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Carol Lachata / JPL Photo Lab

Busiest year coming up, Elachi says

Director delivers 'State of the Lab' address

By Mark Whalen

With 19 spacecraft currently in operation across the solar system, JPL won't be resting on its laurels anytime soon. In his semiannual state of the Laboratory address Oct. 27, JPL Director Charles Elachi told employees to expect the busiest year ever in fiscal 2009.

Noting that this next set of challenges is underway with the Oct. 22 launch of India's Chandrayaan-1, which includes JPL's Moon Mineralogy Mapper instrument, Elachi said JPL will launch four missions in calendar year 2009 along with significant participation in a key pair of missions led by the European Space Agency.

Launches are planned for the Orbiting Carbon Observatory (January), Kepler (April), Mars Science Laboratory (October) and Wide-field Infrared Survey Explorer (November). JPL also has major instrumentation for the European Space Agency's Herschel-Planck mission (April launch).

To be sure, a successful launch for Mars Science Laboratory is critical for the Laboratory in the year to come.

"There's no question MSL is the toughest thing this institution has undertaken," Elachi said. "But this is the kind of mission we should be doing; we're not supposed to be doing routine things.

"We underestimated how tough MSL was," he continued. "We still have a significant amount of challenges, but the team is making great progress. The next three or four months are particularly critical—by January, we will have finished hardware development and the first environmental testing. If we don't get it done by January and understand all the issues, it could jeopardize our ability to launch in 2009. We are not going to launch this mission unless we have done everything possible to mitigate risks. This is a flagship mission, it's highly visible, and it will be our highest priority."

Elachi also noted the key contributions made by JPLers who don't work on the technical aspects of the Mars Science Laboratory spacecraft. He expressed his appreciation to Michele Schneider, who did "an excellent job" negotiating a major contract for the project. "It's not only the technical people on MSL who are critical, it's everybody," Elachi said.

The director noted that because more funds were needed for Mars Science Laboratory to make its launch, some projects were asked to minimize their budget carryover into next year. This action, he said, will not impact any project or its funding need for this year.

Overall, JPL is in "reasonably good shape," Elachi said, despite uncertainty with respect to the NASA budget. Congress passed a continuing resolution through March, meaning that until then the agency can only spend at last year's rate.

"As of now, even with the continuing resolution, we're looking for a stable year," he said. "Basically, all of our projects are funded and are on track."

In Earth science, beyond Orbiting Carbon Observatory lies Aquarius, which launches in 2010, and the Soil Moisture Active and Passive mission, an in-house project that is approved and in formulation for a 2012 launch. Also, Elachi reminded the audience that an office has been formed to coordinate JPL's contributions to understanding global change. Funding has been acquired to partner with Lawrence Livermore National Laboratory. "We want to make contributions that will make a fundamental difference," he said.

In the planetary area, Juno and Grail are fully funded. In addition, under study are possible missions to a Titan/Saturnian system and a Europa/Jovian system. Elachi said NASA Headquarters would decide early next year about the sequence in which they will be done. He believes the missions will launch in 2016 or later. "In the NASA budget profile, there is a significant amount of funding in the next couple of years to get one of these activities started," he noted. Announcements of opportunity are also expected next year for the Discovery (2014 launch) and New Frontiers (2016 launch) programs.

Elachi praised the efforts of NASA space science chief Ed Weiler in restoring funding to the Mars Program. "It's critical to have Mars launches at every opportunity," Elachi said. Indeed, following Mars Science Laboratory, JPL will have program responsibility for the Mars Atmosphere and Volatile Evolution mission, a Goddard Space Flight Center–managed, principal investigator mission set for a 2013 launch. NASA is also planning a Mars 2016 mission, most likely with a lander and rover. "This will probably need to be defined within the next six months," he said.

JPL's astrophysics efforts will move forward with NuStar, Wide-field Infrared Survey Explorer and Kepler fully funded. Elachi also noted that NASA has decided JPL will manage an upcoming exoplanet mission, with the specific concept not yet fully determined and up for competition.

Non-NASA work, now funded at about $170 million or about 10 percent of the Lab's activities, is expected to be "somewhat higher" next year, with a goal of 13 to 15 percent a few years downstream. "We have been very successful in working with agencies other than NASA in developing very advanced space technologies," Elachi said. "The technology program is critical for us to be at the leading edge."

The director noted an unprecedented amount of planning activity for the Deep Space Network, with "serious discussion" about developing a set of antennas to replace the 70-meter dish by 2015 that would include an investment in optical communication. "We will be playing a significant role; we'll be responsible for the deep-space optical communication, while Goddard will handle near-Earth," he said.

Elachi also outlined institutional activities of note.

• The new Flight Projects Center, about 70 percent complete, is on schedule and on cost. The building, which will have 620 offices, 20 conference rooms and an auditorium to hold 450 people, is due for occupancy in July 2009.

• Elachi said that in the last two years, the Lab has saved 9 million kilowatts of power, resulting in a $500,000 energy rebate from Edison. Further, JPL Facilities has installed a 30-kilowatt photovoltaic sys-

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State of the Lab

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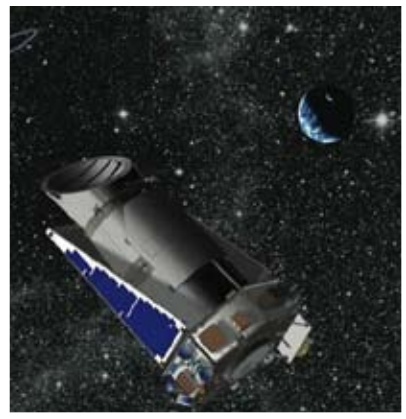
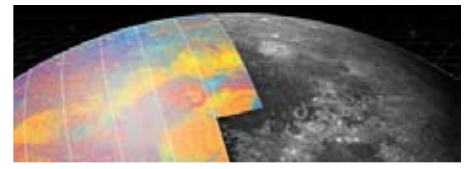
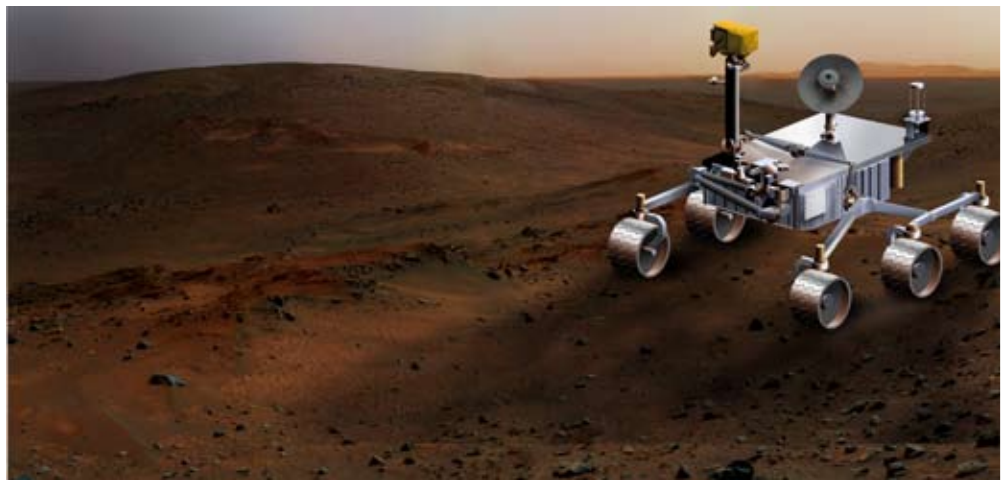
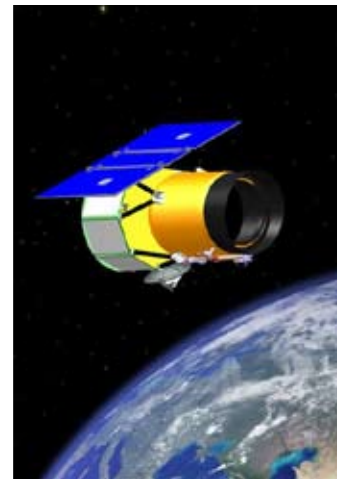








tem on Building 302 and re-roofed 17 buildings with energy-efficient reflective roofing. JPL won a NASA-wide competition for the "Blue Marble" for excellence in energy management. JPL has a history, he noted, of contributing studies related to energy efficiency efforts such as electric cars and solar power, which is currently highlighted in a display in Building 111. He also praised the Lab's recently introduced global climate change site at *http://globalclimatechange.jpl.nasa.gov.*

• Elachi expressed appreciation for JPL's emergency preparedness efforts, including a new communications system that will send early alerts first to employees who must be at work during a natural disaster or other emergency. The system was tested during the July 29 Chino quake, he said, with good results. He reminded the crowd that JPL will participate in the Nov. 13 "Southern California ShakeOut," a region-wide earthquake drill and preparedness check—based on a potential magnitude 7.8 earthquake—in which many area companies will participate. Elachi praised the efforts of JPL's Office of Protective Services in helping employees prepare for the unexpected, including the establishment of an emergency preparedness website *(http://prepare.jpl.nasa.gov).*

• A critical item for FY '09 is the job classification redesign project. The program defines career paths in line management, program/project management and individual contributors, where the Fellows grade is at the same level—for salaries and benefits—as a senior project manager or senior line manager. "This gives technical employees who don't want to go into management the same opportunities to move up to the highest level at JPL," Elachi said, thanking Monica Garcia and her team in Human Resources for their efforts.

• Elachi said burden budget rates for FY '09 were a bit higher than originally expected, but reminded staff that the Lab reduced the '08 burden rate at the end of the year and rebated money back to JPL organizations.

As examples of burden budget spending for FY '09, $10.3 million will be invested in a large-scale technology test facility—which will provide for testing of very large optics—as well as state of the art equipment for the microdevices and photonics labs. Also, allocations for research and technology development will be within a few percent of this year's budget, he said.

• In the Lab's efforts to prepare the next generation of JPLers, the director said he was "delighted" that last year 183 early career hires joined the Lab, many from the top universities in the country. Some of them have been assigned to self-defined "small but significant" projects including a study on the flight boom that deploys sensors on the Nuclear Spectroscopic Telescope Array and precision landing using sub-orbital rockets.

• A new graduate fellowship program led by Chief Scientist Dan McCleese—open to Americans and foreign nationals—will be established in November.

• Elachi noted a major accomplishment with the certification of JPL's procurement system that will provide "flexibility and authority in doing acquisitions."

• The director cautioned employees that Congress has stipulated tight restrictions on conference attendance for NASA in FY '09. He said JPL would not put tight restrictions on attendance at all conferences, but will focus on four or five highly attended events. "It doesn't apply specifically to JPL but we need to self-limit our attendance; if we are not sensitive to it, it could come back to bite us."

• Elachi praised the Lab's outreach efforts. "People love the kind of thing JPL does. That's very important, because we're being funded by the taxpayers. It's very critical we tell them what we're doing on their behalf." He noted the positive results by the Media Relations Office in garnering much media coverage for JPL and in developing the newly redesigned JPL website.

In conclusion, the director quoted his favorite U.S. President, Teddy Roosevelt, on the value of the endeavors JPLers put forth every day.

"Roosevelt said, 'Far and away the best prize that life has to offer is the chance to work hard at work worth doing.' And what we do is not only worth doing, it's work that's changing our idea of who we are in this universe, our concept of evolution in the universe and how we came about, and the public thinks we are doing things that definitely are worth doing."

United Way campaign underway

JPL's 2008–09 United Way campaign is now underway through Wednesday, Nov. 26. In concert with the campaign, the Lab's annual food drive is also underway through Nov. 20.

JPL's donations of non-perishable food items will go to local community food assistance programs. Collection barrels are located at Building 114, JPL Store lobby; 180, first and second floor lobbies; 198-105, office; 291, credit union; 301, second floor entrance; 303, first floor lobby; 601, first floor lobby.

United Way programs focus on helping families meet their basic needs like housing and affordable health care; improving educational achievement to help all kids graduate from high school and prepare for college and the workforce; and providing hard-working adults with the economic and employment opportunities they need to provide for their families' future.

To donate to United Way, log on to the campaign pledge form at *https://nbs.jpl.nasa.gov/login*. In the Employee Tool Kit, click on the "JPL United Way" link.

To find out how United Way is creating pathways out of poverty in the local community, the navigation bar also contains a link to the United Way of Greater Los Angeles website. For more information, call JPL's United Way coordinator, Nancy Kapell, at ext. 4-9432.

Walk to combat homelessness

JPLers are eligible to join the Caltech team participating in HomeWalk, a 5K event that is part of United Way's campaign to end homelessness in Los Angeles County, to be held Saturday, Nov. 15 at Exposition Park in Los Angeles.

HomeWalk is part of United Way of Greater Los Angeles' year-round campaign to end homelessness, called Pathway Home. The 2008 goal is to recruit an estimated 7,000 people and more than 250 volunteers to help raise approximately $750,000.

Registration will begin at 7:30 a.m., followed by an opening ceremony at 8:30 a.m. HomeWalk begins at 9 a.m.

All money raised from HomeWalk is distributed back into the community to help quickly rehouse homeless families and provide permanent housing with supportive services (e.g., job training, substance abuse treatment) to the chronically homeless. According to United Way of Greater Los Angeles, last year HomeWalk raised $500,000, helping more than 2,300 homeless people off the streets and into permanent housing over the next 12 months.

For more information, or to register online as a participant, visit *http://www.homewalkla.org*. To sign up for the Caltech team, click on Teams, then Team Listing, and scroll down to Team Caltech. Contact Caltech's Christine Boyle at 626-395-1745 for more information.

JPL mapper on moon flight

JPL has provided a key instrument onboard India's first mission to the moon, Chandrayaan-1, which launched from that nation Oct. 22.

The Moon Mineralogy Mapper is an imaging spectrometer whose primary science goal is to characterize and map the mineral composition of the lunar surface to gain information about the moon's geologic evolution, and will give scientists their first opportunity to examine lunar mineralogy at high spatial and spectral resolution.

JPL, which designed, built and tested the instrument and supported spacecraft integration, will manage science data archiving, processing and distribution to the science team. Scientific observations are expected to begin about a month after launch.

JPL's Rob Green is instrument scientist and Tom Glavich is project manager. The Moon Mineralogy Mapper team includes about 50 engineers and scientists, post-doctoral researchers, graduate and undergraduate students from more than a dozen American universities and research institutions.

Targets for the instrument will include such features as outcrops exposed at the walls and central peaks of large craters, complex volcanic terrain, boundaries where different kinds of rocks converge, unusual or rare compositions and polar regions. The instrument will also have a primary exploration goal of assessing the mineral resources of the moon at high spatial resolution.

The Moon Mineralogy Mapper team.

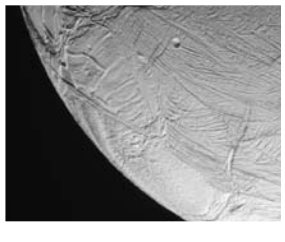
Along with other Chandrayaan-1 data, Moon Mineralogy Mapper results will be analyzed in decades ahead to identify and characterize landing and exploration sites and to locate resources necessary to help support future lunar explorers.

The Moon Mineralogy Mapper is one of two instruments provided by NASA for the mission. The other is a miniature synthetic aperture radar that will map the polar regions to look for ice.

The Moon Mineralogy Mapper is funded by NASA as a Discovery Program mission of opportunity. For more information, visit *http://moonmineralogymapper.jpl.nasa.gov*.

SEARCH FOR LIFE INTENSIFIES

Lab will lead two new teams in Astrobiology Institute



JPL has been named to lead two new teams in NASA's Astrobiology Institute to study the origins, evolution, distribution and future of life in the universe.

In the fifth round of team selections since the institute's founding in 1998, NASA last month awarded five-year grants, averaging $7 million each, to 10 research teams from across the country to become new members of the institute, located at NASA's Ames Research Center. The newly announced teams will begin their terms in early 2009.

Isik Kanik, manager of the Planetary Science Section, will lead the "Astrobiology of Icy Worlds" team, while Mark Allen, supervisor of the Earth and Planetary Atmospheres Group, will lead "Titan as a Prebiotic Chemical System." The pair discussed the new teams in recent Universe interviews.

By Mark Whalen

Q: WHAT ARE YOUR MAIN GOALS WITH THIS NEW RESEARCH?

Kanik: Icy worlds such as Europa, Enceladus, Titan and others are potential hosts to biological compounds and may harbor the greatest volume of habitable space in the solar system. For at least five of these worlds, considerable evidence exists to support the conclusion that oceans or seas may lie beneath the icy surfaces. The total liquid water reservoir within these worlds may be some 30 to 40 times the volume of liquid water on Earth.

Can life emerge and thrive in such cold, lightless oceans beneath many kilometers of ice? And if so, do the icy shells hold clues to life in the subsurface?

Our team's goal is to answer these questions by pursuing laboratory, numerical and field investigations into the habitability, survivability and detectability of life on icy worlds. These three investigations will collectively form a technology investigation to develop a path to flight for instruments designed to pursue this science further in space.

Allen: We're focusing on Titan in the here and now … or maybe back a few million years, but not much more than that. Titan is the only place in the solar system we know of where there is active organic chemistry and contact between organic chemistry and water, in different forms.

There will be three facets to our research: one is to consider the environment on Titan, where organics can actually come into contact with water in solid or liquid form, and under what circumstances contact would occur. The second is to consider how complex the chemistry in the atmosphere can evolve. In the third theme, we will explore how the organic chemistry on the surface can take what's coming out of the atmosphere and, in the variety of different situations like impacts or cryovolcanism, can generate even more complex chemical compounds, potentially bringing molecules to the threshold of the origin of life.

So this whole thing is really centered on chemistry. We'll use models and a lot of laboratory experiments. There is no fieldwork, as with many of the other NAI teams. We're going to rigorously do experiments under Titan-like conditions to understand in detail what types of processes can go on.

HOW MANY TEAM MEMBERS DO YOU HAVE, AND HOW MANY ARE FROM JPL?

Kanik: The Icy Worlds team consists of 47 researchers and education/public outreach specialists representing 21 institutions (including 17 universities, two non-profit research organizations and two NASA centers, including JPL) in 11 states, and four countries—the United States, France, Iceland and Italy. The majority of the work will be carried out here by 24 JPL investigators utilizing JPL's state-of-the-art laboratory and computational facilities.

Allen: There are 16 co-investigators on the science team, besides myself. In addition to six scientists from JPL and four Caltech faculty members, other co-investigators are from the University of Arizona, Georgia Institute of Technology and the Foundation for Applied Molecular Evolution. Also, a science team co-investigator from the Denver Museum of Natural Science will lead education and public outreach efforts.

HOW WILL YOUR DATA COMPARE WITH PREVIOUS STUDIES? HOW MIGHT IT BENEFIT FUTURE MISSIONS?

Kanik: Results from our investigations will be compared with various observations obtained by Galileo and Cassini. For example, the Cassini ion neutral mass spectrometer has been critical for understanding the plume on Enceladus and it is currently under discussion for future flagship mission payloads. With the Icy Worlds laboratory investigations on sputtered microbial cells we will be able to quantify and characterize the mass spectral biosignature of microbes irradiated in ice and provide an assessment of the utility of a ion neutral mass spectrometer for sputtered products around icy worlds such as Europa and Enceladus.

Other missions that will benefit from this work include two flagship missions (Europa Explorer and Titan Explorer) currently under consideration by NASA, as well as Jupiter System Observatory (remote observations of the

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"The majority of the work will be carried out here by 24 JPL investigators utilizing JPL's state-of-the-art laboratory and computational facilities."

Isik Kanik

"What we will do is test measurement protocols in the laboratory and see how useful they are on lab samples, then we can understand how useful they might be on a Titan mission."

Mark Allen

Carol Lachata / JPL Photo Lab

Jupiter system from Ganymede orbit) and New Frontiers–class missions to icy bodies such as Comet Odyssey. New results from this investigation will also help interpreting results from current missions to the moons of Saturn (Cassini), the large asteroids Ceres and Vesta (Dawn), and to the Pluto–Charon system and other icy dwarf planets in the Kuiper Belt (New Horizons). The focus of our research is critical, as these missions to the satellites of the outer planets and other icy bodies advance our knowledge about these worlds and, more importantly, provide information about their potential as abodes for life in the solar system.

Allen: The existing Cassini data provide motivation and a touch point for calibrating some of our work. The radar observations have revealed interesting places on the surface at which chemical evolution could occur, particularly places where there might be mixing between organics from the atmosphere and water ice or the potentiality for liquid water under some conditions, which could lead to quite elaborate prebiotic chemistry.

The organic chemistry in Titan's atmosphere is extremely rich; it motivates the question as to what level of complexity can chemical compounds evolve in both the atmosphere and surface environments. Our project will use a variety of models and laboratory experiments to make predictions for measurements to be made on a future Titan mission.

IS ONE OF YOUR GOALS THE DEVELOPMENT OF ASTROBIOLOGY INSTRUMENTATION?

Kanik: Yes. The search for life requires instruments and techniques that can detect biosignatures in space. Advancing this capacity is the focus of our technology investigation. Our technology development and demonstration will utilize astrobiology instrumentation previously built with non-NAI funding (e.g., Astrobiology Science and Technology Instrument Development, the Astrobiology Science and Technology Experiment Program and the Planetary Instrument Definition and Development Program). The instruments have not yet reached a technology readiness level adequate for flight but our team expects to achieve higher levels, a step or two closer to those adequate for flight. It is difficult to estimate a time scale for a future mission to carry astrobiology in-situ instrument to an icy world.

Allen: We chose not to develop specific instruments, but rather to consider what measurement techniques would be useful to elucidate composition in the atmosphere and on the surface, such that either the team or others might want to try and implement these ideas in instrument concepts. What we will do is test measurement protocols in the laboratory and see how useful they are on lab samples, then we can understand how useful they might be on a Titan mission.

ULTIMATELY, WHAT ARE THE BEST RESULTS YOU THINK YOU MIGHT ACHIEVE?

Kanik: In our investigation (with a total budget of approximately $8.3 million), our ultimate goal is to advance astrobiology by characterizing astrobiologically relevant environments through organic and inorganic chemistry, volatile inventory and elemental and isotopic measurements of complex microbial and biological materials. We can also further NASA's capabilities for discovering life elsewhere while improving our understanding of life here on Earth through an integrated approach to the habitability, survivability and detectability of life on icy worlds.

Allen: The best thing would be to see if in a non-biological system you can create amino acids and find that they actually incorporate themselves into a peptide sequence; there's potential for that in the nature of the experiments we'll be conducting across the board.

The NAI was looking for mission relevance. I think they're always looking for new approaches to doing astrobiology. So we provided a new perspective for the institute, having both the strong ties to the Titan mission and looking at astrobiology in a different way, a very intense way, for a very specific context.

News Briefs

Kudos to Phoenix

JPL's Phoenix Mars Lander mission has been awarded the National Space Club's Astronautics Engineer Award.

The nonprofit National Space Club established the Astronautics Engineer Award in 1991. It is given to scientists and engineers in the United States who have led and made significant contributions in rocketry and astronautics. Past recipients include NASA's Return to Flight Team and Alan Stern, former associate administrator for NASA's Science Mission Directorate.

Phoenix Project Manager Barry Goldstein accepted the award on behalf of the team at the Space Club's annual Dr. Wernher von Braun Memorial Dinner last month.

The dinner honors the memory of von Braun, the first director of NASA's Marshall Space Flight Center and one of the most important rocket developers and champions of space exploration in the 20th century.

"This award recognizes that our team really met the ideals of the von Braun legacy," said Goldstein. "Being recognized at a ceremony named for one of the seminal engineers in our industry is a true honor for our teams at JPL, Lockheed Martin, the University of Arizona and the many other organizations responsible for our success."

Proposal wins noted

Numerous JPL researchers have been named as principal investigators on recently awarded NASA proposals.

In a solicitation to develop a portable sensor from airborne platforms to address key research goals of the NASA Ocean Biology and Biogeochemistry Program, Pantazis Mouroulis of the Optical Technology Group will lead "Portable Remote Imaging Spectrometer for Ocean Biology Research." The study proposes to advance scientific understanding and meet societal needs by using airborne sensor technology to address the impact of episodic hazards and pollutants affecting coastal ecosystems and communities.

Three JPL teams were selected for Astrobiology Science and Technology Instrument Development and Mission Concept Studies, including Concept Studies for the Small Payloads and Satellites Program.

Brian Drouin of the Laboratory Studies and Modeling Group will lead "Submillimeter Gas Analysis for Life Detection," a high-sensitivity analyzer with absolute specificity to nearly all gas phase species. Through the technology development, the study proposes to demonstrate significant improvements in minimum detectable species concentrations.

Alexandre Tsapin of the Advanced Instrumentation and Spectroscopy Group will lead "Fluorescent and Stop-Flow Raman Spectrometer," which addresses the needs stated in a NASA astrobiology roadmap for a miniature in-situ detection system to measure a wide range of chemicals extracted from rocks, soils, ices and water on Mars, Europa, Titan and other planetary bodies.

Jaroslava Wilcox of the Nano and Micro Systems Group will lead "Fourier Transform X-Ray Reflectivity Spectral Imager for Fingerprinting Molecular Structure of Planetary Samples In Situ." The study proposes to demonstrate a proof-of-concept for a spectral imager that will be able to resolve bonding structures of biologically relevant elements in chemical compounds in situ without extensive sample preparation. The imager is a novel instrument concept with spectral imaging capabilities that do not currently exist.

Four researchers were awarded studies under EarthScope, an Earth science program managed by the National Science Foundation to explore the four-dimensional structure of the North American continent. This solicitation requested proposals to strengthen the role of remote sensing in the determination of crustal dynamics and geologic history through the development and application of geodetic imaging technologies.

Andrea Donnellan of the Science Division will lead "Imaging of Seismically and Tectonically Active Regions in Northern and Southern California." Using unmanned aerial vehicle synthetic aperture radar, the study proposes to observe regions in three yearly campaigns in Northern California across the Bay Area, the front of the Transverse Ranges and in the Southern California region west of and spanning the Salton Trough. The study will specifically address distribution of crustal deformation, correlating deformation with regional tectonics and seismicity, and patterns of deformation.

Eric Fielding of the Solid Earth Group will lead "Dynamics of Active Fault Slip and Landsliding Along the Hayward Fault From High-Resolution Geodetic Imaging." Using unmanned aerial vehicle synthetic aperture radar, the study proposes to acquire repeat-pass interferometry for geodetic imaging optimally designed to measure elastic strain accumulation that can drive future earthquakes and other surface deformation.

Xiaoqing Pi of the Ionospheric and Atmospheric Remote Sensing Group will lead "Imaging the Ionosphere Using Polarimetric Synthetic Aperture Radar and Global Positioning System." The proposed development and analyses of the combined ionospheric imaging capability will shed light on many Earth and space science research topics and be used to support future NASA missions such as Deformation, Ecosystem Structure and Dynamics of Ice.

Paul Lundgren of the Solid Earth Group was named to lead two studies. The first proposes to apply unmanned aerial vehicle synthetic aperture radar to volcanoes in the United States that span a range of types and levels of activity. The goal is to improve the evaluation of the radar's performance and applicability to study volcano processes and hazard mitigation. His second study will image western United States deformation processes by integrating interferometric satellite aperture radar and global positioning system data. The approach will be used to understand time-varying deformation processes across the central and southern San Andreas fault systems and other areas.

Passings

Ronald Murray, 70, retired from the former Section 394, died Aug. 11. He worked at JPL from 1973 to 1998.

Arthur Bouck, 73, a retired operations chief and network operations project engineer in the Deep Space Network, died Aug. 15.

Bouck worked at the Lab from 1957 to 2000. He is survived by his wife, Jacqueline; children Ronald, Shelly, Bruce and David; seven grandchildren; and sister Barbara.

Retiree **James Johansen,** 70, died Aug. 23. He joined JPL in 1959 and retired in 1995.

Martha Molodowitch, a long-time member of the JPL Acquisition Division, died Aug. 24.

Molodowitch had been with JPL since 1984, starting as the project secretary for the Wide Field Planetary Camera. She later was promoted to subcontracts manager and senior subcontracts manager. She also managed the Non-Flight Research and Development Group for two years.

She is survived by her mother, sister and brother. Services were held Sept. 3 at Forest Lawn Memorial Park in Covina Hills.

Palmer Harrison

Palmer Harrison, 84, a retired Deep Space Network engineer, died Aug. 30.

Harrison joined JPL in 1950 and retired in 1989. In the late 1960s and early 1970s he served as cognizant engineer for frequency and timing at the network's stations in Madrid, Spain, where he set up one of three tracking stations for the Apollo moon missions.

He is survived by his son, Dana, and daughter, Kimberly Harrison Sombrotto.

Retiree **Michael Diethelm,** 74, died Sept. 8. He worked at JPL from 1966 to 1997.

Diethelm is survived by his daughter Susan and sons Scott and Steven.

David Bregman, 63, an electrician in the former Section 662, died Oct. 13.

Bregman worked as a JPL employee from 1982 to 1998 and continued as an affiliate through 2007.

He is survived by his son Ben, daughter-in-law Sally, grandson Freddie and sisters Celia and Tonie.

Retiree **Don Sparks,** 77, died Sept. 20.

Sparks worked at JPL from 1971 to 1990. He is survived by his wife, Nancy, and a daughter. Services were held in Kerrville, Texas.

Letters

Thank you so much to Section 316, Section 315, MSL, the testbed and all of you who sent cards, flowers and contributed to the collection that was given to me. You cannot begin to imagine how much your thoughts, prayers, positive energies and general well-wishes mean to me and my family and how much they have contributed to the success of my surgery and my recovery. Words cannot express the overwhelming feelings of love, friendship and support I have felt over the past month from JPL and I feel very lucky to work for such a fine organization and with such compassionate and caring co-workers. Thank you. Sincerely,

Katie Weiss

Thanks so much to all my friends and colleagues in Division 31 and the Altair project for their heartfelt wishes, prayers and support during this difficult time following the passing of my father, a truly wonderful man. My family and I greatly appreciated the very generous donation made to the Cancer Research Institute in my dad's memory. Thanks also to JPL for the stunning red anthurium plant that reminds me of him daily.

Michel Ingham

Retirees

The following JPL employees retired in November:

Sylvia Miller, 40 years, Section 610; **Edward Rinderle,** 40 years, Section 343P; **Terrence Adamski,** 31 years, Section 800; **Robert Hughes,** 30 years, Section 3547; **Barbara Mochrie,** 26 years, Section 220; **Margaret Rice,** 26 years; **Graham Bothwell**, 24 years, Section 710; **Stephen Appleford,** 21 years, Section 710; **Dennis Shebel,** 21 years, Section 313J.

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