

Challenges faced with confidence

Despite an uncertain federal budget and lean economic times, JPL Director Charles Elachi remains confident that the Laboratory can maintain a robust portfolio of missions, technology and science in coming years.

In an all-hands talk Nov. 28, Elachi said NASA's fiscal year 2012 budget, approved in late November, reflects a cut of about 3 percent, to \$17.8 billion. "In this environment that's pretty good," he noted.

NASA's science budget, which was \$4.47 billion two years ago and \$4.9 billion last year, increases in FY 12 to \$5 billion. Most of that increase is directed to the James Webb Space Telescope.

Elachi pointed to one of JPL's ongoing strengths: its growing portfolio of NASA Earth science missions. The FY 12 NASA Earth science budget is at \$1.766 billion, about a 2 percent reduction from 2011; at JPL, the Earth science budget in FY 12 is about the same amount as the Mars and planetary programs put together. "There's been a significant broadening of our base so we don't have to depend on one area" to support the Laboratory, he said.

"All activities at JPL have been roughly funded at the level we've needed," Elachi said. He projected that JPL's budget this year, which in FY 11 was \$1.547 billion, would be \$1.512 billion in FY 12. This includes a previously implemented reduction in the Lab's burden budget by about 7 percent, while preserving an increase in the Lab's investment portfolio of 2 percent. While the Lab must consider belt-tightening in all areas at this time, Elachi stressed, it's still important to keep an eye on the future.

Elachi said that over the last year an increase in retirements, reduced hiring and layoffs resulted in a reduction of 311 people at JPL. From that, 246 were layoffs—roughly half in technical divisions, half from burden-funded work.

JPL is pursuing follow-on work to its efforts on the Department of Defense's Advanced Mirror Development project, for which the Lab has received high praise. If this additional work comes about and JPL is able to secure a new flagship planetary or Mars mission, Elachi said he is confident that over the next five years JPL can sustain its employee level at 5,000, plus or minus 100.

While noting that "we're in pretty good shape," for FY 12, Elachi noted that FY 13 is much less assured. Congress' bipartisan "Super Committee" recently announced it was unable to negotiate at least \$1.2 trillion in deficit-reduction measures over 10 years, which "in principle would trigger an automatic cut of about 10 percent across the government," he added. Although he doesn't envision such cuts would affect any of JPL's missions under development, Elachi said the extent of the effect on NASA is unknown, if it happens at all.

"Clearly, during the next 20 months while we plan for 2013 there's going to be a lot of uncertainty, but we're just going to have to learn to live with it," Elachi said.

The director remains optimistic that the Lab's diverse expertise and capabilities will keep it moving forward. A good example is the Lab's work in non-mission areas.

Elachi praised JPL's "superb work" in NASA's growing technology arena, which is budgeted at \$575 million next year. "We're pursuing opportunities aggressively," he said. In addition, "Now that NASA has defined a direction for the human program, what we have invested in building those relationships should pay off." JPL recently received \$7 million to work on a definition phase for a telescope targeted for the International Space Station.

In addition to pursuing new Mars and Europa flagship opportunities, the Lab will continue to seek opportunities in all of NASA's competitive areas: the New Frontier and Discovery classes for planetary; the Venture class missions in Earth science; and the Explorer Program for astrophysics.

"We have got to get away from the thinking that if we don't have a flagship mission, we're in deep trouble," he said. "That's not true."

He cited technology flight demonstrations—one of which was assigned to JPL in recent weeks—that add up to about \$250 million, about the same level as an Explorer mission. Also, he stated that the collection of Earth science missions is equivalent

Elachi addresses staff on upcoming budgets, activities

By Mark Whalen

to a flagship mission.

Elachi also stressed the importance of streamlining internal processes for "Class D" missions (\$100 million to \$500 million). "We need to look at how we organize and manage smaller missions," he said, suggesting that some of the management levels on larger projects might not be needed for smaller ones.

Elachi noted the continued, critical support of Rep. David Dreier and Rep. Adam Schiff, who represent local districts in Congress, along with that of California senators Dianne Feinstein and Barbara Boxer. He also expressed appreciation for the longtime support of NASA's space science programs by Maryland Sen. Barbara Mikulski and Rep. John Culberson of Texas.

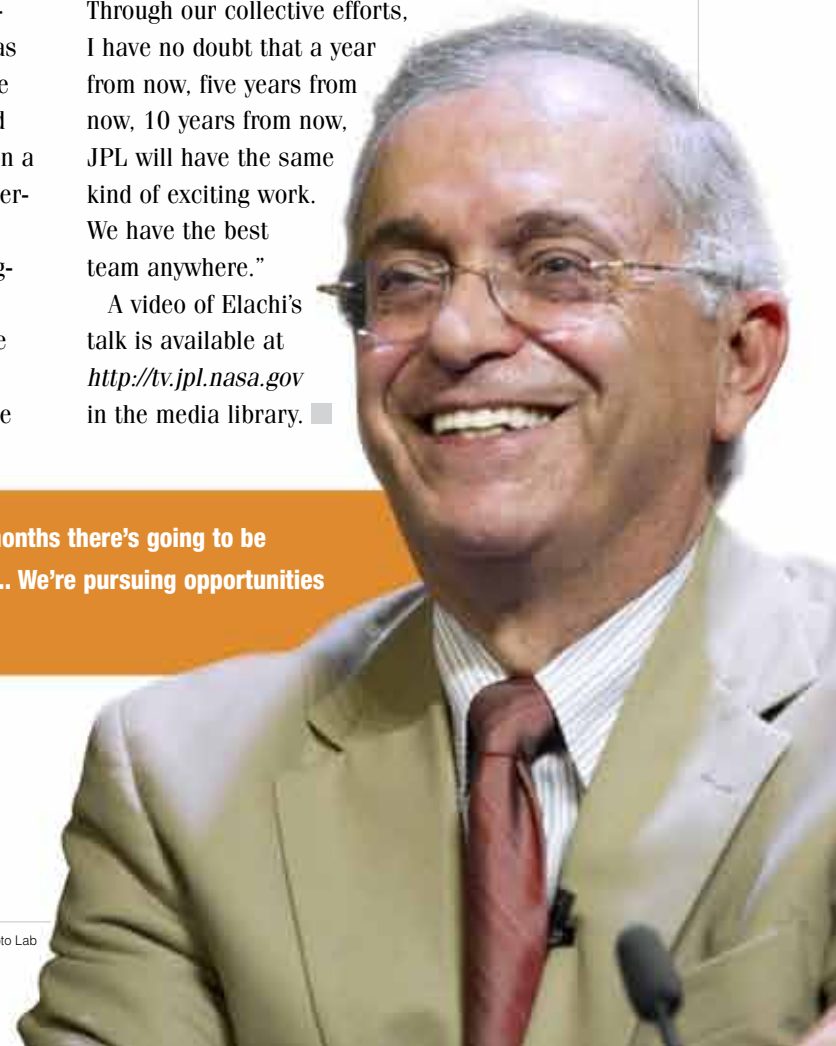
While mindful of the challenges and uncertainty facing the Lab, the director emphasized the importance of looking ahead and planning for future challenges.

"We're not sitting down, waiting until things happen to us," Elachi said. "We are proactively trying to do things that will put us in a sound position. Through our collective efforts,

I have no doubt that a year from now, five years from now, 10 years from now, JPL will have the same kind of exciting work. We have the best team anywhere."

A video of Elachi's talk is available at <http://tv.jpl.nasa.gov> in the media library. ■

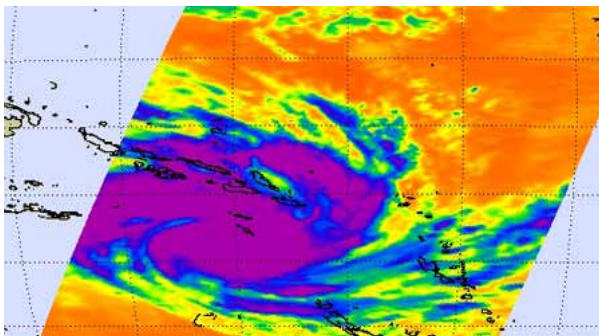
During the next 20 months there's going to be a lot of uncertainty. ... We're pursuing opportunities aggressively.



2011

IN REVIEW

In one of JPL's busiest years, the Lab launched four missions, flew by a comet and arrived at an asteroid. These and other major achievements and discoveries are highlighted below.



01

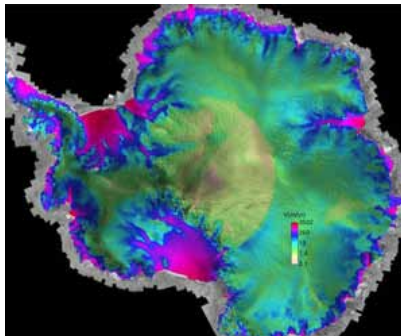
In January, the Atmospheric Infrared Sounder instrument on NASA's Aqua satellite, built and managed by JPL, provided images of cyclone Yasi (above), one of the largest such storms ever to hit the Australian continent, which caused mass evacuations in the northeastern state of Queensland. The instrument creates an accurate 3-D map of atmospheric temperature, water vapor and clouds, data that are useful to forecasters. ...



02

JPL's Stardust spacecraft completed a flyby of comet Tempel 1 Feb. 14 (above) at a closest approach of about 178 kilometers (111 miles), a bonus mission for the comet chaser that previously flew past comet Wild 2 and returned samples from its coma to Earth. The spacecraft obtained images of Tempel 1's surface to observe changes since JPL's Deep Impact spacecraft impacted it in 2005. ... JPL's Advanced Spaceborne Thermal Emission and Reflection Radiometer instrument on NASA's Terra spacecraft imaged the Christchurch, New Zealand, region a day after a magnitude 6.3 earthquake rocked the area Feb. 22. The imaging was done at the request of the International Charter, Space and Major Disasters, which provides emergency satellite data to federal agencies in disaster-stricken regions. ...

03



The findings of a study released in March and led by Eric Rignot of JPL and UC Irvine showed that the Greenland and Antarctic ice sheets are losing mass at an accelerating pace. Rignot's team combined nearly two decades (1992–2009) of monthly satellite measurements with advanced regional atmospheric climate-model data to examine changes in ice-sheet mass and trends in acceleration of ice loss (above). ... The extent of damage from the destructive and deadly tsunami triggered by the March 11, magnitude 8.9 earthquake centered off Japan's northeastern coast was revealed in images from JPL's Multi-angle Imaging SpectroRadiometer instrument on NASA's Terra spacecraft. Also, new before-and-after images from Terra's Advanced Spaceborne Thermal Emission and Reflection Radiometer instrument showed damage in a region of Japan's northeastern coast. ...

04

Observations from the W.M. Keck Observatory in Hawaii in April uncovered one of the youngest galaxies in the distant universe, with stars that formed 13.5 billion years ago, a mere 200 million years after the Big Bang. The finding addresses questions about when the first galaxies arose, and how the early universe evolved. ... More than 30 years after they left Earth, JPL's twin Voyager probes reached the edge of the solar system and prepared to enter the realm of interstellar space in our Milky Way galaxy. ...

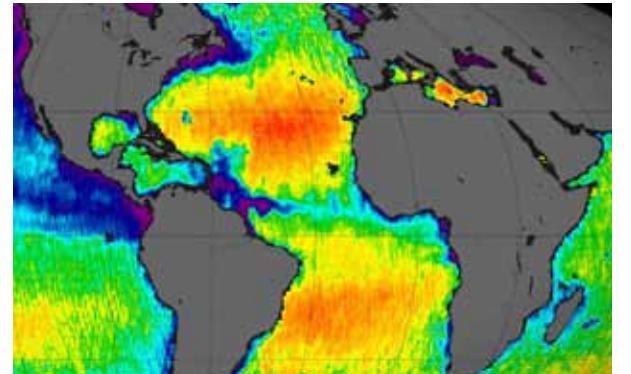


05

More than 38,000 visitors attended the Lab's annual open house May 14–15 (right). ... New data analysis from JPL's Galileo spacecraft revealed a subsurface ocean of molten or partially molten magma beneath the surface of Jupiter's volcanic moon Io. The finding was the first direct confirmation of this kind of magma layer at Io and explains why the moon is the most volcanic object known in the solar system. ... JPL ended operations for the Spirit rover and transitioned the Mars Exploration Rover Project to focus on Spirit's still-active twin, Opportunity. Spirit last communicated on March 22, 2010. ...

06

JPL's Aquarius instrument, which will measure the salinity of Earth's oceans to advance our understanding of the global water cycle and improve climate forecasts, launched into orbit aboard Argentina's Aquarius/SAC-D spacecraft June 10. The instrument's first global salinity map (below) was released in September. During the mission's three-year baseline, Aquarius will produce a global map every seven days. The mission's in-orbit checkout phase ended Dec. 1, signifying the start of the science mission through November 2014. ... JPL's Cassini spacecraft discovered the best evidence yet for a large-scale saltwater reservoir beneath the icy crust of Saturn's moon Enceladus. The data came from the analysis of ice grains close to the jets ejected from the moon. The salt-rich particles have an "ocean-like" composition and indicate that most, if not all, of the expelled ice and water vapor comes from the evaporation of liquid salt water. ...



07

JPL's Dawn spacecraft on July 15 entered orbit around asteroid Vesta (below), becoming the first probe ever to do so in the main asteroid belt between Mars and Jupiter. Among Vesta's tantalizing features is a mountain in the south polar region almost three times as high as Mt. Everest. Dawn is on schedule to reach its lowest-altitude science orbit (an average of



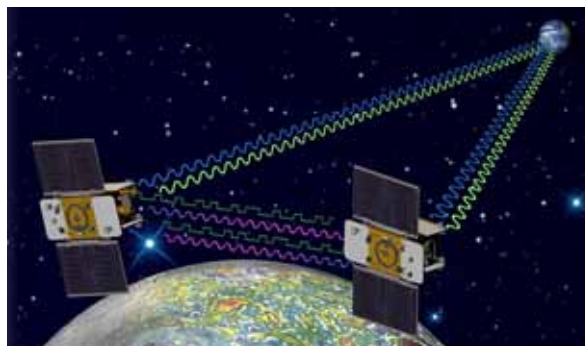
210 kilometers or 130 miles) and begin observations on Dec. 12, continuing through next April. Observations of Vesta will be conducted from two very different orbits before Dawn departs next summer to begin its flight toward dwarf planet Ceres, to be orbited in 2015. ... JPL and Chevron Corp. announced a partnership to develop advanced technologies that can be used in harsh environments, both on Earth and in space. JPL will assist in the demonstration, development and commercial deployment of technologies that benefit from JPL's heritage in space exploration. ...



JPL's Juno spacecraft lifted off from Florida's Cape Canaveral Air Force Station Aug. 5 (above) to begin a five-year journey to Jupiter. Juno will investigate the existence of a solid planetary core, map Jupiter's intense magnetic field, measure the amount of water and ammonia in the deep atmosphere and observe the planet's auroras. The spacecraft will receive its first trajectory-correction maneuver in early February. The major focus for 2012 will be deep space maneuver main engine burns Aug. 30 and Sept. 3. ... Observations from JPL's Mars Reconnaissance Orbiter revealed possible flowing water during the warmest months on Mars (below). Dark, finger-like features appeared and extended down some Martian slopes during late spring through summer, faded in winter, and returned during the next spring. Repeated observations tracked the seasonal changes in these recurring features on several steep slopes in the middle latitudes of Mars' southern hemisphere. ...



JPL's twin lunar Gravity Recovery and Interior Laboratory (GRAIL) spacecraft lifted off from Cape Canaveral Air Force Station in Florida Sept. 10 to begin a three-month mission to study the moon in unprecedented detail. The two spacecraft will fly in tandem orbits to measure the moon's gravity field and will give scientists a better understanding of how Earth and other rocky planets in the solar system formed. GRAIL-A is scheduled to reach the moon on New Year's Eve 2011, while GRAIL-B will arrive New Year's Day 2012. From there, it takes two months to align the



orbits before starting science operations on March 8 (above). ... A team led by JPL research scientist Essam Heggy used radar sounding technology developed to explore the subsurface of Mars to create high-resolution maps of freshwater aquifers buried deep beneath a Kuwait desert, in the first use of airborne sounding radar for aquifer mapping. The research may help scientists better understand current and past hydrological conditions in deserts and assess how climate change is impacting them. ... The JPL-developed Kepler mission made the first unambiguous detection of a circumbinary planet—a planet orbiting two stars—200 light-years from Earth. Kepler detected such a planet, Kepler-16b, by observing transits, where the brightness of a parent star dims from the planet crossing in front of it. "This discovery confirms a new class of planetary systems that could harbor life," said Kepler Principal Investigator William Borucki of Ames Research Center. ...

More than seven years after completing their three-month prime missions on Mars, the Spirit and Opportunity rovers in October were named to receive lifetime achievement award honors by Popular Mechanics magazine. Mars rover engineers, and the rovers themselves, were cited "for overcoming great challenges in their dogged pursuit of new discoveries on the Red Planet." ... NASA and Japan released a significantly improved version of the most complete digital topographic map of Earth, produced with images from the Advanced Spaceborne Thermal Emission and Reflection Radiometer instrument aboard Terra. JPL's Mike Abrams, science team leader for the instrument, said the data can be used for a broad range of applications, from planning highways and protecting lands with cultural or environmental significance, to searching for natural resources. ...



JPL's Deep Space Network antenna in Goldstone, Calif. captured new radar images of asteroid 2005 YU55 as it safely flew past Earth slightly closer than the moon's orbit on Nov. 8. At the point of closest approach, it was no closer than 201,900 miles (324,900 kilometers) as measured from

the center of Earth, and the gravitational influence of the asteroid had no detectable effect on Earth, including tides and tectonic plates. The encounter with Earth is the closest it has come for at least the last 200 years. ... Mars Science Laboratory launched toward its eight-month journey to the Red Planet Nov. 26 (above). The Curiosity rover, the most sophisticated vehicle ever to travel to another planet, will assess whether the Gale Crater landing site has ever offered conditions favorable for microbial life. The mission will last about two Earth years (one Mars year) beginning next August.

Muir solar boat impresses

JPLers | By Susan Braunheim



Muir students Louie Velasco, right, and Rose Reyes, next to her, chat with JPLer Kim Aaron, left, about their winning solar boat.

A solar-powered boat built by students at Pasadena's John Muir High School took home a surprising win in a regional competition earlier this year with some support from JPL and Caltech engineers.

The 14-member team from Muir High School's Engineering and Environmental Sciences Academy who worked on the boat upset more experienced teams to win the regional championship at the annual three-day Solar Cup race held at Lake Skinner in Riverside County in May.

JPL has an ongoing relationship with Muir High School. In the past, JPL engineers have mentored a FIRST Robotics Competition team. More recently, Muir has become home to the Engineering and Environmental Sciences Academy, part of the Pasadena Unified School District and the Pasadena Educational Foundation "Pathways" program.

Muir students displayed their winning boat at JPL Nov. 14 by invitation of Lab Director Charles Elachi, who had visited the school earlier this year and was impressed with the boat and the team. JPL's Diversity and Inclusion Committee hosted the team with the Education Office. The students even got an opportunity to meet with the Executive Council and participate in a design review.

Tracy Van Houten, a systems engineer for Mars Science Laboratory, is a member of the advisory board for the Engineering and Environmental Sciences Pathway. She feels that both JPL and the students gain from the experience. "Being involved with solar boat or any of the mentorship opportunities with Muir

Continued on page 4



JPL sustained mostly minor damage from a severe windstorm that pounded the San Gabriel Valley Nov. 30 and Dec. 1. The Lab's Woodbury facility was closed to staff during the storm but generators worked throughout the outage to keep the data center operational. Power was restored at 3:15 p.m. Friday, Dec. 2. At the Oak Grove facility, ground crews cleared tree and ground debris through Dec. 3. Repairs and replacements were scheduled for two structures, including Building 322 (above), and all equipment/structure debris blown off roofs was secured.

News Briefs

Erik
Conway

Conway garners honor for 'Merchants of Doubt'

JPL historian Erik Conway and his co-author of the 2010 book "Merchants of Doubt" have been awarded a major honor for best general audience book in the history of science.

The History of Science Society awarded the Watson Davis and Helen Miles Davis Prize to Conway and co-author Naomi Oreskes, a professor of history and science studies at UC San Diego and an adjunct professor of geosciences at the Scripps Institution of Oceanography. The book examines public debates about five of the leading environmental and public-health questions of the past half-century—DDT, tobacco smoke, acid rain, the ozone hole and global warming—and reveals a historical pattern in which a small group of science advisors undermine scientific findings and raise doubt about the work of scientific experts.

Conway joined JPL in 2004 after serving as a historian at NASA's Langley Research Center.

Matousek named institute fellow

Steve Matousek of the Mission Systems Concepts Section was re-

Steve
Matousek

cently elected an associate fellow of the American Institute of Aeronautics and Astronautics.

Associate fellows are individuals of distinction who have made notable and valuable contributions to the arts, sciences, or technology of aeronautics or astronautics. Formal presentation will be in conjunction with the 50th American Institute of Aeronautics and Astronautics Aerospace Sciences meeting in Nashville, Tenn. in January.

Matousek joined JPL in 1985. Currently, he is the JPL Innovation Foundry study lead and is capture lead/proposal manager for the Fast Infrared Exoplanet Spectroscopy Survey Explorer, Phase A. Previously he managed the Mars Scout Program and the Mission Concepts Section, and has led numerous deep-space and astrophysics mission studies and proposals.

JPLers to lead Southeast Asia airborne campaign

Four JPL researchers have been named to lead investigations for NASA's Southeast Asia Composition, Cloud, Climate Coupling Regional Study in support of the Earth Science Division.

Lance Christensen will lead a study that proposes to fly the Aircraft Laser Infrared Absorption Spectrometer on a NASA ER-2 aircraft. The high sensitivity and time resolution will permit the device to distinguish features as small as aircraft contrails.

David Diner will lead deployment of the Airborne Multiangle SpectroPolarimetric Imager instrument, which flies in the nose of the ER-2 aircraft. The instrument is an advanced version of the airborne version of JPL's Multi-angle Imaging SpectroRadiometer currently flying on Terra.

Robert Herman will lead a study that proposes to provide in-situ measurements to characterize water vapor in the upper troposphere/lower stratosphere. These measurements will be made with the JPL Laser Hygrometer, an instrument with a long heritage on NASA aircraft.

lanberger; and two grandchildren. A memorial was held in Quartz Hill, Calif.

Robertson
Stevens

Robertson Stevens, 89, who was instrumental in developing communications systems for numerous JPL missions, died Nov. 12.

Stevens joined JPL in 1949, following graduation from the United States Naval Academy. His 42-year career at the Lab focused on the construction of the Deep Space Network. He is credited as a key contributor to the communications systems for the Viking, Mariner, Voyager, Seasat Earth Orbiting, Magellan and Galileo missions.

He is survived by his wife, Laurie; children Daryll, Brett, Bryn, Bruce, and Darcy Koemans; 10 grandchildren and

JPLers take agency software honors



Dutch Slager / JPL Photo Lab

A JPL team that developed the Autonomous Exploration for Gathering Increased Science technology and its implementation aboard the Mars Exploration Rover Opportunity was named winner of the NASA Software of the Year Award.

Front row, from left: Robert C. Anderson, Benjamin Bornstein, Dan Gaines, Michael Burl. Back row, from left: Tom Soderstrom, head of JPL's Office of the IT Chief Technology Officer; JPL Director Charles Elachi; Tara Estlin; Rebecca Castano; Michele Judd; David Thompson; Chris Jaggars of the Innovative Technology Asset Management Office. Team member David Thompson is not pictured.

For more information on the winning software, visit <http://aegis.jpl.nasa.gov>.

SOLAR BOAT *Continued from page 3*

allows JPLers to share their passion for engineering and science and to give back to their community in a very meaningful way," she said. "We are helping to shape, mold and inspire the next generation of engineers and that's good for JPL as well as for our country as we face a lack of students choosing to enter science, technology, engineering and math-related fields."

"Learning how to use a drill for the first time, driving a boat, the spirit of competition and sportsmanship, the laughter shared over small talk is all so

important," said Beverly Rodriguez, the Solar Cup advisor at Muir. "Day-to-day you see them grow and discover their own limits and potential."

Co-captain Rose Reyes, an 18-year-old senior, will serve as the boat's skipper this year. "I spent so many hours working on this. It has really made me feel like a part of something big," she said. "Winning last year was so rewarding because in years past we hadn't had very good boats. It feels so good knowing that our innovations and efforts made to our previous designs paid off." ■

Simone Tanelli will lead a proposal to provide radar observation of cloud microphysics and dynamics in convective environments using airborne second-generation precipitation radar.

The funded research is part of an airborne campaign in Southeast Asia whose goals include a quantitative understanding of the processes control-

ling atmospheric composition in the troposphere and upper atmosphere as affected by natural and anthropogenic surface emissions and vertical convection. Airborne, ground-based and satellite-based observations will be incorporated using models to bridge spatial and temporal scales. ■

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Passings

William Tibbitts, 75, retired supervisor of JPL's former Edwards Test Station, died Sept. 8.

Tibbitts joined JPL in 1968. He initially worked as a photographer at the Edwards Test Station and in 1970 received an award from NASA's Inventions and Contributions Board for his design of a protective enclosure for a camera, located on the centerline of the exhaust stream of a rocket engine, that permitted continuous recording of the erosion processes of metals used in nozzles.

Tibbitts was named supervisor of the Edwards Test Station in 1994. JPL closed the station the next year, and the facility's staff were all reassigned. Tibbitts, who later worked in the Solid Propellant Section, was also the recipient of a NASA Exceptional Achievement Medal in 1996. He retired in 2002.

Tibbitts is survived by his wife, Andrea; children Billy, Debbie and Destiny Tibbitts, A.J. Szoke and Norm Schul-

two great-grandchildren. Stevens' family requests considerations of donations in his memory be made to The First Tee of Pasadena, www.thefirstteepasadena.org.

Letters

I would like to thank my friends and colleagues for all the kindness shown to me after the passing of my little sister, Monica Lynn Parker. The plant and cards I received from everyone are still kept close at hand and in view for the strength they bring me as I try to adjust to this new reality. She was an artist, a comedienne, and a true force of nature. I wish you could have all known her.

Lori Mooradian

My family and I would like to thank all my friends and colleagues for their kind words and condolences after the passing of my father; your thoughts helped us through a very difficult time. We'd also like to thank the ERC for the lovely plant.

Stacy Weinstein-Weiss

My family and I would like to thank all of the members in the Facilities Division for the beautiful flowers you so kindly sent in remembrance of the passing of my dear mother. Your kind words of comfort and generosity were greatly appreciated and heartfelt. I would also like to thank the JPL ERC for the beautiful plant.

Terry Gentry

My family and I would like to thank our friends at JPL for the beautiful plants that we received in remembrance of my father, Stewart. He would have appreciated the gesture, having proudly worn the JPL and NASA jackets and sweatsuits that he received as birthday presents over the years.

Scott Bowdan

Retirees

The following JPL employees retired in November:

Kenneth Kimball, 46 years, Section 9210; **Joseph Wackley**, 35 years, Section 9200; **Robert Losey**, 32 years, Section 356E; **Rodney Hoffman**, 19 years, Section 388K.