

Lab discoveries find

Earth's wet moon, an icy Mars

Data from three spacecraft confirm water molecules on lunar surface

Three JPL instruments have played a central role in the discovery of water molecules in the polar regions of the moon—a possibility long imagined by scientists that could help provide resources for future humans living on Earth's natural satellite.

The JPL-managed Moon Mineralogy Mapper, or M3, instrument reported the observations. M3 was launched Oct. 22, 2008, aboard the Indian Space Research Organization's Chandrayaan-1 spacecraft. Data from the Visual and Infrared Mapping Spectrometer on JPL's Cassini spacecraft and the High-Resolution Infrared Imaging Spectrometer on the JPL-managed Epoxi spacecraft contributed to confirmation of the finding. The imaging spectrometers revealed water molecules in amounts that are greater than predicted, but still relatively small. Hydroxyl, a molecule consisting of one oxygen atom and one hydrogen atom, also was found in the lunar soil.

"This is an exciting discovery on the 40th anniversary of the Apollo 11 landing that provides the impetus for new ideas and opportunities, for which JPL is in a strong position to compete," noted Cinzia Zuffada, JPL associate chief scientist. "It is likely to change

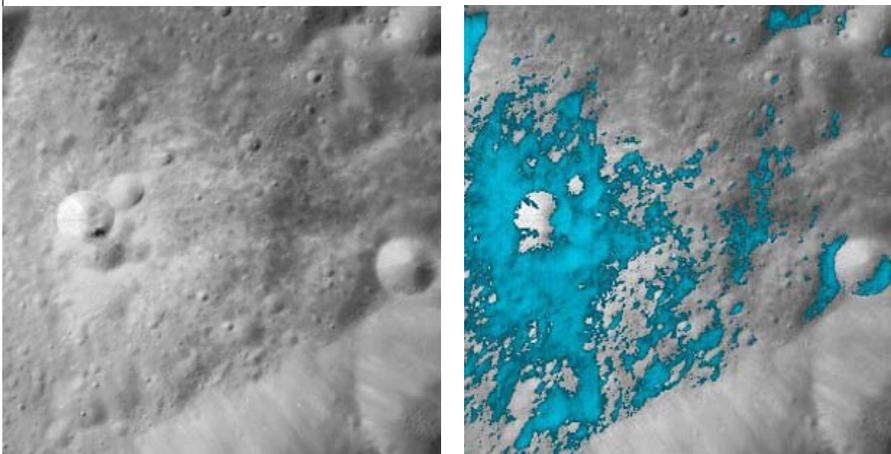
our understanding of the moon. This exceptional accomplishment rests on the state-of-the-art M3 spectrometer developed at JPL and is a tribute to the Laboratory's commitment to the success of such a complex international collaboration."

"These intriguing results," added JPL Planetary Science Instruments Manager Chris Webster, "remind us of the great richness in science discovery that accompanies every planetary mission that we conduct; even to our nearest neighbor that we thought was well understood."

M3's spectrometer measured light reflecting off the moon's surface at infrared wavelengths, splitting the spectral colors into small enough bits to reveal a new level of detail in surface composition. When the mission's science team analyzed data from the instrument, they found the wavelengths of light being absorbed were consistent with the absorption patterns for water molecules and hydroxyl.

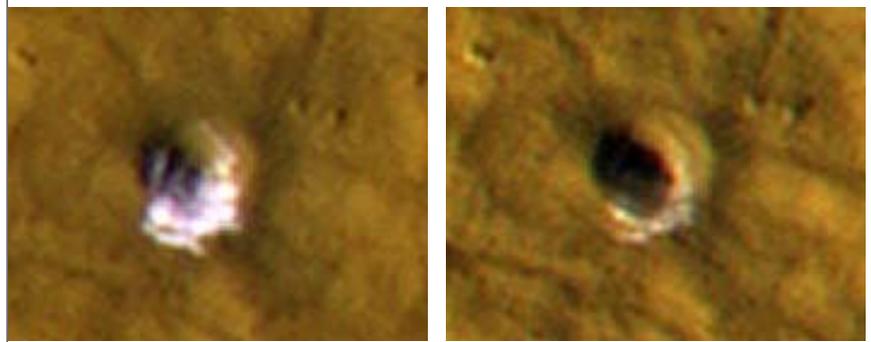
JPL's Rob Green, project instrument scientist for M3, noted that the instrument—which weighs about 20 pounds, runs with the energy equivalent to a 20-

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These images show a very young lunar crater on the side of the moon that faces away from Earth, as viewed by JPL's Moon Mineralogy Mapper on the Indian Space Research Organization's Chandrayaan-1 spacecraft. On the left is an image showing brightness at shorter infrared wavelengths. On the right, the distribution of water-rich minerals is shown around a small crater.

Reconnaissance orbiter sees frozen water exposed by meteor impacts



Mars Reconnaissance Orbiter's HiRISE camera took these images of a fresh, 6-meter-wide crater on Oct. 18, 2008 (left) and on Jan. 14, 2009. Each image is 35 meters across. This crater's depth is estimated to be 1.33 meters. The impact exposed water ice—the bright material visible in this pair of images—from below the surface.

In a fortuitous and unexpected discovery, JPL's Mars Reconnaissance Orbiter has revealed frozen water hiding just below the surface of the Red Planet's middle latitudes. The spacecraft's observations were obtained after meteorites excavated fresh craters.

The findings provide "a new window into the 'water on Mars' story," noted Suzanne Smrekar, Mars Reconnaissance Orbiter deputy project scientist. "The distribution of subsurface ice is something scientists have been pursuing for a long time. This is our first insight into how water and climate have changed on Mars over the last 10,000 to 100,000 years."

Scientists controlling instruments on the orbiter found bright ice exposed at five Martian sites with new craters that range in depth from about half a meter to 2.5 meters (1.5 feet to 8 feet). The craters did not exist in earlier images of the same sites. Some of the craters show a thin layer of bright ice atop darker underlying material. The bright patches darkened in the weeks following initial observations, as the freshly exposed ice vaporized into the thin Martian atmosphere. One of the new craters had a bright patch of material large enough for the orbiter's spectrometer to confirm it is water-ice.

The findings indicate water-ice occurs

beneath Mars' surface halfway between the north pole and the equator, a lower latitude than expected in the Martian climate.

"This ice is a relic of a more humid climate from perhaps just several thousand years ago," said Shane Byrne of the University of Arizona, a member of the team operating the orbiter's High Resolution Imaging Science Experiment, or HiRISE camera, which captured the images. Byrne and 17 co-authors report the findings in the Sept. 25 edition of the journal *Science*.

"We now know we can use new impact sites as probes to look for ice in the shallow subsurface," said Megan Kennedy of Malin Space Science Systems, a co-author of the paper and member of the team operating the orbiter's Context Camera.

During a typical week, the camera returns more than 200 images of Mars that cover a total area greater than California. The camera team examines each image, sometimes finding dark spots that fresh, small craters make in terrain covered with dust. Checking earlier photos of the same areas can confirm a feature is new. The team has found more than 100 fresh impact sites, mostly closer to the equator than the ones that revealed ice.

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Building a future for flight projects

By Mark Whalen and Alex Abels

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Bottom row, from left: An exterior view of the building and its greenery; Pete Jones shows off the new look in sliding glass doors for offices; one of the newly designed cubicles, which offer enhanced working and storage space; the "green" roof; the theater-style auditorium; one of the meeting rooms that are on most corners of the structure.



Tom Wyner, JPL, Photo Lab

JPL's sparkling new Flight Projects Center, which started occupancy in September, is so much more than a structure that will provide additional office space for JPLers.

Planning calls for the building to house project team members who are transitioning from missions' formulation phase to development and implementation phases, said Pete Jones of the Engineering and Science Directorate staff office. To date, most of the 150 Mars Science Laboratory staff members have relocated to the new Building 321, as have Orbiting Carbon Observatory staff. Members of the Solar System Exploration and Mars Exploration directorates are scheduled to move in by the first week of October.

The next groups to move in, said Jones, will be, in order, the Soil Moisture Active and Passive Mission, Juno, NuStar, Space Interferometry Mission Lite Astrometric Observatory, and Grail.

The six-story building will be completely occupied by early December, Jones said. Maximum occupancy is 620 in offices and workstations, with about 100 people per floor.

The 193,491-square-foot Flight Projects Center is a testament to energy efficiency and a salute to the

"greening" of JPL. The facility has received gold certification from the U.S. Green Building Council's Leadership in Energy and Environmental Design rating system, which verifies that the building was designed and built to save energy and water, reduce carbon dioxide emissions and improve indoor environmental quality. The certification is a first for NASA, noted Randy Wager, supervisor of project administration in the Facilities Engineering and Construction Section and project manager for the building.

Overall, the facility's efficiency measures include enhanced wall and roof insulation and window-shading devices. Compared to similar structures, Wager said, a 50 percent water reduction in landscaping and a 30 percent water use reduction is expected for the building. Also, the structure well exceeds standards set by the American Society of Heating, Refrigerating and Air-Conditioning Engineers for energy performance (25 percent below requirements) and lighting power density (24 percent below requirements). And 95 percent of construction waste has been recycled.

A green, living roof atop the new 422-seat auditorium will help keep the building cool in the summer and warm in the winter. The green roof, comprising mostly succulent plants, will provide insulation from thermal shock from the auditorium and will also help minimize storm water runoff into the Arroyo Seco, Wager said.

The state-of-the-art auditorium contributes significantly to the building's promise of energy efficiency. Its features include carbon dioxide sensors to reduce heating and cooling when lightly occupied as well as displacement ventilation for improved air quality.

"We have taken a great leap toward saving energy by installing new LED-based stage lights that have far less power consumption and much lower heat output than the traditional theatrical lights in von Kármán Auditorium," added Marian Inova, manager of JPL's Television Operations Office. "We've also saved energy by using multi-view monitors in the auditorium control booth instead of individual monitors for each camera or input."

Perhaps more reminiscent of a theater than an auditorium, the new facility is also cutting edge in many other ways. A noticeable improvement, Inova noted, is that for high-definition content with a 16:9 aspect ratio, the center projector throws out an especially big, impressive image. The 14-foot screen and 10,000-lu-

The state-of-the-art auditorium contributes significantly to the building's promise of energy efficiency. Its features include carbon dioxide sensors to reduce heating and cooling when lightly occupied as well as displacement ventilation for improved air quality.

Earth's moon *Continued from page 1*

watt light bulb and is about the size of a desktop laser printer—has returned almost 1,000 gigabytes of data in the past 10 months "to allow us to cover more than 90 percent of the moon. You're seeing just the beginning of the results and some of the highlights from the early analysis of the data."

"We are not talking about lakes, oceans or even puddles," said Carle Pieters, M3's principal investigator from Brown University. Team members said that on average, one ton of the top layer of the moon's surface could contain as much as 32 ounces of water.

While the M3 team found water molecules and hydroxyl at diverse areas of the moon's sunlit region, the water signature appeared stronger at higher latitudes. Water molecules and hydroxyl previously were suspected in data from a 1999 Cassini flyby of the moon, but the findings were not published until now. "The data from Cassini's instrument and M3 closely agree," noted Roger Clark, a U.S. Geological Survey scientist in Denver and member of both the M3 and Cassini spectrometer teams.

For additional confirmation, scientists turned to the Epoxi mission while it was flying past the moon in June 2009 on its way to a November 2010 encounter with comet Hartley 2. The spacecraft, which JPL directed to a 2005 comet encounter for the Deep Impact mission, not only confirmed the Cassini and M3 findings, but also expanded on them. Jessica Sunshine of the University of Maryland, Epoxi's deputy principal investigator and a scientist on the M3 team, said Epoxi data "unequivocally confirms" the presence of both water and hydroxyl and reveals that the entire surface appears to be hydrated during at least some portion of the lunar day.

men projectors combine to provide bigger and brighter pictures than those offered in von Kármán Auditorium.

The new auditorium will utilize built-in, multi-camera, high-definition videotaping and permanent video teleconference capability. The seating capacity is approximately double that of von Kármán. Chairs in the new facility include small, retractable desktops for easier note taking. Food is prohibited inside but water is allowed. Events in the auditorium require a minimum of 50 people.

For large meetings that don't quite require all the auditorium's features, the building's basement includes a 200-seat multipurpose room, which will be available in late November. With capabilities similar to the 180-101 and 167 conference rooms, the room will offer multiple projectors and non-permanent seating so it can be configured in a "U-shape" with tables, a feature often used for design reviews. In this configuration, the seating capacity is approximately 130 people (compared to about 80 in 180-101). Other setups will be available, Inova said. To schedule events, call ext. 4-6666 or 4-6170.

All told, more than 40 meeting/conference rooms are available in the building. Floors 3, 4 and 5 each have meeting rooms in the four corners of the building; floors 1 and 2 have meeting rooms in three corners. Conference rooms offer a centralized control system, projection capability, computers and a voice conferencing system. By late November, each

"For all of those who thought the moon was just a white or gray body in orbit around the Earth, it isn't," Green said. "It's full of spectacular spectral variations, which we can relate to composition. There are many more questions today than we had six months ago, and there's going to be a lot of work over years, and probably decades, understanding this phenomenon and following up on it.

"The discovery will have important consequences to NASA's portfolio of future missions and needed instrumentation, and may impact the ongoing Planetary Science Decadal Survey priorities," Webster said. "For JPL, it is a validation of the careful, meticulous way that we build robust but sophisticated spectrometers like M3, under the guidance of instrument managers Tom Glavitch and Mary White. We are delighted with the spectacular results from Carle Pieters' team and the Chandrayaan spacecraft performance on India's first lunar mission.

"Already, we are discussing future mission opportunities with Carle and Rob Green that include interest expressed by both the India Space Research Organization and the Japanese Space Agency in a next-generation instrument capability," Webster said, adding that JPL is planning to propose a similar instrument on NASA's Jupiter Europa Orbiter mission in 2025 to look at the shell of Europa that is believed to be made up of water ice. ■

Ice on Mars *Continued from page 1*

An image from the camera on Aug. 10, 2008, showed apparent cratering that occurred after an image of the same ground was taken 67 days earlier. The opportunity to study such a fresh impact site prompted a look by the

floor will include at least one conference room with high-definition video capability. The Office of the CIO provides full-service networking capabilities for both the smaller meeting rooms (with a capacity of 12) and conference rooms (capacity 40), which are scheduled through JPL's Unified Messaging Service.

The facility also includes some new recycling features not found in other buildings on Lab. Pantry areas on each floor (which also serve as a copy center) are equipped with receptacles for the recycling of bottles and cans. Each floor has an additional area adjacent to the elevators for recycling newspapers and magazines, and an additional receptacle for plastic bottles. Pantries also have a tall blue paper-recycling bin, next to the copy machine. Additional bottle and can recycling can be provided for auditorium events. For information, contact Taeha Goodrich, ext. 4-1973.

An exercise room is also being prepared in the basement, and will be available in late October.

The Flight Projects Center was championed among others by retired JPL executive Tom Gavin, thus the building's affectionate designation as "Gavin Towers." Conceived early in this decade, the building was constructed in approximately 24 months. The cost of about \$71 million was funded by JPL projects through NASA's Construction of Facilities program. ■

orbiter's higher resolution camera on Sept. 12, 2008, confirming a cluster of small craters.

"Initially, the science team was extremely excited and hoped that it was water, but they were cautious, since it could have been an observation of salt or some other material," Smrekar said. "So the team had to keep it under wraps until the final confirmation."

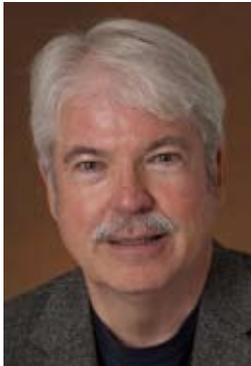
Indeed, she said, confirmation came through with data from Mars Reconnaissance Orbiter's Compact Reconnaissance Imaging Spectrometer for Mars, "a tool that looks deeper than spectrometers can observe and thus provides us with a view of shallow ice at lower latitudes."

Smrekar praised the successful collaboration between the mission teams, noting the critical coordination that's needed between the Context Camera, HiRISE and spectrometer teams to rapidly obtain images and the ability of the Mars Reconnaissance Orbiter spacecraft team to successfully roll the orbiter multiple times over a short period to see the same interesting sites.

One of the great ironies of the discovery, Smrekar noted, is that several of these craters were found in the vicinity of 1976's Viking 2 lander, which had an arm that dug down into the soil looking for ice. "We realized from looking at the distribution of ice in these craters that if Viking 2 had dug down 6 inches deeper, it should have found ice," she said.

"We would have seen the potential for the development for life," she added, "and I think we would have gone back to Mars sooner than we did." Indeed, JPL's Pathfinder landing in 1997, more than 20 years after Viking touched down, was to be the next Mars visit from Earth but did represent the first in a progression of rovers that continues to the present day. ■

News Briefs



Dave Doody

Doody releases book

Dave Doody, flight operations lead engineer for the Cassini Mission Support and Services Office, has authored a new book, "Deep Space Craft: An Overview of Interplanetary Flight."

Written for advanced undergraduate students of astronautical engineering/mission design as well as space professionals and researchers, the book offers an insider's view of current and recent interplanetary space exploration and spacecraft that operate throughout the solar system. Also discussed are space-related fields of specialization, experiments and instrumentation, and the interaction between science teams and flight teams to plan and specify observations, gather and analyze data in flight, and present results and discoveries to the scientific community.

For more information, visit <http://www.springer.com/astronomy/space+exploration/book/978-3-540-89509-1>.

Safety Office sponsors poster contest

The Occupational Safety Program Office seeks entries for its poster contest that convey a clear and positive message about relieving stress and fatigue.

Some criteria: posters must be original content and measure 8 1/2" x 11"; media such as watercolor, pen and ink, crayon, chalk and markers are acceptable; put identifying information on the back of the poster, including artist's name and age (if a child), JPL contact, mail stop and phone number.

Entries will be accepted through Oct. 23. Submit entries to Robin Precie, mail stop 190-117.

Semi-finalists' entries will be displayed on the mall during Safety Day on Tuesday, Oct. 27, from 9 a.m. to 1 p.m., where employees will vote for their favorite in each age group (adults, teens and children under 12).

For more information, call Precie, ext. 4-9834, or visit <http://safety>.

Fighting seasonal, H1N1 flu

By Dr. Robert Estrada
JPL Occupational Health Services

The seasonal flu is a serious, contagious disease. Each year in the United States, on average, more than 200,000 people are hospitalized and 36,000 people die from seasonal flu complications.

This flu season could be the worst ever. A new and very different influenza virus called 2009 H1N1 is circulating now. The Centers for Disease Control expects both 2009 H1N1 flu and seasonal flu to cause illness, hospital stays and deaths this season and is preparing for an early and possibly severe flu season.

The Centers for Disease Control urges you to take three actions to protect against the flu.

1) Take time to get a flu vaccine. The Centers for Disease Control recommends a yearly seasonal flu vaccine as the first and most important step in protection against seasonal influenza. Although there are many different flu viruses, the seasonal flu vaccine protects against three seasonal viruses that research suggests will be the most common in a given year. Such vaccination is especially important for people at high risk of serious flu complications including young children; pregnant women; people with chronic health conditions like asthma, diabetes or heart and lung disease; and people 65 years and older. Seasonal flu vaccine also is important for health-care workers and for people who live with or care for high-risk people to keep from getting them sick. However, a seasonal vaccine will not protect you against 2009 H1N1.

A new vaccine against 2009 H1N1 will be distributed starting in October. People at greatest risk for the 2009 H1N1 virus infection include children, pregnant women and people with chronic health conditions like asthma, diabetes or heart and lung disease. Ask your doctor whether you should get a 2009 H1N1 vaccination.

2) Take everyday preventive actions. Cover your nose and mouth with a tissue when you cough or sneeze. Throw the tissue in the trash after you use it. Wash your hands right afterward and often with soap and water. If soap and water are not available, use an alcohol-based hand sanitizer rub. Avoid touching your eyes, nose and mouth; germs spread this way. Try to avoid close contact with sick people. If you are sick with a flu-like illness, stay

home and don't go out except to get medical care or for other necessities.

Fever is a good indicator of how infectious you are. Don't return to work until the fever is gone for at least 24 hours without the use of a fever-reducing medicine. While sick, limit contact with others as much as possible to keep from infecting them. Follow public health advice regarding school closures, avoiding crowds and other measures to keep your distance from others to lessen the spread of flu.

3) Take flu antiviral drugs if your doctor recommends them to you. If you get the seasonal or 2009 H1N1 flu, antiviral drugs can treat the flu. Antiviral drugs are prescription medicines (pills, liquid or an inhaled powder) that fight the flu by inhibiting flu viruses from reproducing in your body. The priority use for antiviral drugs this season is to treat people who are very sick (hospitalized) or people who are sick with flu-like symptoms and who are at increased risk of serious flu complications, such as pregnant women, very young children, people 65 and older and anyone with certain chronic health conditions. However, most people have been able to recover at home from 2009 H1N1 or seasonal flu without needing medical care or antiviral medication.

Nevertheless, antiviral drugs recommended by your doctor can make illness milder and shorten the time you are sick. They may also prevent serious flu complications. Such antiviral drugs are not sold over-the-counter and are different from antibiotics normally used for bacterial infections. For treatment, such antiviral drugs work best if started within the first two days of symptoms.

For updated information and to find out what to do if you get sick with the seasonal and 2009 H1N1 flu and how to care for someone at home who is sick with the flu, visit the Centers for Disease Control 2009 H1N1 website at www.cdc.gov or www.flu.gov or call 1-800-CDC-INFO (232-4636).

To learn more about the two influenzas, visit the new JPL Occupational Health Services Influenza, Seasonal & H1N1 page at the Occupational Health Services website, <http://hr.jpl.nasa.gov/ohs>.

To find out where you can get a seasonal flu shot in your area, visit the American Lung Association's Flu Clinic Locator at <http://www.lungusa.org/site/pp.asp?c=aqKGLXOAIH&b=1015035>.

Passings



Frances Lolich, 90, a prominent volunteer who participated in numerous JPL public engagement efforts, died Aug. 31.

A nun for the Community of the Holy Spirit, Lolich was known in NASA circles as "Sister Clarice." Beginning in 1989 she dedicated one week a month at JPL, offering special tours of the Lab to local elementary school kids. In 2001 she left JPL to continue her work in education at the NASA Ames Research Center. She also participated in the JPL-managed Solar System Ambassador program, a NASA effort that works with volunteers nationwide.

Lolich received a special recognition award from NASA's Urban

Community Enrichment Program; the Aviation Educator of the Year Award by the California Association of Aeronautics Educators; and NASA's Lifetime Achievement Award from the Aerospace Education Services Program.

She is survived by her sister-in-law Julie and many nieces, nephews and cousins. Services were held in Fremont, Calif.

Martin Berdahl, 91, a retired engineer and manager, died Aug. 22.

Berdahl started at the Caltech wind tunnel in 1951 as an instrumentation engineer. When the wind tunnel was shut down, he moved to JPL's Instrumentation Section in 1961 as a group supervisor, then to section manager in 1963.

He accepted an assignment in India for two years to help develop India's equivalent to the U.S. National Bureau of Standards, then returned to JPL in the Instrumentation Section to continue his technical developments. A major interest was a radiometer to measure the sun's intensity.

Berdahl is survived by his wife, Barbara, daughter Susan, son John, and many grandchildren and great grandchildren. Services were held Sept. 23 at Douglas and Zook Mortuary in Monrovia.

Letters

Jan and I wish to thank everyone who offered thoughts and prayers and words of support and comfort after the passing of her mother. We especially appreciate the plant from DDOSO and the plant from JPL hospitality. Finally, we appreciate Mona for being there like a sister at this time.

Pat and Jan Beyer

Thank you to fellow JPLers for their expressions of sympathy following the passing of my mom, Betty. She was one of those treasured JPL family members who cared for the kids and kept the home fires burning when a mission called for an extra effort from

us. She was excited about the Lab's work, and far surpassed her goal of being around for Cassini's arrival at Saturn and Huygens' exploration of Titan. We carry happy memories of her caring nature and feisty spirit.

Mary Beth Murrill and family

I want to express my heartfelt appreciation to my JPL colleagues for all the expressions of sympathy after the recent passing of my mother—they meant a lot to my family and me. I especially want to thank the Juno team for the amazing flowers sent to my hometown and the ERC for the beautiful plant that was sent to my home. Your thoughts and kind words will remain with me always.

Rick Nybakken

I would like to thank my JPL friends and colleagues for your kindness, sympathy and help during the passing of my father and the illnesses of my son and mother. This has been a difficult few months and I really appreciate all my colleagues have done to make it possible to attend to the needs of my family. In addition, I would like to thank the ERC for the beautiful plant, which will remind me of my dad for a long time to come.

Pat Beauchamp

Retirees

The following JPL employees retired in September:

Robert Vincent, 49 years, Section 172E; **Michael Girard**, 34 years, Section 388H; **Albert Taylor**, 29 years, Section 173E; **James Parrish**, 24 years, Section 2722; **Kenneth Crabtree**, 23 years, Section 3455; **John Swift**, 22 years, Section 314D; **Hugh Briggs**, 20 years, Section 3500; **Charles Backus**, 17 years, Section 3265.



JPL RETIREES:
FOR ACCESS TO CLASSIFIED ADS
AT JPL'S ONLINE NEWS SOURCE

<http://dailyplanet>

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