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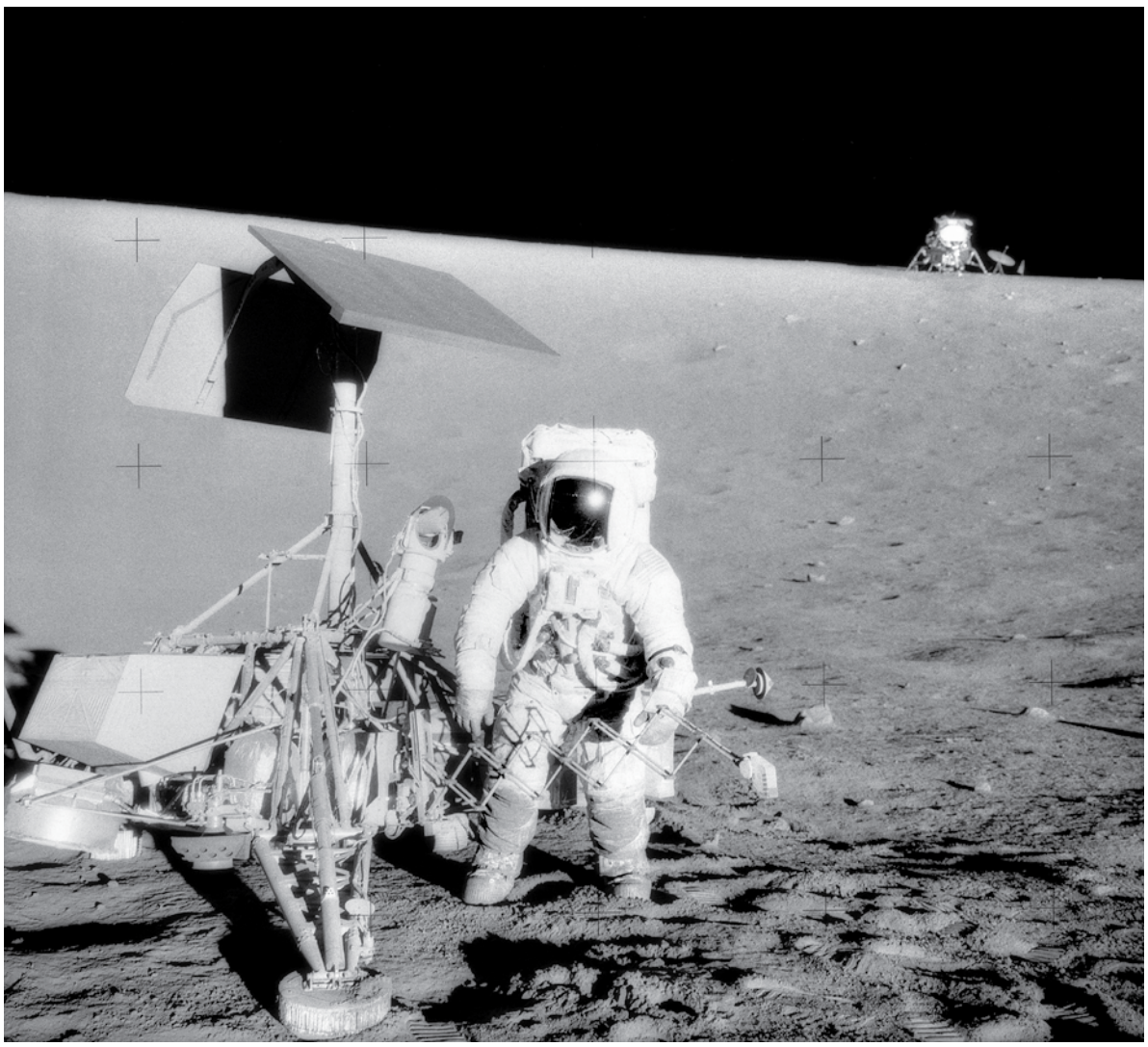
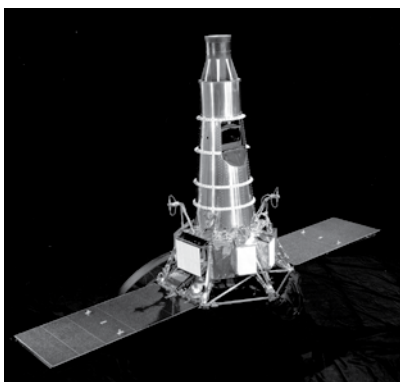
40 years after Apollo 11, JPL roles recalled





1963 Ranger 7

1966 Surveyor 1

Above: In this Nov. 19, 1969, photo, Apollo 12 mission commander Pete Conrad retrieves parts from JPL's Surveyor 3, which had landed on the moon about three years earlier. The lunar module, visible in the distance, touched down within about 180 meters of Surveyor 3. Conrad and lunar module pilot Alan Bean, who shot the photo, retrieved Surveyor 3's television camera and sampler scoop for return to Earth.

After Surveyor 7's mission in 1968, JPL turned its attention to more distant targets, but in recent years the moon has once again become a focus for the Lab.

Lab's history at the moon continues with current and future efforts

Forty years ago, a pair of American astronauts became the first humans to set foot on another world. But before Apollo 11's "giant leap for mankind" on July 20, 1969, JPL had helped paved the way to Earth's natural satellite with the Ranger and Surveyor robotic spacecraft.

Yet it almost didn't happen that way. After NASA was created in 1958, the new agency asked JPL for a blueprint of the missions the Lab proposed to build and fly. The Lab responded with a plan that emphasized early flybys and orbiters to Venus and Mars; less ambitious robotic spacecraft targeting the moon were sprinkled in when the planets were out of reach. NASA, though, believed the first priority had to be closer—and less ambitious—and directed JPL to set its sights first on getting to the moon.

The Lab already had experience in that realm. In December 1958, only two months after NASA began functioning, JPL and the Army Ballistic Missile Agency—the same team that had launched America's first satellite, Explorer 1—sent aloft Pioneer 3, a cone-shaped probe intended to fly past the moon. Due to a launch-vehicle error, it never escaped Earth orbit and fell back over Africa. Pioneer 4, an identical probe, was more successful when it was launched in March 1959. Passing within 37,300 miles of the moon, Pioneer 4 sailed on and has been in orbit around the sun ever since.

That set the stage for the Rangers of the early 1960s. This ambitious series by JPL was the United States' first effort to develop an attitude-stabilized platform capable of providing power, thermal control, sequencing and data handling for a payload of science instruments. The goal of the Ranger missions was to send pictures and other data to Earth as they approached the moon, ultimately executing a planned crash-landing. Little did JPL's leadership know that the project would also lead the Lab into its darkest days.

When Ranger 1 and 2 were launched in August and November 1961, the second stage of the Agena B rockets failed to restart, leaving them stranded in low-Earth orbit. On the positive side, JPL engineers noted that in their brief flights they believed the basic spacecraft design—complex for the day—would work. "They both worked the way they were supposed to, but they didn't get to where they were supposed be," said JPL veteran John Casani, the design team leader for the Ranger spacecraft.

But the next four Rangers also failed for various reasons. Following six consecutive failures, Congress held hearings to look into why the United States' space laboratory was falling flat on its face. Congress released a report criticizing JPL's management structure, which led, among other changes, to the creation for the first time of the Lab's deputy director position.

Thankfully for the beleaguered JPL workforce, Ranger 7 was a crowning success. On July 31, 1964, it captured

Continued on page 2

Moon *Continued from page 1*

more than 4,300 pictures from six cameras as it descended to hit the moon in a plain, soon named Mare Cognitum, south of the crater Copernicus. The new images revealed that craters caused by impact were the dominant features of the moon's surface, even in the seemingly smooth and empty plains.

Rangers 8 and 9 were equally successful. In February and March 1965, they flew toward other impact sites on the moon, sending back a total of 13,100 images confirming that the lunar landscape consisted of rolling contours of craters upon craters.

Around that time, Casani recalls, some JPLers toyed briefly with the idea of taking a page from the Soviets and sending another species of mammal to the moon as a precursor to landing humans. "What they were proposing was that we land some dogs on the moon in little dog space suits," explained Casani. "They figured that the dogs could be trained to do things once they got down there." The idea was quickly dropped when it sank in what the dog-loving public reaction to leaving canines stranded on the moon would be.

Following Ranger was a far more ambitious project—soft landing on the moon. The Surveyor spacecraft also marked the first time JPL sent a flight project outside to be designed and built by a subcontractor—in this case, Hughes Aircraft Company. Like Ranger, Surveyor had its travails. But the first Surveyor made a flawless landing at Flamsteed in Oceanus Procellarum in June 1966, sending back 11,240 frames from a remote-controlled TV camera. With Surveyor 1 NASA had the answer to a critical question: Would the lunar surface support the weight of the Apollo astronauts' landing spacecraft?

Surveyor 2 was not as successful, crashing into the moon, while Surveyor 4's signal was lost 2-1/2 minutes after lunar impact. But Surveyors 3, 5, 6 and 7 repeated the initial triumph in different sites and successively added a robot arm with scoop and a chemical element analyzer to the scientific tool kit.

In November 1969, the crew of Apollo 12 used the Surveyor 3 site to improve their high-precision landing navigation. Surveyor 3, launched in April 1967, had the distinction of being the first robotic spacecraft to be visited by astronauts, who cut off portions of Surveyor's camera and brought them back to Earth to analyze.

Upon inspection in the lab, scientists found inside the Surveyor 3 camera what they believed to be a common bacteria, Streptococcus mitis. The announcement was a contentious finding in the science community, but if true, the bacteria is the only known survivor of unprotected space travel, having gone through launch, space vacuum, three years of radiation exposure and no nutrient, water or energy source. No other life forms were found in soil samples retrieved by the Apollo missions or by two Soviet unmanned sampling missions.

After Surveyor 7's mission in 1968, JPL turned its attention to more distant targets, but in recent years the moon has once again become a focus for the Lab. By the 1990s, JPL scientists participated in lunar missions managed by other facilities, such as the Department of Defense's Clementine lunar orbiter and Ames Research Center's Lunar Prospector. JPL scientists also conducted other moon-related studies, such as ground-based observations that resulted in the detection of solid-body tides and a fluid lunar core.

Today a lunar renaissance of sorts is in progress at JPL—taking the Lab back to its 1960s roots. In October 2008, India launched its first robotic mission to the moon, Chandrayaan 1, carrying JPL's Moon Mineralogy Mapper, a state-of-the-art imaging spectrometer. The mission is primarily looking for the mineral composition of the moon, which could help scientists determine the composition of the moon's interior, as well as give a view to Earth's early history.

JPL is also taking part in Lunar Reconnaissance Orbiter, a Goddard Space Flight Center–managed mission that launched from Cape Canaveral June 18. JPL designed and built the Diviner lunar radiometer, which will be used to create a thermal map of the moon—providing data crucial for understanding the potential of water ice as well as for future operations and exploration. JPL will power up Diviner around July 5 for the first time since launch.

Still ahead is another lunar mission—the Gravity Recovery and Interior Laboratory, or Grail, set to launch in September 2011. This mission will use twin spacecraft to orbit the moon in tandem, making highly precise measurements of the lunar gravity field. The design is based on JPL's Gravity Recovery and Climate Experiment, or Grace, currently in orbit around Earth. The mission team hopes to determine the structure of the lunar interior and provide more information about the thermal evolution of the moon. Maria Zuber of MIT is the mission's principal investigator, with the spacecraft to be built by Lockheed Martin Space Systems, Denver.

And JPL has a hand as well in NASA's current human exploration program. JPL's Exploration Systems and Technology Office is leading JPL's contributions to NASA's Constellation program, which also includes program integration and mission operations support. Moon-based astronauts, for example, could make use of robotic surface vehicles such as JPL's All-Terrain Hex-Limbed Extra-Terrestrial Explorer, better known around the Lab as "Athlete."

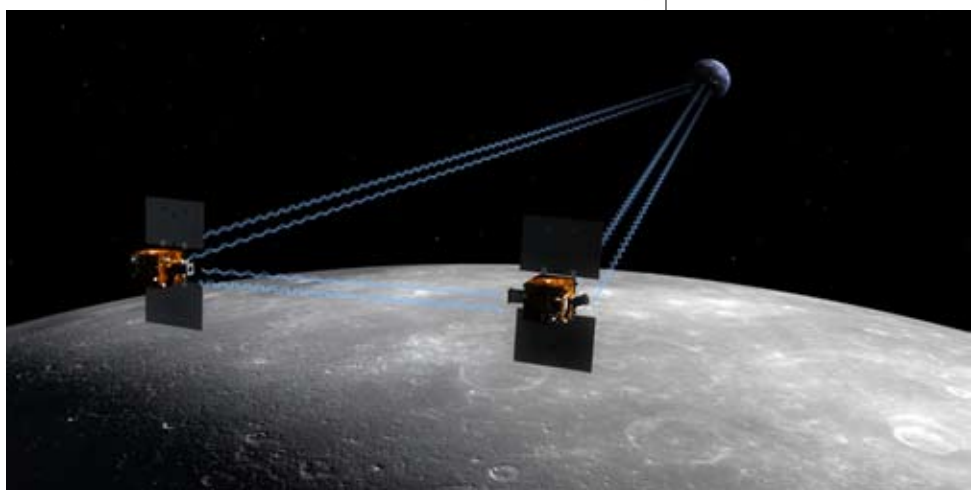
So later this month, when the news media features reports about the 40th anniversary of Apollo 11, you can keep in mind that JPL has been—and is definitely once again—moonstruck.

Today the Moon . . . Tomorrow Mars.

Above: This August 1964 image taken at Goldstone Tracking Station to celebrate the success of Ranger 7 shows, from left, then-JPL Deputy Director Alvin Luedecke, Director William Pickering, Assistant Laboratory Director for Lunar and Planetary Projects Robert Parks and Ranger Project Manager Harris "Bud" Schurmeier. Signs on the back wall reading "Today the Moon" and "Tomorrow, Mars" refer to Ranger 7's successful mission and their high hopes for Mariner 4, the first Mars flyby mission, which was launched in November 1964.

Above, right: JPL's Ranger 7 took this image, the first picture of the moon by a U.S. spacecraft, on July 31, 1964, about 17 minutes before impacting the lunar surface. The Rangers were designed solely to take high-quality pictures of the moon and transmit them back to Earth in real time. The images were used for scientific study as well as for selecting landing sites for the Apollo missions. Ranger 7 transmitted 4,308 high-quality images over the last 17 minutes of flight.

Into the future



Below: Artist's concept of Grail, which will fly twin spacecraft in tandem orbits around the moon for several months to measure its gravity field in unprecedented detail.

Phaeton helping early career hires achieve big goals

By Brian Frank

Carol Lachata / JPL Photolab

Phaeton team members are joined by former engineering and science director Pete Theisinger, above left, and JPL Director Charles Elachi, first row left.

It started Halloween night in 2007 when Benjamin Solish, who had been employed at the Lab for about six months, drew the short straw among his peers and fired off an e-mail to JPL Director Charles Elachi.

"Dear Dr. Elachi," it began, "as you may know, the X Prize Foundation recently released a challenge to the engineering community to send a rover mission to the moon. Our team, all early career hires at JPL, is excited to answer that challenge." Early career hire is a designation for employees three years out of college.

The e-mail contained a request to use JPL facilities to compete in the Google Lunar X Prize and cited that this would be a chance for younger employees "to gain valuable end-to-end experience on a small-scale mission, which would greatly benefit our future work at JPL." It was signed "The Phaeton Explorer Team," followed by the names of seven early career hires.

To their surprise, the Phaeton Explorers received an e-mail back from Elachi requesting to meet with them. During the meeting Elachi took their shoot-for-the-moon enthusiasm and channeled it instead into creating a one-of-a-kind training program that would achieve their original objective. After several months of brainstorming and iterations with upper management and Elachi, the Phaeton Program was born.

The group's recommended approach for the program included developing small payloads in the range of $2 million to $5 million with a life cycle of about three years and a start date separated by about one year. Participants will be assigned multiple positions on Phaeton projects in different phases of mission life cycle—projects are to mimic JPL flight projects but be staffed by early career hires in key positions, including those in business and human resource management. Each year the program will solicit early career hires with half- to three-quarter time on the program for a period of up to 18 months.

The plan also calls for a Phaeton advisory board to annually down-select project concepts, and for the recruiting and funding of mentors in a 1:1 to 1:2 ratio with early career hire participants.

With an institutional blessing and committed funds for two projects, Phaeton formally debuted in September 2008 with a core group of 19 early career hires selected out of 70 applicants. Now the program has grown to about 25 early career hires with a third project in concept definition.

The Phaeton Mast Dynamics project will measure and characterize the dynamical behavior of the 10-meter boom of the NuStar project. "I've been exposed to a lot of the Phase C and D work but never been exposed to Phases A and B," said Lauren Halatek of the Measurement Systems Group, the Phaeton Mast Dynamics project manager. "[Phaeton] is a great learning experience," Halatek said. "I have a lot more respect for those who have been here a long time and make it look so easy."

With the help of mentors, a group of early career hires helped secure Phaeton's second project by developing the winning proposal in response to a NASA solicitation last December for an in-house project team to fly an Earth- or space-science payload to be launched by the agency's Sounding Rockets Program Office in the second quarter of 2010. The winning proposal, called Terrain Relative Navigation and Employee Development, or TRaiNED, gives the team the opportunity to work with Wallops Flight Facility to launch the payload at the White Sands Missile Range, N.M.

"The Phaeton Program gave a group of early career hires an opportunity to learn the JPL formulation process from a group of senior experienced mentors," said Don Heyer, the project manager for TRaiNED. "The fact that we won just makes it even more rewarding."

The latest Phaeton project, Optical Planetary Access Link for Space Station, is currently in concept development. This project will validate optical acquisition and tracking algorithms and mechanisms intended for use at Mars by placing an instrument on the International Space Station. Calls for participants were announced in June and selection is ongoing for a team of about 10 early career hires.

The Phaeton experience isn't limited to the Lab's potential future engineers.

"Phaeton isn't only for the technical side, it's also for the business side," noted Hosanna Aroyan, project resource analyst and business administration manager for Phaeton. Aroyan, also an early career hire, believes learning to manage the business components of flight projects through Phaeton will pay dividends for the Lab over time. "Hopefully this will become more the norm, where communication between line and project on the business side will be clearer," she said.

Supplying business and flight project experience to early career hires was a complex notion that came from the ground up. "When you first get to the Lab, you get pigeonholed into one area," said the aforementioned Solish, one of those who worked early on to develop the Phaeton concept and is now a systems engineer for Trained. "Phaeton is not just networking, it's understanding how the Lab is put together and how it works."

"The ways the new generations of engineers learn and interact are very different from when I came out of college. They are a lot more savvy in the use of information technology resources and social networking, so they can acquire knowledge much more rapidly. Phaeton provides them an environment to excel."

Johnny Kwok, Phaeton Program Manager

Phaeton members are not only gaining exposure to project formulation, they've also embraced the roles often reserved for JPLers with technical lead experience. Since hired last year, Darren Michaels has gone from designing analog circuits for the Europa Orbiter to becoming lead electrical engineer on an instrument that will measure the dynamics of a flexible boom during space flight. After securing his position at JPL and graduating from Caltech with a master's degree in electrical engineering, the prospect of working on a major flight project so quickly out of school excited Michaels. "Here [at JPL], it's more of providing good science," he said. "It's not about competition; it's about doing a good job."

"The ways the new generations of engineers learn and interact are very different from when I came out of college," Phaeton Program Manager Johnny Kwok said. "They are a lot more savvy in the use of information technology resources and social networking, so they can acquire knowledge much more rapidly. Phaeton provides them an environment to excel."

Although the idea to compete against industry for Google's $30-million-dollar prize purse was rebuffed, the ambition and drive of those young engineers was apparent and rewarded with the formation of Phaeton. As Elachi said at Phaeton's open house last year: "Bring the best people, provide them support, and get out of the way."

For more information about the Phaeton Early Career Hire Development Program, visit *http://phaeton.*

News Briefs

Steve Lichten

Phoenix Project Scientist Leslie Tamppari and Project Manager Barry Goldstein accept Rotary Awards.

Lichten to lead Division 33

Steve Lichten has been named manager of the Communications, Tracking and Radar Division 33.

With JPL since 1983, Lichten most recently served as Division 33 deputy manager. He was also manager of the Tracking Systems and Applications Section, leading the organization through challenging infusions of advanced ground and flight technologies, including the implementation of delta-differential one-way ranging tracking and 34-meter arraying into the Deep Space Network, and the delivery of 12 GPS flight instruments over a two-year period to multiple projects. He has also served as the supervisor of the Earth Orbiter Systems Group and managed numerous NASA and non-NASA technology and implementation tasks. He has authored more than 130 publications and secured four patents.

Lichten was on the team that won the NASA Software of the Year Award in 2000 and was also on the JPL software team that was inducted into the Space Technology Hall of Fame in 2004.

NASA Honor Awards

JPL employees, contractors and partners from industry and universities received recognition of individual and team accomplishments from calendar year 2008 at JPL's annual NASA Honor Awards ceremony in June.

For a list of the honorees, visit *http://hr.jpl.nasa.gov/compensation/reward/nasahonor.cfm.*

More kudos for Phoenix

JPL's Mars Phoenix lander was a recent winner of two Rotary National Awards for Space Achievement, which were bestowed by the Space Center Rotary Club of Houston.

The awards, which honor individual and team achievements in human and robotic spaceflight programs, went to the Phoenix project team for "Outstanding technical excellence and team dedication enabling another first for the United States space program by the successful polar mission around another celestial body" and to Barry Goldstein for "Outstanding contributions as the Phoenix Project Manager, leading to the successful Mars landing followed by unprecedented scientific findings from the north polar region of Mars."

Explorer Awards bestowed

Recent ceremonies honored JPLers named winners of the Lab's Explorer Award, which recognize significant individual technical/business accomplishments or outstanding performance. The criteria are generally based on the focus areas of the JPL Implementation Plan. The monetary award is $5,000. The honorees:

Strategic Leadership: Douglas Bernard, Laureano Cangahuala, Kevin Endo, Robert O. Green, Susan Kurtik, Leslie Tamppari, Stephen Unwin, Steven Wissler.

Scientific and Technical Excellence: Harlow Ahlstrom, Todd Bayer, Pablo Narvaez, Ernesto Rodriguez, Scott Shaffer, Simone Tanelli, John Ziemer.

Effective Business Management: Todd Cetti, Martin Ramirez.

Effective Partnerships and Relationships: William M. Greene.

Also bestowed were the following winners of the Edward Stone Award for Outstanding Research Publication, which is administered by the Office of the Chief Scientist:

Peter Eisenhardt, Mark Swain.

For information on JPL's awards program, visit *http://hr.jpl.nasa.gov/compensation/reward/bonus.cfm.*

Cassini site wins Webby

The Cassini mission Web site, *http://saturn.jpl.nasa.gov,* has received a Webby award for best science site.

More than 500,000 people cast online votes for the Webbys, which are presented by The International Academy of Digital Arts and Sciences. Also among the winners was NASA's main Web site, which won the People's Voice award for best government Web site as it also did in 2003.

"The Cassini site is the door to the science and technology of the mission to Saturn, contained in hundreds of thousands of pages," said Alice Wessen, manager of Cassini public engagement at JPL. "The site houses all the latest news, science findings and images Cassini returns as it orbits Saturn. The public can see every picture within eight hours after it's beamed down from the spacecraft."

"We're extremely happy to be honored by the Internet community this way," said Brian Dunbar, the content manager for *http://www.nasa.gov.* "We've always tried to focus the site on giving the public what they're looking for in an engaging and compelling way. Combined with some of the highest customer-satisfaction ratings in the government, this award tells us we're on the right track."

NASA's Web team also was among the honorees for Rich Media/Advertising for its multimedia commemoration of NASA's 50th anniversary, *http://www.nasa.gov/50years.* The feature, hosted by the robot Automa, includes an interactive news conference with the original Mercury astronauts, music from across the decades and an "appearance" by renowned astronomer Carl Sagan.

Boris Oks

Rideshare effort hailed

Boris Oks of the Web Applications Development Group was recently honored by the Los Angeles County Metropolitan Transportation Authority for his efforts that contributed to the success of JPL's rideshare program.

Oks received honorable mention in ceremonies recognizing Pasadena employers for their outstanding employee rideshare programs. He designed a program that made the Lab's transportation survey process easier for employees to complete online, including a tracking feature to show who has and hasn't completed a survey form.

Carol Lachata / JPL Photo Lab

Senior research scientists meet

JPL Director Charles Elachi (far right), Associate Chief Scientist Cinzia Zuffada (second from left) and Moustafa Chahine (third from left) recently met with JPL's 2008 senior research scientists for a roundtable discussion. The awardees are, from left, L. Douglas Bell, Kasthuri Venkateswaran, Son Ngheim, Rosaly Lopes, Linda Brown, Abhinandan Jain, James Williams and Klaus Havelund.

QuikScat: recalling JPL's can-do spirit

By Alex Abels

JPL recently celebrated the 10-year anniversary of the launch of Quick Scatterometer, or QuikScat, a recovery mission that replaced the NASA Scatterometer instrument on Japan's Advanced Earth Observation Satellite when it failed in 1997. "It's really an example of the kind of spirit here at JPL, that even things that seem impossible to do, we have been able to do," said JPL Director Charles Elachi at the anniversary event in von Kármán Auditorium on June 16.

The entire mission was pulled together in record time and launched in June 1999, a mere two years after the initial failure, giving the mission its "quick" name. "You had a critical need, and to address that critical need, you had a series of elements that came together in a fast solution," said Jim Graf, JPL deputy director for Earth science and technology and the original QuikScat project manager. "I'm not sure that you will ever see that again."

The critical need was to procure wind measurements from space, something scientists waited over a decade to acquire and finally had a taste of with the Japanese mission. Scientists, as well as those forecasting the weather and following storms, became wedded to the nine months of data from the NASA Scatterometer and were at a loss when it failed. Luckily, JPL was able to line up everything they needed—instrument, spacecraft, procurement and a strong management team—to put together a successful and speedy recovery mission. Graf got the official go-ahead on QuikScat in November 1997 and was fully ready for launch in November 1998, meaning all of the heavy lifting was done in 12 months.

QuikScat continues to operate to this day, even though the original mission success criteria were to get one year's worth of data and to operate for two years. Since its launch, QuikScat has provided detailed global measurements of surface wind speed and direction for about 90% of the Earth's surface.

QuikScat is also used for weather and storm forecasting, a function that agencies like National Oceanic and Atmospheric Administration have come to heavily rely on because of the instrument's near-real-time data.

Graf emphasized that one of the most important aspects of this mission was everybody's willingness to take a risk. "I think that all of us at JPL need to remember that we're in a risky business. What we do is hard, but we shouldn't shy away from taking on these hard, difficult, risky roles," he said. "This mission shows we succeed quite often."

QuikScat has suffered a few minor hardware failures recently, but is still as accurate as it was a decade ago, according to current Project Manager Rob Gaston. "I continue to be very optimistic about the mission," said Gaston at the anniversary event. He recently helped submit a proposal for a four-year funding extension of the mission.

Just last year, QuikScat received the esteemed William T. Pecora Award, given by the Department of Interior and NASA.

‘Curiosity’ brings 12-year-old for a visit to Mars Science Lab rover she named

By Alex Abels

Tom Wynne / JPL Photo Lab

Dutch Slager / JPL Photo Lab

Top: Clara Ma holds a wheel from the Curiosity rover, which is under assembly. Her mother, Lisheng Cao, is at right; at left is Jaime Waydo of the Mechanisms and Mobility Group, who helped host the 12-year-old during her visit. Bottom: Clara, left, and her sister, Renny, visit with JPL Director Charles Elachi as Mars Exploration Director Fuk Li looks on.

Clara Ma’s curiosity will make her name known all the way from Earth to Mars.

The 12-year-old student from Lenexa, Kansas, signed her name in both English and Chinese to JPL’s Mars Science Laboratory rover June 8 in the clean room where it is being assembled. Clara named the rover “Curiosity” in the national essay contest that she won, which was sponsored by NASA and the Walt Disney Studios Motion Pictures flick “Wall-E.”

Clara came to JPL with her parents and sister Renny, 11, June 8 to meet the engineers working on the newly named rover. “It’s really exciting!” said Clara of her trip to California. “It’s a big honor to meet everyone involved, it’s just amazing.”

Clara and her family first went to the Mars Yard, where they got to see a full-sized model of Curiosity in a rocky, Mars-like setting, and engineers showed Clara exactly where she would sign the rover, which is planned for a fall 2011 launch. Later, Clara donned a bunny suit in the clean room and signed the inside of the rover with a marker.

The engineers said they were impressed with Clara and her relative calm throughout the whole process. “It’s great to have a kid so interested in everything we’re doing here,” said Julie Townsend, a systems engineer for the robot arm on Curiosity. “With everything we’ve thrown at her today, she’s still absorbing it and asking intelligent questions.”

Clara’s mother, Lisheng Cao, said she couldn’t be prouder of Clara, who is always looking for a challenge. “I feel like this is unbelievable. I didn’t think things like this happened,” said Cao.

Her mother—who said she didn’t even know Clara had entered the contest until she became a finalist—was also the first in the family to learn that Clara had won when she received a phone call from NASA. Renny overheard the conversation and, although she said she tried to keep it a secret from her sister, yelled the good news to Clara before their mother could. “I just started screaming and running up and down the stairs with my sister,” recalled Clara, whose JPL visit with her family also included a tour of the In-Situ Instruments Lab and a meeting with JPL Director Charles Elachi.

Clara’s essay was one of about 9,000 submitted from students nationwide. She heard about the contest in class at Sunflower Elementary School, and sent in her name idea and essay over the Internet at home.

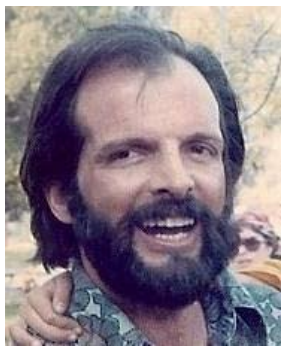
Before signing the rover, Clara reiterated some of the sentiments from her essay and made clear that she does not plan for her curiosity to end here. “Curiosity is the beginning of learning,” she said. “It motivates us to learn and to discover.”

THANKS *for the memories*

JPLers said goodbye and paid tribute to Tom Gavin at his retirement gathering June 18 at JPL.

Photos by Dutch Slager / JPL Photo Lab

Passings



Donald Moore

Donald Moore, a principal mechanical engineer in Section 355, died Feb. 14.

Moore joined JPL in 1972 and had been on medical leave prior to his passing. Considered one of the Lab's preeminent opto-mechanical design engineers and a mentor in the field, Moore was well known for insightful engineering of precision optical instruments and mechanisms. He developed an innovative mirror mount concept, now known as the Moore Mount, which was employed on Galex, Primary Atomic Reference Clock in Space, GeoSar and other instruments and projects.

For his contributions to Galex, he received NASA's Exceptional Engineering Achievement Medal and Group Achievement Award. He also earned NASA's Exceptional Service Medal for "Contributions to significant advances in intricate opto-mechanical state-of-the-art designs that enable higher performance missions at lower risk and cost to NASA." He also received JPL's Level A Outstanding Accomplishment Award for designing the new optical mount.

Moore is survived by his brother James, sister Suzanne, daughter Monique, son Douglas, and grandchildren Jean-Luc, Zachary, Dylan and Violet. Contributions may be made to Webb Institute of Naval Architecture.

Bruce Woodward, 59, an instrumentation engineer in the Environmental Test Laboratory Group, died April 6.

Woodward joined JPL in 1993 as an electrician in the Facilities Maintenance Group and worked on thermal vacuum test instrumentation for the Mars Exploration Rovers and other JPL projects. He also served as a facility electrical engineer, overseeing electrical maintenance and construction activities.

Woodward is survived by his wife, Lee. A memorial stone was placed in his honor at Verdugo Hills Golf course and a celebration of life was held at Descanso Gardens.

Retiree **Robert Barton,** 78, died April 17. He worked at the Lab from 1985 to 1995, contributing to the Galileo and Mars Observer missions.

Barton is survived by four children, eight grandchildren and four great grandchildren. Services were held at Eternal Valley Memorial Park in Newhall.

Jack Pattison, 82, a retired quality control engineer, died April 17.

Pattison, previously a teacher and ham radio operator, worked at JPL for 14 years, serving as a training instructor for personnel who worked on unmanned space vehicles and for the Lab's metric conversion efforts. He retired in 1996.

Pattison is survived by daughters Julie and Sharon, son Randy, six grandchildren and brother Ken. Cremation services were pending.

Frank Goodwin

Frank Goodwin, 88, a retired engineer specialist, died May 5.

Goodwin worked at the Lab from 1959 to 1987. He served as the JPL Mechanical Division representative to the Mariner missions to Venus and Mercury as well as the experimental Seasat satellite project.

Goodwin is survived by his wife, Gloria; daughter Laura; sons Neal and Richard; stepchildren Sally, Vicki and Gary; grandchildren Alexandra and Derek; brothers Richard and Warren; sister Natalie; six step grandchildren and six step great grandchildren.

A celebration of life was held in May. A memorial fund has been set up in Goodwin's name through Loma Linda University Medical Center, P.O. Box 2000, Loma Linda, CA 92350.

Stan Locke

C. Stanley Locke, 86, former editor of the JPL newspaper Lab-Oratory and manager of the Lab's Employees Recreation Club, died May 15.

Locke joined the Lab in 1956 and retired in 1981. The employee paper, which preceded Universe, was at the time published by the Employees Recreation Club, now known as the JPL Store. Locke served as Lab-Oratory editor for 13 years. Known post-retirement by his pseudonym "Ormly Gumfudgin," Locke for many years contributed a column titled "Warmly, Ormly" to the Associated Retirees of JPL/Caltech monthly newsletter.

No services were held. Locke's family requests consideration of donations in his memory to Vitas Hospice, 16615 Arminta St., Van Nuys, CA 91406.

George Hansen Jr., 83, a retired senior research engineer, died May 17.

Hansen worked at JPL from 1951 to 1992. He worked on the Ranger and Mariner projects in the 1960s, as well as Viking, Galileo, Cassini and Mars Observer. During his career he was credited with inventing a system, patented by NASA, that was used by police to locate patrol cars, shortening response time and aiding officers who fell out of contact.

He is survived by his wife, Joyce, and children Eric Hansen, Kerry Wiger, Kim Berger, Gregg Hansen and Kristen Hansen Brakeman, as well as 10 grandchildren. A memorial service was held May 30 in Arcadia. Hansen's family suggests donations be considered to the American Lung Association or the Church of the Transfiguration Memorial Fund.

Letters

Thank you: To my first wife, family and friends for their complete support. To Charles, Ed and Jean Lou for the opportunity they afforded me. To NASA for the confidence they put in me, to John Casani for being my mentor and friend. To the entire JPL/Caltech community of scientists, engineers and administrative staff who have worked so hard to make our missions successful. Forty-seven years ago I was reading the newspaper in the kitchen of our small apartment in the suburban Philadelphia borough of Holmes and saw an ad for an aerospace job fair, which included JPL. I interviewed with Bill Shipley and subsequently was offered a job as an engineering associate for the staggering sum of $610 per month. Betty and I decided to take the offer and give it a one-year try. So in November 1962, I, my pregnant wife and our 6-month-old son Tom loaded our possessions into a 1956 Ford convertible and left for California (that was pre-Interstate). Forty-seven years, four children and 16 grandchildren later, we concluded the tryout is over. I know with all of my friends at JPL there is no way I could stand up here and thank each one individually, so let me say that all the people I have met, all the people I have worked with and all the missions we have done have made my time at JPL/CIT a joy.

Tom Gavin

I owe thanks and gratitude to many friends in Section 343 for their support after my father's death. As an aeronautical engineer, he always kept up with the happenings at the Lab and I was fortunate to have him in my life. The orchid that was sent by JPL is still blooming on our windowsill.

Allen Halsell

Thank you to all our friends and colleagues at JPL for the heartfelt cards and messages on the recent passing of my mother, Margaret Revere. The support and encouragement you gave us is so much appreciated, and comforted us tremendously during this very stressful time. Thank you also for the lovely plant. She will be missed, but we will remember her every time we look at it. We truly appreciate the kindness you provided at a time when it was most needed.

Bill and Jessica Revere

Sincere thanks to all my JPL friends and colleagues for your kind words on the passing of my wife's father. Your support during this difficult time was deeply appreciated. My wife loves the nice plant sent to us by JPL.

Charles and Beverly Naudet

The recent passing of my father, who suffered from Alzheimer's, has been a difficult time for both myself and my family. However, the outpouring of support by both my group and the entire JPL family has helped greatly to ease the sorrow. The flowers at the services, the lovely plant sent to our home (arthurium) and the basket of fruit and assorted goodies—all have been enjoyed and greatly appreciated. Thanks to all of you for being there as an incredible support group!

Rob and Mary Miller and family

I would like to thank all of my JPL friends and extended family for their cards, gifts and kind words as I embark into a new phase of life called retirement. I will always remember the great times I've experienced while working at the Lab and especially all of the laughs. Your love and support is what's sustained me through these years. Working with all of you has been a true blessing in my life. Thank you for a great 25 years!

Karen Callum

Thank you to whomever found the sterling silver chain with oblong dark turquoise stone set in silver (lost on 5/27 about 9 a.m. in east lot). It truly means a lot that you turned this in! My daughter was extremely grateful! Thanks again!

Anita Serrato

Retirees

The following JPL employees retired in June:

David Skinner, 36 years, Section 343D; **Deborah McCarthy,** 35 years, Section 2123; **Fred Hammer,** 34 years, Section 3170; **Martha Strain,** 23 years, Section 333G; **Stephen Giacoma,** 22 years, Section 2632; **Ronald Milton**, 20 years, Section 5126; **Wing-Sang Chong,** 20 years, Section 5125.

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