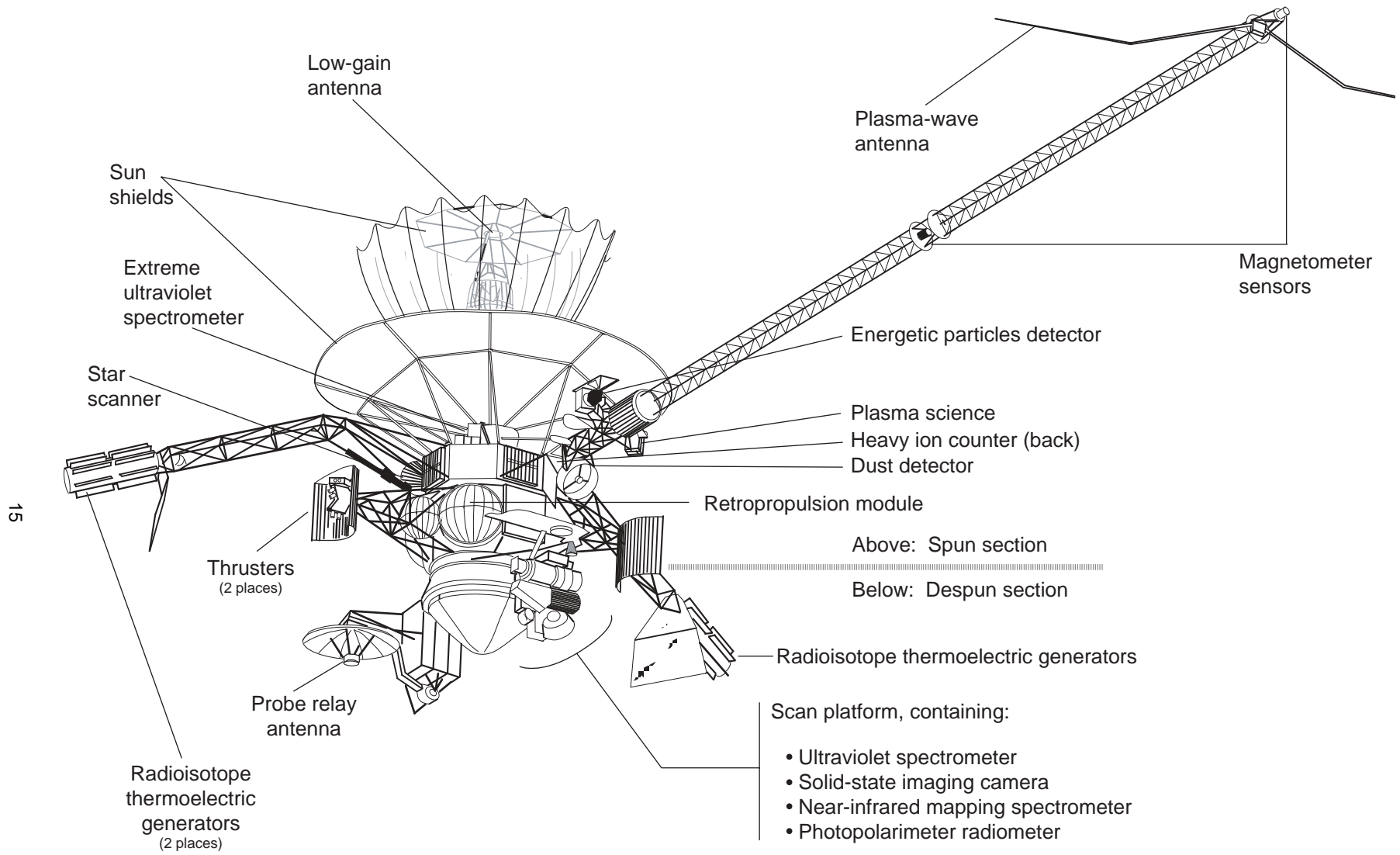
The Galileo orbiter weighed 2,223 kilograms at launch (2-1/2 tons) and measured 5.3 meters (17 feet) from the top of the low-gain antenna to the bottom of the probe. The orbiter features an innovative "dual-spin" design. Most spacecraft are stabilized in flight either by spinning around a major axis, or by maintaining a fixed orientation in space, referenced to the Sun and another star. As the first dual-spin planetary spacecraft, Galileo combines these techniques. A spinning section rotates at about 3 rpm, and a "despun" section is counter-rotated to provide a fixed orientation for cameras and other remote sensors. A star scanner on the spinning side determines orientation and spin rate; gyroscopes on the despun side provide the basis for measuring turns and pointing instruments.

The power supply, propulsion module and most of the computers and control electronics are mounted on the spinning section. The spinning section also carries instruments to study magnetic fields and charged particles. These instruments include magnetometer sensors mounted on an 11-meter (36-foot) boom to minimize interference from the spacecraft's electronics; a plasma instrument to detect low-energy charged particles; and a plasma-wave detector to study electromagnetic waves generated by the particles. There is also a high-energy particle detector and a detector of cosmic and Jovian dust, an extreme ultraviolet detector associated with the ultraviolet spectrometer, and a heavy ion counter to assess potentially hazardous charged-particle environments the spacecraft flies through.

Galileo's de-spun section carries instruments that need to be held steady. These instruments include the camera system; the near-infrared mapping spectrometer to make multispectral images for atmosphere and surface chemical analysis; the ultraviolet spectrometer to study gases; and the photopolarimeter-radiometer to measure radiant and reflected energy. The camera system obtains images of Jupiter's satellites at resolutions from 20 to 1,000 times better than the best possible from NASA's Voyager spacecraft; its charge-coupled-device (CCD) sensor is much more sensitive than previous spacecraft cameras and is able to detect a broader color band. Galileo's de-spun section also carries a dish antenna that picked up the descent probe's signals during its fall into Jupiter's atmosphere.

The spacecraft's propulsion module consists of twelve 10-newton (2.25-pound-force) thrusters and a single 400-newton (90-pound-force) engine which use monomethylhydrazine fuel and nitrogen-tetroxide oxidizer. The propulsion system was developed and built by Messerschmitt-Bolkow-Blohm (MBB) and provided by the Federal Republic of Germany as NASA's major international partner on Galileo.

Because radio signals take more than one hour to travel from Earth to Jupiter and back, the Galileo spacecraft was designed to operate from computer instructions sent to it in advance and stored in spacecraft memory. A single master sequence of com-



Galileo spacecraft

mands can cover a period ranging from weeks to months of quiet operations between flybys of Jupiter's moons. During busy encounter operations, one sequence of commands covers only about a week.

These sequences operate through flight software installed in the spacecraft computers, with built-in automatic fault protection software designed to put Galileo in a safe state in case of computer glitches or other unforeseen circumstance. Electrical power is provided by two radioisotope thermoelectric generators. Heat produced by natural radioactive decay of plutonium is converted to electricity (570 watts at launch, 485 at the end of the mission) to operate the orbiter spacecraft's equipment. This is the same type of power source used on other NASA missions including Viking to Mars, Voyager and Pioneer to the outer planets, Ulysses to study the Sun, and Cassini to Saturn.

Descent Probe

Galileo's descent probe had a mass of 339 kilograms (750 pounds), and included a deceleration module to slow and protect the descent module. The deceleration module consisted of an aeroshell and an aft cover designed to block heat generated by friction during atmospheric entry. Inside the aeroshells were the descent module and its 2.5-meter (8-foot) parachute. The descent module carried a radio transmitter and seven scientific instruments. These were devices to measure temperature, pressure and deceleration, atmospheric composition, clouds, particles, and light and radio emissions from lightning and energetic particles in Jupiter's radiation belts.

Orbiter Instruments

The Galileo orbiter spacecraft carries 11 scientific instruments. Another seven were on the descent probe. One engineering instrument on the orbiter, originally for measurements to aid design of future spacecraft, also collects scientific information.

End of Mission Sequence of Events

On the day of impact, it will take Galileo's radio signals approximately 52 minutes to travel between the spacecraft and Earth. The time at which radio signals reach Earth indicating that an event has occurred is known as "Earth-received time." All times quoted below are in Earth-received time at the Jet Propulsion Laboratory in Pasadena, Calif. All times are Pacific Daylight Time, which is seven hours behind Universal Time.

At 12:52 a.m. PDT on Sunday, Sept. 21, 2003, the 70-meter-diameter (230-foot) Deep Space Network tracking station antenna near Madrid, Spain, will listen to the spacecraft. The science instruments will be configured and begin to send their data in real-time to Earth. Galileo is at a distance of 965,000 kilometers (600,000 miles).

About eight hours later, Galileo will cross the volcanic satellite Io's orbit at a distance of 422,000 kilometers (262,000 miles). The spacecraft has ventured inside this distance only twice: as it arrived at Jupiter in 1995 and again in 2002, when it made a flyby of the small inner moon Amalthea.

By 9:42 a.m., the intensity of radiation interference will reach a point where even a bright star like Vega can no longer reliably be seen by the attitude control star scanner. The software will now be told to expect to see no more stars.

At 11:31 a.m., Galileo will be 143,000 kilometers (89,000 miles) above the clouds and the magnetometer instrument will take its final data for the mission. At this distance from Jupiter, the magnetic field is so strong that the instrument, even in its most robust configuration, would produce a signal that would be completely saturated, and of no further scientific value.

Seventeen minutes later (11:48 a.m.), the spacecraft will pass the orbit of the tiny satellite Amalthea. As the spacecraft passes Amalthea, a special measurement will be taken using the star scanner. During a previous flyby of this small body on Nov. 5, 2002, flashes of light were seen by the star scanner that might indicate the presence of rocky debris circling Jupiter in the vicinity of the satellite. Though on this final pass Galileo will not be near Amalthea, the measurement may help confirm or constrain the extent of this hypothesized orbital debris.

At about 12:17 p.m., Galileo will pass the orbits of the innermost moons, Adrastea and Metis. Galileo will be just 57,500 kilometers (35,700 miles) above the clouds, closing fast, and picking up speed. A few minutes later the Galileo Orbiter will join the Galileo probe in going closer to Jupiter than any other man-made object. At 43,000 kilometers altitude (26,725 miles), the spacecraft is now at a distance that is 1/9th of the span between Earth and its own Moon.

At 12:42 p.m. with roughly seven minutes to go, Galileo will move from day to night as

it passes into Jupiter's shadow, and, one minute later, it will pass behind the limb of the giant planet as seen from Earth. Only 9,283 kilometers (5,768 miles) above the clouds, the path of the spacecraft will take it out of sight of ground controllers. The last data ever to be received from the Galileo spacecraft will now be sent. The remaining few minutes of the craft will be spent in darkness.

At approximately 12:49 p.m., Galileo will reach the end of its nearly 14-year odyssey.

Program/Project Management

The Galileo project is managed for NASA's Office of Space Science, Washington, D.C., by the Jet Propulsion Laboratory, Pasadena, a division of the California Institute of Technology. JPL designed and built the Galileo orbiter, and operates the mission.

At NASA Headquarters, Dr. Barry Geldzahler is Galileo program manager and Dr. Denis Bogan is program scientist.

At JPL, the position of project manager has been held successively by John Casani, Richard Spehalski, Bill O'Neil, Bob Mitchell, Jim Erickson, Eilene Theilig and, currently, Dr. Claudia J. Alexander. Dr. Torrence V. Johnson is project scientist.

NASA's Ames Research Center, Moffett Field, Calif., managed the descent probe, which was built by Hughes Aircraft Co, El Segundo, Calif. The position of probe manager was held successively by Joel Sperans, Benny Chinn and Marcie Smith. The probe scientist is Dr. Richard E. Young.

9-15-03