Jet Propulsion Laboratory

# Universe

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# State OF THE Lab CONTINUES STRONG

By Mark Whalen

Although JPL has no spacecraft launches scheduled for 2010, Laboratory Director Charles Elachi assured employees in his annual State of the Lab address that the coming year will be a very busy one.

Speaking from the Flight Projects Center auditorium Feb. 3, Elachi noted the recently announced decision to re-fly the Orbiting Carbon Observatory, whose launch vehicle failed on its takeoff attempt about a year ago. "This is a very important mission for our nation and for science," Elachi said, noting that in the fiscal year 2010 budget that was already submitted to the White House, the project received $50 million to get restarted. "The FY 2011 budget will have additional money," he added, "so OCO is moving aggressively. We are committed to fly it by early 2013, and I've challenged the project to launch by late 2012. Credit to the team for its quick reaction to resurrect the mission."

Meanwhile, the Lab is preparing for five launches in fiscal year 2011. Scheduled for launch are NuStar and Aquarius, as well as three planetary missions in three months—Mars Science Laboratory, Juno and the Gravity Recovery and Interior Laboratory (Grail).

"FY 11," the director said, "is going to require a lot of preparation and a lot of effort."

More news for JPL comes via NASA's proposed fiscal year 2011 budget.

Elachi said all of the Lab's ongoing activities are fully funded in the proposal, including another extended mission for Cassini, through 2017. Projects in definition include DESDynI (the Deformation, Ecosystem Structure and Dynamics of Ice mission), and a Europa orbiter, funded for $21 million, "which is about the right amount needed to stay on track for a potential 2020 launch," he said.

"In the big picture, NASA is getting $6 billion more over the next five years above the original plan," Elachi said. "This is at a time when the president has frozen all discretionary spending for the next three years. Clearly that's a message from the administration that science and technology, and NASA, are very important."

The key news for JPL comes with the budget's proposal for Earth science studies to grow by 45 percent over five years, from about $1.3 billion to about $2.3 billion. Elachi noted that seven JPL Earth science missions would be launched over the next decade, starting with Aquarius.

Also in the development phase this year, Elachi said, are the Soil Moisture Active Passive mission and two Mars missions, both in collaboration with the European Space Agency. ESA is leading the Mars 2016 orbiter mission, with JPL developing the telecommunications as well as competing for some of the instruments onboard. JPL is project lead for Mars 2018, which will carry two rovers, one from Europe and one from JPL.

Elachi also pointed out the numerous opportunities to compete for new work through the New Frontier, Discovery and Explorer programs. JPL will also vie for a new Earth science Venture-class line item for a competition worth $90 million annually, he said.

JPL can also benefit with the reinvigoration of NASA's space technology program, which is being reinstated. "The great news is that in FY 11 there is almost $600 million available in technology; in FY 12 it's $1 billion. These will be competed activities, so we will have a great opportunity to compete for and conduct some really exciting technology."

NASA recently announced the cancellation of the Constellation Program, which would have returned astronauts to the moon. Dozens of JPLers contributed to Constellation, and Elachi commended their hard work and acknowledged the disappointment many might be feeling but emphasized the importance for them to continue the support in the transition period.

On the other hand, Elachi believes the new direction helps to set the stage for the NASA of the next 50 years, with innovation in launches, space transportation and other areas. "I think we will end up with a strong and bold NASA for making these investments now," he said.

In fact, JPL may have more opportunities to support NASA's long-range goals for human spaceflight. Elachi noted possibilities in the new robotic precursor missions, working with other NASA centers, that will help lay the groundwork for astronaut flights to the moon, asteroids, the Lagrange point, moons of Mars and ultimately the surface of Mars.

Elachi said JPL has built great relationships with other NASA centers, particularly Johnson Space Center. JPL has gained a lot of respect for its capabilities and teamwork, he said, "and we got to know how the human exploration area works. I think now that's going to pay off a lot. We expect to play a significant role here, and we have a number of ideas in the works to contribute to the program" working with other centers.

Elachi also noted the International Space Station will continue to operate through at least 2020. NASA has requested 10 proposals for payloads from JPL and other centers, rated by priority. A few of them will be selected for development, he said.

Among JPL institutional issues Elachi discussed:

- In NASA's annual "report card," which evaluates the Lab's overall performance over the past year, JPL received a ranking of "excellent," with a score of 92. This was JPL's best ever with the exception of 2004 when the Lab landed two rovers on Mars. Elachi hailed the second straight year of a perfect score of 100 for public affairs efforts inside the Office of Communications and Education, and praised the Lab's institutional organizations, which he said typically earned "good" or "very good" scores but this time received an excellent rating as well. And a new NASA-rated category called safety in engineering was also rated as excellent.
- Elachi thanked JPLers for their understanding regarding the decision to not grant

*Continued on page 4*

Carol Lachata / JPL Photo Lab

# Hillside protection efforts pay off

By Mark Whalen

Chemical-dropping planes helped firefighters on the ground in putting out the Station Fire, which burned more than 160,000 acres in the Angeles National Forest.

It's a well-established story in the local foothills: wildfires destroy vegetation, which later leads to floods, mudslides and debris flow. However, the combination of recent downpours and last summer's ravaging Station Fire went far beyond typical patterns, threatening devastating damage and presenting emergency planners with a major challenge.

Long before the Station Fire, JPL's Office of Protective Services, Facilities, Transportation and other groups had met and considered how to deal with local smoke, fire and flood emergencies. Those early discussions really paid off in January.

For JPL, nestled ever-so-close to the August–September blaze, the biggest in Los Angeles County history, the rains that pounded the area the week of Jan. 17 provided a good test case for the Lab's efforts to mitigate damage. So far, so good, according to Eric Fuller, JPL's emergency preparedness coordinator.

The Lab's biggest concern related to flooding is at the bridge connecting the east gate entrance and east parking lot. Fuller said flowing water and mud aren't nearly as big a problem as the debris that also comes tumbling downhill. "That's our biggest fear," he said. "Logs, brush, boulders and other refuse push the water up higher. Logs that start to jam up the flow are soon followed by more logs, creating a temporary dam such that water builds up behind it, leading to possible flash floods."

The recent huge rainfall also could have led to a bridge failure and potentially threatened parking lots on the east side.

Fortunately, the aforementioned Lab organizations have taken action to minimize damage as much as possible.

Among the steps taken thus far: about 40 feet of fence fabric was rolled back to encourage flows to go to the east end of the bridge; flood-level markings have been painted on the bridge wall and can be observed by security cameras; concrete K-rail barriers have been placed at the east gate to deflect debris flow away from the Laboratory; water-filled barriers and sandbags have been placed around buildings 159 and 306, with additional water barriers at the south arroyo parking lot to help reduce or redirect debris if the lot floods.

Fuller, who has also been assessing where flooding might occur when the water is at different levels on the nearby Devil's Gate Dam, said plans are in place should the east gate bridge require closure. Besides the placement of additional K-rail and water barriers as needed, JPL buses to and from the east parking lot would be rerouted. If safe use of the lot were compromised, JPL may advise employees to park at the Rose Bowl, from which JPL Fleet Management would provide charter bus service. Should JPL need to implement Rose Bowl parking, personnel can anticipate messages from the Lab's Everbridge emergency notification system.

Two short videos by local residents recently posted on You Tube show the effects of the recent storms, including dramatic views of powerful, rushing water, very dark in color due to the ash-based runoff that infiltrated the water. They may be viewed at *http://bit.ly/devilsgate* and *http://bit.ly/arroyostorm*.

"Mother Nature is much more powerful than we are," Fuller said. But for the things that JPL can control, he added, "We are as prepared as we can be."

JPL climatologist Bill Patzert, who has consulted with the Lab's emergency planners, provided some perspective by noting that despite January's strong rainfall, "The recent storms turned out not to be catastrophic—the hillsides didn't come down along the foothills."

"The storms during the week of Jan. 17 dropped a total of 4 to 8 inches of rain along the coasts and valleys, and 8 to 12 inches in the mountains," Patzert said. "The total rainfall in downtown Los Angeles for this series of storms was 4.58 inches—far shy of the January 2008 rainfall of 7.97 inches and the January 2005 mark of 9.3 inches. Many weary JPLers and residents of hillsides denuded by recent fires can at least find comfort in the fact that the storms weren't as bad as feared. Here at JPL, the week's total was 7.40 inches. This was definitely not big in terms of rain rate and rainfall, but future storms could be," he cautioned.

"Looking ahead, February and March are our two wettest months," Patzert added. "JPLers and foothill residents have to remain vigilant." Looking further into the future, Patzert notes that it will take five to seven years for vegetation to restabilize local and national forest hillsides. "We're not out of mud and debris danger. It's going to be a muddy ride for the next few years," he warned.

# Positive safety audit for Microdevices Lab

JPL's Microdevices Laboratory garnered high marks from a recent safety audit conducted by NASA's Office of Safety and Mission Assurance.

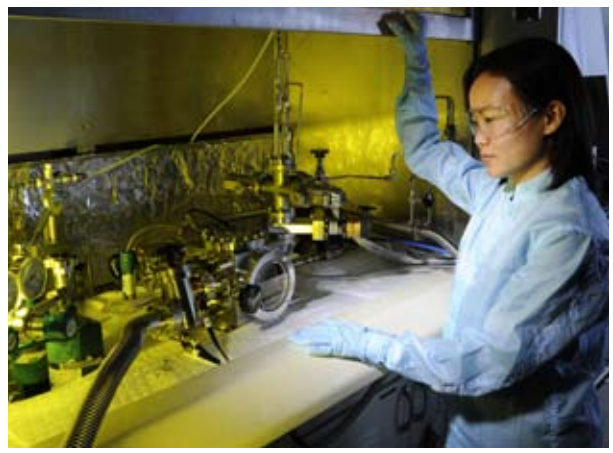
NASA's Operations and Engineering Panel review results showed that the laboratory scored very well when compared to the typical amount of action findings at most NASA centers, said Art Lee, the NASA Headquarters audit lead who oversees the reviews and audits at the centers.

JPL received 16 actions, 14 observations, and six commendations in the audit. Frank Mortelliti, manager of JPL's Environmental Health and Safety Program Office, noted that the number of actions typically runs in the 30-plus range. The audit divides safety findings into three categories: actions, which are non-compliant areas of either federal, state, local or NASA safety, environmental or health policies; observations, which are things auditors saw but didn't have enough time to determine if an issue of non-conformance exists, and are simply brought to the center's attention; and commendations, outstanding examples of safety in action that are shared with other NASA centers.

The NASA Operations and Engineering Panel comprised 22 members, all subject matter experts, from other NASA centers and Headquarters. More than 25 program presentations were provided by various JPL experts.

"The Microdevices Lab and all the entities that support it—including medical, facilities, environmental, health and safety, and fire and security—should be proud of their contributions," Mortelliti said, adding that he credited the good performance to "the excellent, knowledgeable and safety-conscience Microdevices Lab employees, and this mirrors the rest of JPL."

Microdevices Lab Manager James Lamb was commended for "his unwavering and passionate dedication to the successful and safe operations" of the laboratory, which by the nature of its work often uses a variety of materials, some hazardous, with safety being the first consideration.



Anna Liao of the Nano and Micro Systems Group tests sensors fabricated in the Microdevices Laboratory.

# A Spirited new mission for rover

By Mark Whalen


Carol Lachata / JPL Photo Lab

*Since JPL's Mars Exploration Rover Spirit broke through a harsh surface and became stuck in soft sand some 10 months ago, a concerted "Free Spirit" effort with a test rover in a sandbox, as well as other analysis, modeling and reviews, have so far been unable to get Spirit unstuck. However, the rover's mission is not over, not by a long shot, as Project Manager John Callas explains; it has just entered another phase of its long life.*

**With Spirit's new stationary mission, what was the "point of no return" in the decision to change the mission—that you're not going to try to dig out anymore or drive backwards to get out—that you're just going to stay put?**

Well, I'd say that's a misconception. There really is no point of no return. Obviously, we've had a lot of difficulty in this embedded location. Although lately we've had some good progress in extrication, the prospects of us getting unstuck were pretty grim.

But looking ahead, with a four-wheel drive vehicle—we're no longer a five-wheel vehicle and we haven't operated with six wheels for many years—what can you do? The best science we can do is stationary or near-stationary science. That means we'll leave the rover motionless or near motionless for an extended period of time, then track Spirit's radio communication signals. That allows us to track the motion of Mars, because the rover's position is fixed relative to the surface.

That tracking allows us to get a handle on the wobble of the planet, which tells us about Mars' interior. It may seem unusual to use a surface vehicle to tell us about the interior of the planet.

This is something we always knew we would do once we exhausted the high-value roving science we've been able to do, because we knew eventually the rovers would degrade in mobility. Additionally, since the rover is in one place we can use the robotic arm to do a very exhaustive investigation of the soils and rocks in reach of the arm—and it turns out that Spirit is in one of the most scientifically interesting sites on Mars, so we want to spend more time investigating this area.

So it is a new phase for Spirit, reflecting its change in capabilities. But it's still a very ambitious and exciting campaign for the rover.

**Winter is approaching Mars in a few months. Was this a factor in starting the new phase?**

Yes. We're running out of time, so there's only so much we can do now. Recognizing that we're likely not going to get very far right now, we want to focus on surviving the winter—and there's a real risk that we might not.

Because the rover is tilted slightly to the south, and we really prefer a northerly tilt, we may not be able to maintain the needed energy balance through the winter. We may not get enough sunlight on the solar arrays to produce enough energy that allows the rover to be fully active each day. Then we'll be stealing energy from the batteries, which at some point could exhaust their power; the effect is that this will turn off heaters, letting the rover get colder. If we can't improve the attitude, Spirit will be facing colder temperatures than we've ever seen before on Mars. That's the concern that makes this winter the most difficult we've ever had.

**In addition to being colder than ever before, as each year goes by, is each winter tougher to survive simply because it's an older rover?**

There always seems to be a set of circumstances that makes each winter tougher. For example, last winter we had a huge amount of dust on the solar arrays, which necessitated getting the rover tilted toward the north. This time, we don't have as much dust on the solar arrays, but we don't have as mobile a rover either, to take advantage of tilting. That's another challenge in what's likely our toughest winter ever.

**How feasible was it to try to use Spirit's robotic arm to help push the rover out of the sand trap?**

This was the number-one suggested idea from the public. Everyone has an experience where they're stuck in the mud or the snow, but getting stuck on Mars is very different. The rover requires so much force to be moved, and the arm just isn't that strong. And there's nothing to push against in this loose, soft material; even a backhoe can't move against loose mud. It sounds familiar to people, but looking at the technical and engineering aspects of this, it's just not feasible.

But we also didn't want to risk the arm because it's so vital to the future science we can do. Spirit can be an accomplished Mars lander, even if it were never to move again. I mean, we pushed relentlessly when we had mobility, because the most important characteristic of this rover is the ability to drive it to a new location. But we've also been blowing by stuff where we really would have loved to have stopped and "smelled the roses." This is a case where we can do that, and with this limited mobility that's the right science to do now.

**Is there a sense on the team of frustration or disappointment that all your efforts to free Spirit didn't work?**

Yes, there is frustration, because we all want to continue to have a roving vehicle, which has worked for six years now and has accomplished so much.

It's kind of like an elderly parent: grandma can no longer walk to the grocery store, but she can still move around the kitchen and make the best cookies possible. So it's a change, and it is an indicator that the rovers are getting older and are not going to be there forever, and there will be a time that will come when the rovers won't be there any longer.

It's a sign that the rovers are aging, just like humans age. There's that emotional attachment where we realize that someone—or in this case, something—might not be there anymore.

**Any regrets about anything you've tried, or do you feel you did everything possible?**

We've got the best team in the solar system working on this problem, and this is a challenge like no other. We've got a vehicle stuck on the surface of another world, with no one there; it's an experience humanity hasn't had before.

It's exceedingly difficult, trying to diagnose a problem from hundreds of millions of kilometers away, with such a limited set of tools. We can't just call AAA or get out of our vehicle, walk around it and kick the tires and shovel sand under the wheels.

**With this mission's ability to last as long as it has, what are lessons learned? Can future missions, to Mars and elsewhere, be designed with the expectation to last several years instead of months?**

Yes, there are lessons learned, and Mars Science Laboratory is a mission that's taking advantage of them. MSL is designed to be a longer-surviving rover. The challenge is that Spirit and Opportunity have raised the bar so high that it's really making it hard for any future missions. It would be hard to develop and implement a design that can give assurance that they can do as well or better than these rovers have. Every day we last is an elevation of that bar that the next mission has to surpass.

**How is the other Mars Exploration Rover, Opportunity, holding up?**

Opportunity is doing exciting things. She is driving, and has accumulated much more odometry than Spirit. Right now, she is at the edge of a small crater, which is likely the youngest crater ever to have been visited on Mars—it's on the order of only about 1,000 years old. In geological terms, that's brand new. It's fresh, because it still has debris ejecta all around it.

It's exciting, because maybe we can find remnants of the original impactor and understand the dynamics of these kinds of impacts and what caused them.

Once we finish there, we're going back on the road again and will push towards Endeavour crater, which is our ultimate objective, and it's still 12 to 15 kilometers away. This is a rover that was designed to only travel a kilometer on the surface of Mars; Opportunity has already gone about 19 kilometers and we're talking about almost doubling that to get to our future targets. So we're really pushing what these vehicles were meant to do.

**Elachi** *Continued from page 1*

raises last year. He said he received a large number of supportive e-mails on the subject, with only two suggesting that the no-raise policy was not the right decision. To illustrate the impact of this action, he said an average raise of 4 percent would have cost about 200 jobs. Raises will be reinstated this year.

Also, when hundreds of JPLers reduced their accumulated vacation hours, a savings of about $1.5 million was realized, he said. A large savings of $6.5 million was also gained from reduced travel, Elachi added, urging JPLers to continue their efforts to reduce costs wherever possible.

- Elachi praised the implementation last year of the Job Classification Redesign Project, acknowledging the efforts of Human Resources leaders Elizabeth Loftus, Monica Garcia, Rick Hann and Steve Wells. Elachi said it's clear that both of the program's career paths—management and individual contributor—are very critical for JPL, noting that the highest-paid employee outside of the Executive Council is not a manager. "If you're really good at work in research or engineering, you will be valued the same way as if you were in management," he said, adding that JPL always strives to make sure compensation is fair, appropriate and competitive.
- Chris Jones, associate director for flight projects and mission success, and Engineering and Science Director Leslie Livesay are leading efforts to clarify, document and educate JPLers on the relative role of projects and line organizations in project implementation. A new process for conflict resolution is being developed. Also, work is underway to better assess mission costs, particularly at the early stage.
- Noting NASA Administrator Charles Bolden's, and his own, passion for education, Elachi urged employees to visit schools to inspire young students to pursue careers in science and technology by spreading the word about the excitement of what JPL and NASA do. He said JPL managers are encouraged to approve requests to volunteer during working hours for educational activity.
- JPL is very focused on being considered a model "green" campus. For example, he said, a current goal is to reduce energy consumption by 13 percent over the next three years. He cited a test in Building 183 in which employees were asked to turn off lights and other electrical equipment; the result was a 5 percent energy savings. He also noted that over the next few years the Lab would install solar panels over several JPL buildings in order to use more green energy.

"The way I look at the last year," Elachi concluded, "we had fires and floods, and economic meltdown, but we prevailed, and we're still the vibrant organization that we all know JPL is. I really feel I am privileged and fortunate to be in this organization. This is the best organization in the world. I hope you feel the same and are very proud of what we do. This is hard work, but after all, we are getting paid to do something other people dream about."

To view Elachi's address, visit *http://jpltv* and check the asset library.

## The King legacy

Dana Howard of Section 2622 presents a plaque in memory of Tom May, the late former manager of JPL's Business Opportunities Office, to May's son Augustine at the Laboratory's annual tribute to Martin Luther King Jr. in January. The event is available for viewing at http://jpltv, in the asset library's "My media" folder.

Richard Hasegawa / JPL Photo Lab



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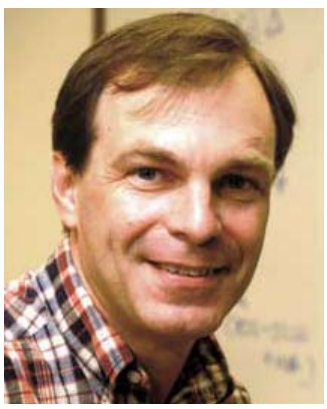
## Passings



**Andrew Lange**

JPL senior research scientist **Andrew Lange**, 52, died Jan. 22. Lange, a world-renowned cosmologist, was a Caltech physics professor and former chair of the institute's Division of Physics, Mathematics and Astronomy.

Lange was co-principal investigator of the Balloon Observations of Millimetric Extragalactic Radiation and Geophysics (Boomerang) experiment, which in 1998 used a balloon-borne telescope equipped with highly sensitive bolometers developed at JPL to study the cosmic microwave background. Boomerang detected spatial variations in the background that showed the universe has a flat geometry, in support of inflation, a theory that the universe underwent a rapid expansion shortly after the Big Bang.

Lange was a pioneer in applying new technology to scientific problems. He was the U.S. principal investigator of the European Space Agency/NASA Planck high-frequency instrument, which was launched in May 2009 and is currently using JPL detectors to measure the cosmic microwave background from space. He was considered to be influential in the careers of many young scientists as students and postdocs who have since gone on to prominent positions in astrophysics.

Lange was named 2003 California Scientist of the Year, and received the 2006 Balzan prize and the 2009 Dan David prize for this work.

He is survived by two sons and a stepson.

## Letters

We would like to thank Section 2820 (Facilities Maintenance and Operations) and 3880 (Instrument Software and Science Data Systems for the expressions of sympathy on the sudden loss of my mother-in-law, and other passings in our family during this past holiday season. Thank you for the support, and the beautiful plants from Emcor and JPL in her memory. It's truly appreciated during this difficult time.

Tom and Rosemary Guerrero

I would like to express my sincere "thanks" to all my friends and coworkers in the Property Group and Photo Lab for their support in the recent passing of my dad. The cards and the many expressions of sympathy have been very comforting. Many thanks to Sunny Schofield and JPL for the lovely plant.

Marta G. Gallegos

My family and I would like to extend a heartfelt appreciation to all my JPL colleagues for their support, thoughts and words at a difficult time during the recent passing of my mother. Thank you all for your kindness; we are forever truly grateful.

Karla Miller

I was not alone when my beloved wife passed away recently. My friends and colleagues were there for me during a difficult time; it was a great comfort. I want to express my deepest gratitude for all you did and the beautiful card and flowers you sent and attending with me the last rites at the cemetery. I will miss keeping Joann up to date on all the things we did together during the last 46 years at JPL.

Al Kirk

My family and I would like to thank all our colleagues and friends at JPL for their thoughts and words at the passing of my father. We very much appreciate the plants. Thank you very much for your support and kindness during this difficult time.

Shouhua Huang

## Retirees

The following JPL employees retired in January:
**Charles Yamarone**, 48 years, Section 1010; **Taher Daud,** 33 years, Section 3453; **Sharon Devore**, 22 years, Section 2661; **Beverly Shank**, 22 years, Section 3313; **Rosalie Betrue,** 14 years, Section 1834; **William Christensen**, 10 years, Section 1173; **Ann Schweiner**, 23 years, Section 1900.