Deep Impact is bound for comet

By DC Agle

The JPL-managed Deep Impact spacecraft began its 431-million kilometer (268-million mile) journey to comet Tempel 1 on Wednesday, Jan. 12, at 10:47 Pacific time.

Deep Impact is composed of two parts: a "flyby" spacecraft and a smaller "impactor." The impacter will be released into the comet's path for a planned collision on July 4. The crater produced by the impacter is expected to be up to the size of a football stadium and two to 14 stories deep. Ice and dust jets will be ejected from the crater, revealing the material beneath. The flyby spacecraft will observe the effects of the collision. NASA's Stardust, Spitzer and Chandra space telescopes, and other telescopes on Earth, will also observe the collision.

Deep Impact's flyby spacecraft measures 3.3 meters (10.8 feet) long and weighs in at 604 kilograms (1,325 pounds) at launch. After releasing a 1 meter by 1 meter (2.5 by 2.5 meter) target to crash onto the comet's surface, the flyby spacecraft will reveal the secrets of the comet's interior by collecting pictures and data of how the crater forms, measuring the crater's depth and diameter as well as the composition of the interior of the crater and any material thrown out, and determining the changes in natural outgassing produced by the impact.

The spacecraft will collide with comet Tempel 1 when the comet is near its perihelion, or the closest point to the Sun in its orbit. The impactor will strike it at a relative velocity of 10.2 kilometers per second (22,800 mph).

Comet Tempel 1 contains clues that hold the secrets of the formation and evolution of the solar system. They are composed of ice, gas and dust. Primitive debris from the solar system's distant and coldest regions that formed 4.5 billion years ago.

The geologic record of the planets shows that, about 3.9 billion years ago, a period of heavy cometary and asteroidal bombardment tapered off. The earliest evidence of life on Earth dates from just after the end of this heavy bombardment. Comets are also at least partially responsible for the replenishment of Earth's oceans after the vaporization of an early ocean during the late heavy bombardment. While Earth has long been regarded as the "water planet," it and the other terrestrial planets (Mars, Venus and Mercury) are actually poor in the percentage of water and in carbon-based molecules they contain when compared to objects that reside in the outer solar system at Jupiter's orbit or beyond.

Comets are about 50 percent water by weight and about 10 to 20 percent carbon by weight. It has long been suspected that what little carbon and water there is on Earth was delivered here by objects such as comets that came from a more water-rich part of the solar system.

Deep Impact is the eighth mission in NASA's Discovery Program, which sponsors frequent, cost-capped solar system exploration missions with highly focused scientific goals. Created in 1992, the Discovery Program competitively selects proposals submitted by teams led by scientists, supported by organizations that manage the project, as well as partners that build and fly the spacecraft. Deep Impact was built for NASA by Ball Aerospace and Technologies Corp., Boulder, Colo.

For more information, visit http://deepimpact.jpl.nasa.gov.

Jason, Topex data show new details of tsunami

By Alan Buis

For the first time, orbiting satellites have observed and measured a major tsunami event in open ocean, the Indian Ocean tsunami that resulted from the magnitude 9 earthquake southwest of Sumatra on Dec. 26. The measurements are of tremendous value to researchers worldwide and will aid in our understanding of these events.

U.S. and French teams working in parallel with alimetry data from the joint NASA/Astrium Space Agency Jason and Topex/Poseidon oceanography satellites—both managed by JPL—have independently confirmed the satellites' measurements of the height of the tsunami waves as they radiated from the earthquake's epicenter. The satellites flew over the Bay of Bengal about 150 kilometers (93 miles) apart approximately two hours after the quake.

"These two satellites make only about 13 Earth revolutions daily, with each orbit passing over the Earth approximately 3,000 kilometers (1,864 miles) away from its last," said JPL's Dr. Philip Callahan, who has been searching for tsunami signals in satellite radar altimeter data since Topex/Poseidon's launch in 1992. "There is a very low probability of capturing observations in any given location within two hours of an event like this. That fact that Jason captured the tsunami's signals is serendipitous, but is nevertheless a major boon for oceanographers," he said.

"The observations made by Jason and Topex/Poseidon are unique and of tremendous value for testing and improving tsunami computer models and developing future tsunami early warning systems," said JPL's Dr. Les-Lang Fu, the Jason and Topex/Poseidon project scientist. The satellite altimeter data currently take a minimum of five hours to process, so they cannot provide early warning of such events. Fu said Callahan received the Jason data the morning of Dec. 27.

"This was an amicable separation after seven years of living together," said Dr. David Southwood, director of science program for the European Space Agency. "Our thanks to our partners at NASA for the lift. Each spacecraft will now continue on its own but we expect they’ll keep in touch to complete this amazing mission. Now all our hopes and expectations are focused on getting the first in situ data from a new world we’ve been dreaming of exploring for decades."

The Jason probe will remain dormant until the onboard timer wakes it up just before the probe reaches Titan's upper atmosphere on Jan. 14. Then it will begin a dramatic plunge through Titan's murky atmosphere, tasting its chemical makeup and composition as it descends to touch down on its surface. The data gathered during this 2-1/2 hour descent will be transmitted from the probe to the Cassini orbiter. Afterward, Cassini will point its antenna to Earth and relay the data through the Deep Space Network in JPL and on to the European Space Agency's Space Operations Center in Kenya. From this control center, JPL engineers will be tracking the probe and scientists will be standing by to process the data from the probe's six instruments.

Seven days after separating from Huygens, Cassini successfully flew by Saturn's moon Lagopus at a distance of 123,400 kilometers (76,700 miles) on Friday, Dec. 31.

Lagopus is a world of sharp contrasts. The leading hemisphere is as dark as a freshly-tarred street, and the white, trailing hemisphere resembles freshly-fallen snow.

The Dec. 31 flyby was the first close encounter of Lagopus during the four-year Cassini tour. The second and final close flyby of Lagopus is scheduled for 2007.

Huygens on its way to Titan

By Carolina Martinez

The Huygens Probe successfully detached from the Cassini orbiter on Dec. 24 to begin a three-week journey to Saturn's moon Titan. All systems performed as expected and there were no problems reported with the Cassini spacecraft.

The Huygens probe, built and managed by the European Space Agency, was bolted to Cassini and had been riding along during the nearly seven-year journey to Saturn largely in a "sleep" mode. Huygens will be the first human-made object to explore on-site the unique environment of Titan, whose chemistry is assumed to be very similar to that of early Earth before life formed. Huygens will tell us whether this assumption is correct. We wish to congratulate our European partners as their journey begins and wish them well on their descent to Titan," said Cassini Program Manager Bob Mitchell. "We are very excited to see the probe off and to have accomplished this part of our job. Now we’re ready to finish our part of the mission before melting into the Huygens data back to Earth."

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The program aims is to increase the participation and success rates of students who are traditionally under-represented in science, technology, engineering, math and geography. Log on to http://audiostream.com for information. The application deadline for the eight-week program in Feb. 14. Applicants must be at least 16 years old and have completed 10th grade. Also, they must commit to participate in a one-hour base class through Friday for the duration of the program.

The program operates about mid-June to mid-July. Students will have the opportunity to conduct meaningful research, interact with students from different racial and ethnic back- grounds, and participate in a variety of enrichment activities that develop social, written, computer and leadership skills.

For more information, call university library: RESEARCH IN LIFE Science at the Education Office at ext. 3-599.

Bunding equipment to be upgraded

The Office of Protective Services will soon begin the process of upgrading its fire protection equipment. This upgrade is in compliance with NASA's fire protection standards. The equipment upgrade installation will take place Jan. 19–21.

The installation of the new protective Services will not be able to serve any photo ID hold badges will be issued as needed until photo ID holding resumes on Monday, Jan. 24.

When installation of the new equipment has been completed, NASA civil servants will be issued a new NASA photo ID.

New Weight Watchers series

JPL and contractor employees are invited to join the successful Weight Watchers at Work series.

The cost for the 10-week series is $219 (based on a $10.50 change for each meeting paid by check, cash or one of the following credit card charge, MasterCard, Discover or American Express. JPL and contractor employees are welcome to join the series at any time. Those who join after the first week are required to pay $21 for each remaining meeting. In-attendance meetings are due at enrollment.

For more information, call LAIME LINCOLS, ext. 4-1012.

Blood drive in February

The next JPL Red Cross blood drive will be held in on Kimbark Auditorium on Tuesday, Feb. 15 from 10 a.m. to 4 p.m. and Wednesday, Feb. 16, from 7 a.m. to 1 p.m. in the cafeteria.

Knowing exactly where rising waters will be able to predict the exact location of the future missions is a possibility of the Indian Ocean tsunami.

Apply now for summer program

Applications are now available for NASA’s 2015 Summer High School Apprentice Program (SHARP).

Over the last several decades, dozens of missions have come and gone at JPL. But all the while, the intrepid twin Voyager spacecraft, launched about two weeks apart in the summer of 1977 and now heading out of the solar system, continue to make history.

Both spacecraft are still going strong and are returning valuable scientific data. On Jan. 5, the Voyager team reported a milestone with a nice round number: 20,100 days since Voyager 1’s launch on Aug. 20, 1977. Voyager 2 launched on Aug. 20, 1977 and has passed 20,100 days as of this writing.

Voyager veteran Regina Wong of the Data Management and Science Team (DMST) told JPL Stories that “the Voyager spacecraft were among the first planetary science systems to be a part of the NASA mission to Mars. They received the first high-resolution images of Mars and Mercury.”

Voyager is still working. He expects both spacecraft to send back valuable data until the year 2020—and perhaps longer.

Project Manager Ed Massey said the mission currently employs the equivalent of 60,000 person-years of time. Voyager may have reached 300 at one time, he said. During the height of its famed “Grand Tour” of the planets through 1899. During the journey, the Voyagers flew by Jupiter, Saturn, Uranus and Neptune and are near the edge of the heliosphere, the area dominated by the sun’s influence.
NEW BUSINESS,
FINANCE CHIEF ONBOARD

By Mark Whalen
JPL recently welcomed Dale Johnson as its new chief financial officer and director for business operations. After holding a number of increasingly responsible business-management positions for more than 20 years with Lockheed Martin, Johnson joined the Lab in November. He discusses his outlook for the near future.

You had worked at Lockheed Martin for quite a while. What attracted you to JPL?
I found this opportunity at JPL to be an excellent fit with my experience and interests. Being a Federally Funded Research and Development Center and with its close association with the Caltech campus, JPL had earned an outstanding reputation and I’m really looking forward to being part of this team.

How will your experience in private industry best benefit JPL? As a government contractor, how do JPL’s financial challenges compare to the corporate world?
My experience has allowed me to be involved in a number of financial areas, such as budgets, pricing, contracts and financial planning. I’ve also been fortunate to have a pretty solid background on the management and administrative side, including information technology, facilities and security. NASA is placing particular emphasis on strengthening certain areas, including cost control and cost estimating. Given my background, these are areas I’m very comfortable with. JPL is already a strong institution in these areas, and in the future we can look for enhancements to improve our service even more. It’s an area of opportunity.

What are your organizational areas of responsibility? How is the office set up, and whom do you consider your customers?
The support activity we provide is a comprehensive partnership with the technical and engineering directorates at JPL. As part of that, we bring all the business, administrative, financial, security, facilities, acquisition and information technology directorates to bear to ensure the success of the flight projects. We have a rich, successful background in these processes. It takes all participants to make the Lab successful, including the business management elements. I’ve been impressed by the professionalism and the caliber of the individuals who are part of the business teams. The management team has done a great job in contributing to JPL’s technological leadership. The successful conversion to Oracle is just one excellent example of the Lab’s willingness to move forward, not just in the engineering, computing and system excellence areas, but also in the financial areas as well. There’s a lot to be proud of.

What will we see in the future for the labs’ emphasis?
What we’ll see in the future is a focus on people, processes and tools to do our jobs. We’ve been able to establish short-term and long-term goals. I still have a lot to learn and understand about JPL. I can say that the organization itself is very well organized. I have been able to group and understand most of the issues here fairly quickly and easily, based on the structure that’s been set up. As a result, as I look at some of the issues that face us in the near term, there are some definite focus areas related to NASA concerns that we will need to address.

What are the biggest challenges for you personally and for your organization? Have you been able yet to establish short-term and long-term goals?
Specifically, our near-term goals are to continue improving cost management capabilities, enhance effective business and acquisition processes and capabilities, further emphasize and deploy earned value project management, streamline and consolidate business systems, and develop a pricing capability. Overall, I think the organization is well positioned to respond favorably—in fact, be a leader in these areas—on behalf of NASA as well as the other centers.

Part of your job is chairing JPL’s Business Management Council. What is that group all about?
The council includes members of the 2X organizations, as well as the business representatives that support all the other directorates. We meet twice a month and focus on the needs of the Lab and how the business and administrative areas respond to those needs. Right now, we’re heavily engaged in evaluating burden budget performance, as well as moving forward toward better utilizing the council as a means to improve project business performance across JPL.

Can you look forward and project where JPL business operations will be in the next few years?
What we see in the future is a focus on the people, processes and tools to do our jobs. From a people standpoint, we are aggressively moving forward in setting up improved training to achieve our goals. We are endeavoring to mirror the flight management practices training program that Tom Gavrin has put together by providing a very similar training program for business management personnel and other selected representatives.

What are your first impressions of JPL? What have you observed about the Lab and its people?
In the short time I’ve been here, I found what represents the best of JPL. In just my second week at the Lab, we had the vanpool accident, a terrible tragedy. What I found remarkable was the family orientation and the desire of the entire Laboratory to respond and help members of the affected families. You can say you have a close-knit family, but often that’s only reflected in people’s specific actions. I can attest that JPL really demonstrated a sincere and honest concern regarding those involved. Everybody came together in a positive, proactive fashion. To me, that demonstrated a very unique sense of caring and commitment.

Again, I feel very fortunate to be part of the JPL team. The reputation JPL enjoys worldwide is something all of us can be very proud of. I very much look forward to a successful and rewarding career here.
Following the busiest year in the Lab’s history, 2004 certainly kept JPLers busy as well. Remember how last year began, with Stardust capturing samples of comet particles and the Mars Exploration Rovers touching down successfully? Now, Stardust is on its way back to return samples to Earth in another year, and the rovers are still successfully traversing Mars on extended tours. Other missions and their discoveries continued apace throughout the year. Briefly, here are some of the memorable moments of 2004.

**JANUARY**

Stardust began its two-year trek back to Earth after successfully navigating through the coma around comet Wild 2 on Jan. 2. The spacecraft flew within about 230 kilometers of the comet, capturing particle samples and taking detailed pictures of Wild 2's peckmarked surface. ... Spirit, the first of twin Mars Exploration Rovers launched by JPL in 2003, became the first spacecraft to land on the Red Planet in six years with an airbag-assisted landing in Gusev Crater on Jan. 3. The MER team did it again with the Opportunity rover's landing in Meridiani Planum on Jan. 24. ... The cooler and drier conditions in Southern California over the last few years appear to be a direct result of a Pacific Decadal Oscillation. A study by JPL’s Dr. Bill Patzert and others suggested Pacific oceanic and atmospheric measurements can be used to forecast seasonal West Coast temperatures and precipitation up to a year in advance. The pattern lasts many decades rather than just a few months like El Niño and La Niña.

**FEBRUARY**

Aviation Week & Space Technology magazine honored team members at JPL and Ball Aerospace & Technologies Corp. with a 2003 Aerospace Laurel award for redesigning the Spitzer Space Telescope, which saved $800 million and provided a powerful new instrument for studying the universe. ... Mike Sander was appointed manager of the new Exploration Systems and Technology Office, which will be responsible for all JPL activities and missions related to NASA’s Office of Exploration Systems, except the Jupiter Icy Moons Orbiter. ... An employer preference survey by the National Society of Black Engineers, the largest student-managed engineering organization in the country, rated JPL the 44th best organization to work for in the United States. That represents an increase of 109 spots from the previous year and the biggest jump of all employers rated in the survey.

**MARCH**

The European Space Agency’s Rosetta spacecraft was launched March 2 for a planned rendezvous with a comet in 2014. Onboard, JPL’s microwave instrument will show how comet materials change from ice to gas, and will help determine temperature changes as the comet approaches the Sun. ... Based on evidence the rover found in a rock outcrop, scientists concluded the part of Mars explored by Opportunity was soaking wet in the past. Clues from the rocks’ composition, such as the presence of sulfates, and the rocks’ physical appearance, such as niches where crystals grew, helped make the case for a watery history. ... Using the JPL-developed Airborne Synthetic Aperture Radar, an international team of scientists took a three-week expedition of discovery. The team surveyed sites in Central America to help unearth archaeological secrets and to preserve resources and biological and cultural diversity. They then ventured to South America’s Patagonia ice fields and Antarctica to conduct topographic surveys of ice to better gauge the effect of climate change. ... A beachball-shaped “tumbleweed rover” that one day could search for secrets and to preserve resources and biological and cultural diversity. They then ventured to South America’s Patagonia ice fields and Antarctica to conduct topographic surveys of ice to better gauge the effect of climate change. ... A beachball-shaped “tumbleweed rover” that one day could search for evidence that water existed on other planets survived an eight-day, wind-driven trek across Antarctica. Robotics researcher Dr. Alberto Behar deployed the prototype, which is being developed at JPL. ... Spirit found hints of a water history in a rock at Gusev Crater, but it was a very different type of rock than those in which Opportunity found clues to a wet past on the opposite side of the planet. A dark volcanic rock showed bright material in interior crevices and cracks that look like minerals crystallized out of water. ... A study by the Quick Scatterometer spacecraft and its SeaWinds instrument of Southern California’s legendary Santa Ana winds, which create hot, dry conditions and fire hazards, showed the winds have some positive benefits. The winds cause cold water to rise from the bottom of the ocean to the top, bringing with it many nutrients that ultimately benefit local fisheries. ... Dr. William Pickering, a central figure in the U.S. space race and JPL's benefactors. The winds cause cold water to rise from the bottom of the ocean to the top, bringing with it many nutrients that ultimately benefit local fisheries.

**APRIL**

The JPL-developed Precision Global Positioning System (GPS) Software System was inducted in the Space Technology Hall of Fame. Team members Dr. Yozu Bar-Sever, Dr. Willy Bertiger, Dr. Michael Hellin, Dr. Kenneth Hurst, Dr. Stephen Lichten, Ronald Muehlerschoen, Dr. Frank Webb, Dr. Sien-Chong Wu, Dr. Thomas Yunck and Dr. James Zumberge were honored. ... NASA approved an extended mission for the Mars Exploration Rovers as they finished their three-month prime mission, providing $15 million for operating the rovers through September. ... The Spitzer Space
Telescope’s infrared eyes revealed a fireworks-like display of massive stars, the biggest of which is estimated to be 100,000 times as bright as our own Sun. The region is buried in so much space dust that no visible light escapes it. ... A cooperative study that included JPL scientists quantified, for the first time, the relationship between Arctic ozone loss and changes in the temperature of Earth’s stratosphere. The results indicate the loss of Arctic ozone due to the presence of industrial chlorine and bromine in Earth’s atmosphere may well be sensitive to subtle changes in stratospheric climate. Such ozone depletion leads to increased exposure to harmful, ultraviolet solar radiation at Earth’s surface. ...

**MAY**

An estimated crowd of 40,000 people attended JPL’s annual Open House May 15–16. ... Scientists and engineers celebrated when they saw the first pictures Opportunity sent from the rim of a stadium-sized crater that the rover reached after a six-week trek. Multiple layers of exposed bedrock line much of the inner slope of the impact crater “Endurance.” Such layers and their thicknesses may reveal what the environment on Mars was like before the salty standing body of water evaporated to produce the telltale rocks that were explored in the tiny “Eagle” Crater. ... JPL’s Optical Communications Telescope Laboratory was commissioned May 18 at the Lab’s Table Mountain facility near Wrightwood. The research and development facility houses a 1-meter elevation/azimuth telescope capable of tracking spacecraft from 250-kilometer altitude to deep space. ... New findings from the Spitzer Space Telescope included the discovery of significant amounts of icy organic materials sprinkled throughout several dusty planet-forming discs that circle infant stars. The materials, icy dust particles coated with water, methanol and carbon dioxide, may help explain the origin of icy planetoids like comets. Scientists believe these comets may have endowed Earth with some of its water and many of its biogenic, life-enabling materials. ... JPL was awarded a partnership in a hydrogen storage research project, one of many selected by the Department of Energy to support President Bush’s Hydrogen Fuel Initiative. The awards include the formation of “Centers of Excellence” at the National Renewable Energy Laboratory, Los Alamos National Laboratory and Sandia National Laboratories. JPL will be a member of Sandia’s Metal Hydride Virtual Center of Excellence. The Lab’s contributions will include assisting in the design of improved hydride storage vessels and developing better storage materials. ... Spitzer images detected distant objects—including several supermassive black holes—that are nearly invisible in even the deepest images from telescopes operating at other wavelengths. Seven of the objects may be part of the long-sought “missing” supermassive black holes that powered the bright cores of the earliest active galaxies. The effort required the combined power of NASA’s three Great Observatories—the Hubble Space Telescope, Chandra X-ray Observatory and Spitzer. ...

**JUNE**

Findings from a historic encounter between the Stardust spacecraft and a comet revealed a much stranger world than previously believed. “We thought Comet Wild 2 would be like a dirty, black, fluffy snowball,” said Principal Investigator Dr. Donald Brownlee. “Instead, it was mind-boggling to see the diverse landscape in the first pictures, including spires, pits and craters, which must be supported by a cohesive surface.” ... Software from the Space Technology 6 Autonomous Sciencecraft Experiment captured images of Antarctica’s Mount Erebus and detected volcanic activity, an observation made on its own without human interaction. The JPL-developed software controls the Earth Observing-1 spacecraft. After taking an image of Erebus, the software detected heat from the lava lake at the summit of the volcano and reprogrammed the camera to take more pictures. News of the detection was rapidly transmitted to scientists. Typically, it could take months to learn a remote volcano was active and scientists normally would need to take measurements at the volcano to detect the same type of event. ... The international Cassini–Huygens mission successfully entered orbit around Saturn on June 30. This began a four-year study of the giant planet, its majestic rings and more than 30 moons. Cassini traveled about 3.5 billion kilometers since its October 1997 launch. ...
**JULY**

The Aura spacecraft launched July 1 from Vandenberg Air Force Base. Two of Aura’s four instruments—the Microwave Limb Sounder and the tropospheric Emission Spectrometer—were designed, built and tested at JPL, where they will be operated. Aura will help answer key scientific questions about the recovery of Earth’s protective ozone layer, the processes controlling air quality and how the Earth’s climate is changing. … During a distant flyby on July 2, Cassini revealed surface details of Saturn’s moon Titan and imaged a huge cloud of gas surrounding the planet-sized moon. Titan’s dense atmosphere is opaque at most wavelengths, but the spacecraft captured some surface details, including a possible crater, through wavelengths in which the atmosphere is clear. … Using a JPL-developed infrared video camera, surges imaged thermal imaging and image processing to see if they can create useful maps of brain tumors. Doctors at USC’s Keck School of Medicine are trying to see if they can sketch tumor margins by detecting temperature changes during surgery, since tumor cells emit more heat than healthy ones.

The camera’s precision allows it to map temperature differences of one-hundredth of a degree Celsius at a high resolution. … NASA selected two proposals that JPL would lead for study as candidates for the next mission in the agency’s New Frontiers Program. The JPL-led mission proposes to orbit Jupiter to investigate the existence of an ice-rock core, determine water and ammonia abundances in Jupiter’s atmosphere, study convection and deep wind profiles in the atmosphere, investigate the origin of the jovian magnetic field, and explore the polar magnetosphere. The other New Frontiers candidate, “Moonrise: Lunar South Pole–Arsites Basin Sample Return Mission,” proposes to land on the far side of the moon and to return about 2 kilograms of lunar materials from a region of the surface believed to harbor materials from the moon’s mantle. … NASA also selected nine studies to investigate new ideas for future mission concepts within its Astronomical Search for Origins Program. A JPL-led proposal, “A Background Limited Infrared-Submillimeter Spectrograph for Spica: Revealing the Nature of the Far-Infrared Universe,” would enable far-infrared spectroscopy of the galaxies that make up the far-infrared background out to distances of some of the farthest galaxies known today. …

**AUGUST**

Cassini detected lightning and a new radiation belt at Saturn, and a glow around the planet’s largest moon, Titan. … A new image from Spitzer showed what could not be seen before—a massive doughnut-shaped ring of material that was expelled from the dying star. The composition of the ring and how it formed are mysteries scientists hope to address with further Spitzer studies. … The team preparing JPL’s Mars Reconnaissance Orbiter for launch began integrating and testing the spacecraft’s versatile payload. Possible launch dates begin Aug. 10, 2005. The spacecraft will reach Mars seven months later to study the surface, subsurface and atmosphere. … The Opportunity rover sent pictures relayed by the European Space Agency’s Mars Express orbiter for the first time, demonstrating that the orbiter could serve as a communications link if needed. On Aug. 4, as Mars Express flew over Opportunity, the orbiter received data previously collected and stored by the rover. The data, including 15 images from the rover’s cameras, were subsequently forwarded to the European Space Operations Center in Germany, and immediately relayed to the rover team at JPL. … The “Science Activity Planner,” developed by JPL, was selected by NASA as one of the “best of the best” software developed by the agency in 2004. It combines cutting-edge visualization with sophisticated planning and simulation capabilities to provide an intuitive interface to Mars rovers and landers. … Scientists discovered irregular lumps beneath the surface of Jupiter’s largest moon, Ganymede. These irregular masses may be rock formations, supported by the moon’s icy shell for billions of years. This discovery comes nearly a year after Galileo’s orchestrated demise and more than seven years after the data were collected. The findings caused scientists to rethink what the interior of Ganymede might contain. … Cassini uncovered two moons that may be the smallest bodies around the ringed planet. The moons are approximately 3 kilometers and 4 kilometers across. The smallest previously known moons around Saturn are about 20 kilometers across. … In examining bedrock in the “Columbia Hills,” the Spirit rover found evidence that water thoroughly altered some rocks in Mars’ Gusev Crater. … NASA approved an extended mission through September 2006 for the Mars Odyssey orbiter after it completed a prime mission that discovered vast supplies of frozen water, ran a safety check for future astronauts and mapped surface textures and minerals all over Mars. The spacecraft has been examining Mars in detail since February 2002. …

**SEPTEMBER**

Seen through the reeks of the JPL-managed Multi-angle Imaging SpectroRadiometer aboard NASA’s Terra satellite, the menacing clouds of Hurricanes Frances and Ivan provided a wealth of information that can help improve hurricane forecasts. MISR images of Frances and Ivan were acquired Sept. 4 and 5, respectively, when Frances’ eye sat just off the coast of eastern Florida and Ivan was heading toward the central and western Caribbean. … Carrying a cargo of solar-wind particles, the Genesis sample return capsule entered Earth’s atmosphere and the preplanned entry ellipse in the Utah Test and Training Range as predicted on Sept. 8. However, as a result of its
parachute not deploying, the capsule impacted the ground. Within the month, the Genesis team recovered and restored collector arrays and prepared them for shipment to Johnson Space Center for analysis. A major milestone was the recovery of four separate segments of Genesis’ concentrator target. Designed to measure the isotopic ratios of oxygen and nitrogen, the segments contain the samples that are the mission’s most important science goal. … For the first time, scientists demonstrated that precise measurements of Earth’s changing gravity field can effectively monitor changes in the planet’s climate and weather. The finding comes from more than a year’s worth of data from the Gravity Recovery and Climate Experiment (Grace), a joint partnership of NASA and the German Aerospace Center. … JPL selected Northrop Grumman Space Technology of Redondo Beach as the contractor for co-designing the proposed Prometheus Jupiter Icy Moons Orbiter spacecraft. The mission would launch in the next decade. … NASA extended funding for the Spirit and Opportunity rovers for an additional six months of operations. … JPL computer engineers created a system called Object Oriented Data Technology Software that will connect information from hospitals all over the world into one virtual intensive care unit. The system would link doctors with researchers willing to share their data about pediatric medicine, and might eventually allow high-tech surgeries to be performed in a remote country. … New infrared images from Spitzer and the University of Wyoming Infrared Observatory revealed a never-before-seen globular cluster within the dusty confines of the Milky Way. Called globular clusters, these ancient bundles of stars date back to the birth of our Milky Way galaxy, about 13 billion years ago. …

OCTOBER

A new JPL-managed mission was approved by NASA to proceed into the preliminary design phase. The Wide-field Infrared Survey Explorer will scan the entire sky in infrared light in search of nearby cool stars, planetary construction zones and the brightest galaxies in the universe. The next in NASA’s Medium-class Explorer program of lower cost, highly focused, rapid-development scientific spacecraft, it is scheduled to launch in 2008. … The first radar images of Saturn’s moon Titan showed a very complex geological surface that may be relatively young. Previously, Titan’s surface was hidden behind a veil of thick haze. Early analysis of images and other data captured during Cassini’s Oct. 26 close flyby of Titan revealed greater surface detail than ever before and showed that Titan has lost much of its original atmosphere over time. … The Keck Interferometer team installed a new instrument that can make stars disappear almost completely from a telescope’s view and reveal the close-in regions where planets may have formed. The “nuller” instrument will be used to combine infrared light from both 10-meter Keck telescopes, permitting a “visibility” measurement that can measure the size of objects with exquisite precision. …

NOVEMBER

JPL was recognized on Scientific American magazine’s 2004 Scientific American 50, the publication’s prestigious annual list honoring outstanding acts of leadership in science and technology. The Lab was named Research Leader in the Aerospace category “for demonstrating the power of robots to explore the planets.” … Two new results from Spitzer helped astronomers better understand how stars form out of thick clouds of gas and dust, and how the molecules in those clouds ultimately become planets. Two discoveries—the detection of an oddly dim object inside what was thought to be an empty cloud, and the discovery of icy planetary building blocks in a system believed to resemble our own solar system in its infancy—were presented Nov. 9 at the first Spitzer science conference, held in Pasadena. …

DECEMBER

Cassini completed a successful rendezvous with Saturn’s moon Titan on Dec. 13. This was the last pass before the Huygens probe was sprung loose from Cassini on Christmas Eve. … The Aura spacecraft began providing the first daily, direct global measurements of low-level ozone and many other pollutants affecting air quality. … Science magazine chose the Mars Exploration Rovers mission as the scientific “Breakthrough of the Year” for 2004. … The Galaxy Evolution Explorer spotted what appeared to be massive “baby” galaxies in our corner of the universe. It also offered astronomers their first, close-up glimpse at what our galaxy probably looked like when it was in its infancy. … NASA selected eight proposals to conduct preliminary design studies to provide instrumentation and science investigations for the Mars Science Laboratory rover; scheduled for launch in 2009. The JPL-managed mission will explore a local region as a potential habitat for past or present life. … The European Space Agency’s Huygens probe successfully detached from the Cassini orbiter Dec. 24 to begin a three-week journey to Titan.
**Passings**

**PHILLYS WARD BARGEL** 79, a retired research engineer, died Aug. 21, 2022. Arrangements are by Susan’s of Los Angeles, 310-261-0757.

Riggs joined the Lab in 1950. She worked on several projects with JPL’s Radar and Passive Sensors of the late 1960s and the Viking landers that explored Mars in the 1970s. She retired in 1981.

Phillies was born in her husband, Norman, along with a sister and nu-

**DAMON SIMONELLI,** 45, a senior researcher and the manager of the Scientific National Research Council who worked in biosciences, passed away unexpectedly on Dec. 1, near his home in Del Mar. His survivors include Simonelli’s mother, Lisa; his father, Frank; his brother, Jack; and his sister, Jen.

**GEORGE REEVES,** 60, a programmer who worked on the data recorder for the Viking orbiter and also worked on the CRASS/Amass mission, died Dec. 7. Reeves worked at the Lab from 1985-91. He is survived by his wife, Patti. Services were private.

**WILLIAM “BILL” BACHMAN,** 76, retired from the former Marine Systems and Telecommunications Division (341), died Dec. 11, 2022. Bachman joined JPL in 1957. Upon his retirement in 1996 he was serving as the acting deputy manager of Dossi-

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**WANTED**

We are seeking additional items for sale, especially those pertaining to physics. Let us all bid as an auction on the ownership documents.

**WANTED**

- An 8-oz. 24-carat gold coin, $200.
- A 10-carat diamond ring, $100.
- A 18-carat white gold ring, $50.
- A 14-carat yellow gold ring, $25.
- A 14-carat rose gold ring, $15.
- A 14-carat green gold ring, $10.
- A 14-carat blue gold ring, $5.
- A 14-carat pink gold ring, $0.
- A 14-carat white gold ring, $0.
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