

It's a wrap

By Mark Whalen

JPL instrument, support help Europe's Rosetta achieve grand finale

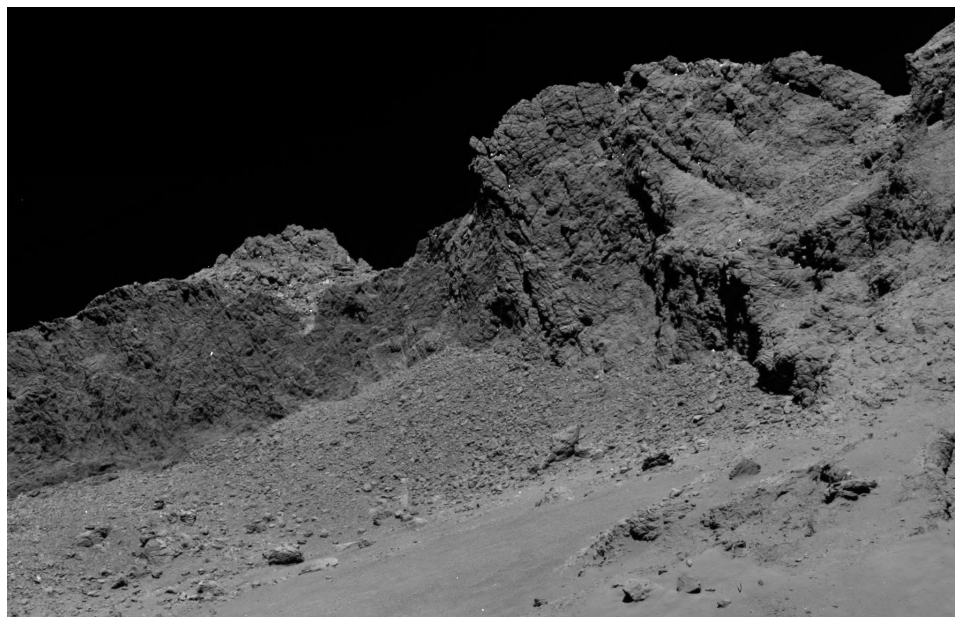
The European Space Agency's Rosetta mission, the first-ever to orbit a comet, came to an end Sept. 30 with a controlled touchdown on the comet's surface. JPL played several key roles in the mission's ultimate success.

Launched in 2004, Rosetta's historic rendezvous with comet 67P/Churyumov-Gerasimenko took place in August 2014, when the spacecraft arrived to begin its two-year orbit to explore the comet's structure, chemical makeup and the interrelationship of solar wind, gas, dust and plasma in the comet's environment.

JPL contributed the Microwave Instrument for Rosetta Orbiter (MIRO), originally led by Principal Investigator Sam Gulkis. Currently, the instrument is led by Mark Hofstadter of the Planetary and Exoplanetary Atmospheres Group. Also provided by NASA was an ultraviolet spectrometer called Alice and the Ion and Electron Sensor, part of the suite of 11 science instruments on the orbiter.

JPL also provided Deep Space Network navigation and communication, along with autonomous planning and scheduling software.

"Being the first time anyone was to



From an altitude of about 10 miles above the surface, the Rosetta spacecraft is shown during its Sept. 30 descent to comet 67P/Churyumov-Gerasimenko.

orbit a comet, it was impossible for us to understand how we were going to do it at the moment we launched," noted JPL's Art Chmielewski, who managed NASA's contributions to the mission. "We didn't understand its gravity, its shape or its activity, so both ESA and NASA worked on how to do orbit determination and optical navigation," he said.

One of the most important achievements of the MIRO instrument, designed and built at JPL with components de-

veloped at JPL's Microdevices Laboratory, came with the detection of water from the comet in early 2014 before the rendezvous, said Gulkis. "The signal was very weak, but MIRO was able to measure the water production rate. As the heliocentric distance of the comet decreased, the gas production rate increased."

Currently, the heliocentric distance of the comet is increasing and the water production rate is decreasing, added

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Gulkis. MIRO has been able to measure the water-production rate from its first detection until the very end of the mission in September of this year, he said.

Because MIRO operates at short radio wavelengths, said Gulkis, it allows scientists to peer beneath the surface of the comet to see the ice as it sublimates—or changes directly from a solid to a gas. “We have a really good idea of where the ice is located, in terms of the depth below the surface,” he said. “We have very good estimates on the water-production rate, its temperature and how fast the water is being released from the nucleus.”

But if you visited Rosetta, there would be no need for a towel. “The water is sublimating from ice to vapor,” said Gulkis. “It’s too cold [for liquid].” MIRO also measured the comet’s near-surface temperature and concluded that its surface is covered with very fine dust powder that protects the comet, he said. “Not all of the heat that hits it flows inside; it heats up the surface, then some of the heat radiates away before entering the comet.

“This was one of the most important measurements we made,” Gulkis said, noting that the finding was taken into consideration for selection of the touchdown site for the Philae lander. Philae, about the size of a washing machine, was steered to the comet’s surface in November 2014 but its harpoons failed to anchor it into the surface for experimental drilling.

The comet’s shape, resembling a duck, was a surprise to the mission team. “It looks like two bodies that have been stuck together,” said Gulkis.



Comet 67P/Churyumov-Gerasimenko as seen by Rosetta’s OSIRIS wide-angle camera on Sept. 29, when Rosetta was at an altitude of 14 miles (23 kilometers).

“The surface of this comet is very irregular. There is a mathematical model that describes the shape right now, with well over a million pixels on it in order to define its shape.”

— Sam Gulkis

Microwave Instrument for Rosetta Orbiter principal investigator

“The surface of this comet is very irregular. There is a mathematical model that describes the shape right now, with well over a million pixels on it in order to define its shape.”

The spacecraft is finished, but the analysis of the data it has provided is far from over. Rosetta’s demise materialized on a region of the comet known for active pits that spew comet dust into space. The walls of the pits exhibit intriguing lumpy structures about 3 feet (1 meter) wide, which some scientists believe could be the signatures of early cometsimals that assembled to create the comet in the early phases of solar-system formation.

Rosetta’s final hours of descent featured many once-in-a-lifetime measurements, including very high-resolution images of the comet’s nucleus as well as gas and dust analysis.

“This could be our only chance for decades to take a look at the inside of a comet,” said Chmielewski.

Gulkis, a veteran of Voyagers 1 and 2 and the Cosmic Background Explorer mission, retired earlier this year after 48 years at JPL. He has worked as a research associate toward the end of the Rosetta mission.

However, with a position as a researcher on the Juno science team, he still has lots of exploration ahead of him.

Spark of the new

Innovation, improvement are goals for campaign, website

One of the keys to JPL's future is the continual improvement of how it does its work, which is considered to be just as important as the world class systems the Lab delivers.

Over the years, many JPLers have contributed significant improvements to advance work processes and innovations. But not everyone is fully aware.

So you've developed a successful new method, let's say, to track your work. But how can you share it with other employees who might benefit?

You're looking for help in a particular area. Has anyone else on Lab been through the same experience?

A new website, JPL Spark, is designed to enable those connections.

"Spark will be a forum to find others who can help you," noted JPL Deputy Director Larry James. "It's all about highlighting the innovative practices and process improvements, and connecting people to expand the benefit."

The site [<https://jplspark.jpl.nasa.gov>] will provide a platform to share improvements and innovations, and will match up potential experienced mentors with those seeking assistance. Also included is a repository of innovations and ideas implemented by employees. The system is de-



"It's about ideas and connections. The ultimate purpose is improving how we do our work."

— Larry James
JPL Deputy Director

signed to incorporate metadata that can search key words of interest.

The site's "Get Started" section shows subject-matter experts in various areas of expertise. The innovation gallery will showcase employees' improvements, each featuring the problem they were facing, the team's improvement idea, what was accomplished, and what was learned. A point of contact is also included.

"It's about ideas and connections," said James. "The ultimate purpose is improving how we do work. We're try-

ing to give people access to others, to effective tools, to mentors, to see the good ideas that have worked, so that there's a forum for them to have this discussion, this debate, on the improvement process.

"As we get feedback from employees, we will make it better," added James. "We want to make sure it meets the users' needs."

The website will go live Monday, Oct. 17, with a demonstration planned for 11 a.m. to 2 p.m. on the mall. Teams will share their success stories with poster displays.

Infinity and beyond

By Franklin O'Donnell

Where is JPL going, and how will it get there? Those questions are at the heart of Dave Gallagher's new job as JPL's Associate Director for Strategy, Technology and Formulation. Gallagher was named to the position in August after five years leading JPL's Astronomy, Physics and Space Technology Directorate. Here he discusses his plans, as well as his views on the Lab's direction.

How do things stand with JPL's strategic planning? Do you foresee major shifts, or is your role more to adjust?

More the latter. By now many employees at the Lab have seen the Vision and Quest video—it captures all of the work led by Jakob [Van Zyl], whose team constructed a really great set of quests connected to the Lab's vision. Now what I need to do is take all those elements and go down one more level—to define actionable tasks out of those quests, which really form the structure of our strategic plan.

If you're working at JPL, you want to understand how what you do fits into the overall plan. I think articulating the vision, the quests, and then taking all that down another level will allow this to happen. We want to be a place where people want to be, so having a plan in place that lets people find themselves is really important.

Do you have a to-do list of anything you need to get done before anything else?

You won't often hear me be critical of JPL, but I think one area where we can improve is the following. We have a long history of innovating our way out of any problem, and we've been incredibly successful at it. But sometimes this has made us a little too inward-looking. I'd like to



Dave Gallagher

Josh Krohn / JPL Photo Lab

see us lift our heads up and take a look at what's going outside the gates, with NewSpace [the private spaceflight industry], with what's going on in technology, what's going on in Silicon Valley.

There are a lot of companies making enormous investments that involve some very smart employees, and we ought to be taking advantage of that. You look at things like cloud computing or cloud storage or data science—there's a massive investment in this country and outside of this country, and we ought to have situational awareness and sometimes perhaps partner with people who are strong in those fields. Those are just examples. There are dozens more.

Are there any other critical areas JPL needs to work?

Technology infusion is very important. We need to make sure, when we are working on a particular technology area, that we figure out how it will be infused

into flight projects. One of JPL's great tools that we can use to accomplish this is our investment budget. We need to allocate our investment budget to leverage opportunities in technology that can be connected to missions.

How do things look with JPL's relationships with NASA and various partners?

I think strategic relationships are extremely important. I'd like to see our relationship with NASA Headquarters strengthened. We recently opened up a very healthy dialogue with NASA on our performance, what they love about what we do and where they'd like to see us improve. I think we need to listen to those conversations. I'd also like to see us engage in more partnerships with other NASA centers. We need to go to our sister centers and look for opportunities to collaborate, as well as universities and as

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GALLAGHER *Continued from page 4*

well as industry, but we ought to start by taking a look at other NASA centers.

And universities? In recent years there was a focus on strengthening relationships with principal investigators who partner with us.

That's something that the Chief Scientist has focused on, and a lot of us across the Lab have supported. In my opinion, in the last decade our reputation with PI's has really dramatically improved. I see that currently as one of our strengths.

How does international collaboration fit into JPL's direction?

NASA is really supportive of international collaborations, and in general they allow us to do things we couldn't do alone. But we need to keep them in balance. For example, we need to make sure that when we collaborate with a new partner, that the entire mission is not dependent on the deliverable that they're making. That's a risky position we don't want to put ourselves in.

You look at what's going on in Earth science, and on the Herschel and Planck missions, and these are all just fabulous examples of really working together to do things that wouldn't have been done otherwise. We've got great relationships with CNES, with ESA, with DLR, with ISRO, really a lot of good examples to build on.

What about how JPL works with industry?

As we get busier, we need to really take a careful look and make sure we're doing the things that we are uniquely qualified for, and send things which perhaps can be done as well in industry out to industry.

I think we're doing reasonably well in that area, but I think there's room for improvement, and we must improve if we're going to execute on all the work we have.

The Lab overall has a strategic plan, but this must also be an area addressed by each of the program directorates. Is part of your job to get those on the same page?

I don't want to micromanage what the directorates have established in terms of their strategy, and, of course, it's easy for me to put myself in their shoes, just having come out of 7X. But at the same time, I want to make sure we're coordinated. I manage the Strategic Planning Management Council, and I'm trying to focus that on strategy discussions so that for example Astrophysics has a decent understanding of where Earth Science or Planetary are trying to go, so that they can advocate for each other when they're at Headquarters—and to make sure that at the directorate levels that they really are in lockstep with their NASA sponsors.

When you came over to your new position, you brought one of the offices concerned with technology with you. How does that work with strategy?

One of the big changes in the office is we've brought in the space technology portion, which was previously in 7X. This is the Space Technology Program Office, headed by Tom Cwik. The reason that we brought it over is due to a realization that it's critical to integrate technology into your strategy, into your formulation. The things that this office does depend entirely on the technology. The other side of that is that it allows us to really make sure we're infusing the right technologies

into the projects.

But there are also other components of the office—there is formulation, and now legislative affairs also reports to you.

Formulation is a big part of this office. The JPL Innovation Foundry is in this organization—that's been a huge success story at JPL, from the proposal shop to the studies and Team X and so on. So as we look at our strategy, we want to make sure that the missions we select to bid on are ones that are consistent with where we want to go, what our overall strategy is, is it something we want to do with our partners.

On the legislative affairs side, the thought there is that if there are legislators or their staff who request information about JPL projects and programs, we want to make sure that we're telling them a consistent story that's aligned with our strategy, so that they can not only just hear about here's project x, but here's how it fits into where JPL is going—which is something I think they're very interested in hearing.

How has your transition been after your first few weeks in this position?

This is very different than anything I've ever done. I've almost always either been managing projects, or managing project managers who are managing projects—and worried about the next test, the delivery, the next launch, what kind of problems are we having. This is completely different than that—looking out into the future, where do we want to be, how do we want to get there, who do we want to partner with. Those are the important questions.

News Briefs

Geodesy honors to Fielding

JPL researcher Eric Fielding has been selected to receive the American Geophysical Union's 2016 Ivan I. Mueller Award, which recognizes major achievements in service and/or leadership to the geodesy community.

Fielding's honor is for "meritorious work and service toward the advancement and promotion of discovery in Earth and space science."

With JPL since 1999, Fielding specializes in tectonics. He is scheduled to receive the award at an AGU meeting in December.

Bayard authors best paper

Senior Research Scientist David Bayard has received the Asian Journal of Control Best Paper of the Year Award for 2016.

The winning paper was chosen from more than 200 published in the Asian Journal of Control last year. The paper, "Markov Chain Approach to Probabilistic Guidance for Swarms of

Autonomous Agents," was co-authored by Be-hcet Acikmese of the University of Washington.

Bayard accepted the award as part of the Society of Instrument and Control Engineers conference in Tsukuba, Japan, in September, where he was also a keynote speaker.

Lew Allen Award honorees named

Four JPLers have been awarded the 2016 Lew Allen Award, which recognizes significant individual accomplishments or leadership in scientific research or technological innovation by employees during the early years of their professional careers.

The recipients:

Andrew Klesh, Mission Concept Systems Development Group, for technical leadership of deep-space smallsats and under-ice robotic rover technologies in support of terrestrial and outer planets exploration.

Mathieu Choukroun, Planetary Ices Group, for pioneering studies of the physical properties of cryogenic materials and contributions to MIRO and the U.S. Rosetta mission.

Boon Lim, Microwave Systems Technology

Group, for leadership and technological innovation in the emerging field of microwave remote sensing science on nanosatellites.

David Wiese, Solar System Dynamics Group, for exceptional leadership and research roles in GRACE data processing and Earth gravity science.

Software achievement renewed

Mission software development in the Engineering and Science Directorate was recently awarded a Capability Maturity Model Integration maturity level 3 rating, renewing the rating first achieved in 2007. It was achieved through an appraisal of software development tasks led by the Autonomous Systems Division, Instruments Division and the Mission Systems and Operations Division, as well as Section 512's Software Quality Assurance Group. The effort was coordinated by the Software Quality Improvement Project, part of the Engineering Development Office in Division 31.

The Capability Maturity Model Integration is internationally recognized to measure and improve process effectiveness.

Passings

George Neilson, 86, a retired senior research scientist, died Aug. 1.

Neilson worked at JPL from 1978 to 1988, conducting research in crystallization and phase separation behavior of glass and ceramics. He was a principal investigator for the Drop Physics Module where he designed microgravity experiments for the space shuttle. After retiring from JPL, Neilson continued his research as a professor in the Materials Science Department at the University of Arizona.

He is survived by his wife, Eleanor; daughters Bonnie, Kristy and Wendy; and eight grandchildren.

Elmer Floyd, 84, a retired mechanical engineer, died Aug. 3.

Floyd joined JPL in 1959 and retired in 1995. He contributed to projects that included an infrared astronomical satellite, wide-field planetary cameras and a multi-angle imaging spectroradiometers.

Floyd is survived by his wife, Janet; children Brian, Kevin and Debra; and grandchildren Patrick, Michael, Kelsey and Marcy. Services were held Aug. 12 in Iowa.

Herb Siegel, 78, a retired computer programmer, died Aug. 16.

Siegel joined JPL in 1993 and retired in 2006. He developed navigation strategies for Voyager and also contributed to Landsat imaging.

He is survived by children Thomas, Rachel and Benny and grandchildren Alec, Marjorie and Ervin.

Rose Sandra Edwards, 79, a retired PBX and phone operator, died Sept. 8.

Edwards joined JPL in 1963 and handled service requests for phone, voicemail, conferencing and data services. She retired in 2004.

Edwards is survived by children Mark and

Nancy; five grandchildren and six great-grandchildren.

Former Voyager Project Manager Richard Laeser, 78, died Sept. 13.

Laeser joined JPL in 1964 and contributed to computing, communications, and tracking and data acquisition support of planetary missions. He became mission operations manager for Voyager in 1974, was mission director

from 1977 to 1981, and was project manager for Voyager 2's 1986 encounter with Uranus, which also included planning for the 1989 flyby of Neptune.

From 1987 to 1991, Laeser established, managed and decommissioned JPL's space station support office in Reston, Va. Returning to JPL, he served as a special assistant to the director, focusing on change of JPL's culture and its underlying management systems and work processes. He retired in 2000.

Laeser is survived by his wife, Sandra; daughters Holly and Kathryn; granddaughters Kaylynn, Ashlin and Breckin; and great-grandchildren McKinley, Alayna, Bryson and Alivia.

Roni Dash, 60, a staff assistant in the Public Services Office, died Sept. 18.

Dash had worked at JPL since 2011, supporting Open House, Invention Challenge, Science Bowl, Ocean Sciences Bowl, and FIRST Robotics.

She is survived by son Daniel, brother Stuart and sister Arline.

Barbara Frink Allen, 92, the widow of former JPL Director Lew Allen Jr., died Oct. 6.



Dick Laeser

The Allens were married in 1949. Lew Allen served as chief of staff of the U.S. Air Force (1978-82) before he became JPL's director, from 1982 to 1990. He died in 2010.

Allen is survived by children Barbara Hatch Miller; Lew Allen III; Marjorie Allen Dauster; Christie Allen Jameson and James Allen; as well as 12 grandchildren and 12 great-grandchildren.

Services will be held at Nov. 11 at Falcons Landing, Potomac Falls, Va. The Allen family requests consideration of donations in her memory to St. Jude Children's Research Hospital/memorial id# 10618423 (800-805-5856).

Letters

Many thanks to my friends here at JPL for their condolences, thoughts and prayers at the passing of my dear mother. I find comfort knowing that my mother is now free and happily with my father. Thank you, JPL, for the beautiful peace lily.

Magdalene Chang

I would like to thank my NISAR and JPL friends and co-workers for the touching cards, flowers and plant at the passing of my father, retired JPL research scientist George Neilson. My father loved his years working at JPL and was thrilled to see me follow in his footsteps at JPL. I appreciate your caring and thoughtfulness.

Wendy Neilson Edelstein

We'd like to thank our JPL friends and co-workers for the cards, flowers and plant following the death of our youngest sister, Rojeanne "Rogie" Ostby. We are blessed to be surrounded by such kind, supportive and caring people. Your support has been a great comfort and is appreciated.

Laurie Lincoln, Shelley and Steve Matousek, Corinne "CoCo" Karpinski

Retirees

The following JPL employees recently announced their retirements:

August

Jacqueline Akers, 44 years, Section 3113; **Edward Motts**, 38 years, Section 506; **Tam Nguyen**, 36 years, Section 647; **Thomas Frascchetti**, 33 years, Section 3000; **Brian Cooper**, 31 years, Section 347K; **Lynne Cooper**, 28 years, Section 1520; **Daniel Barber**, 19 years, Section 355L; **Robert Estrada**, 16 years, Section 1163.

July

Larry Bergman, 43 years, Section 8151; **Anita Sohus**, 42 years, Section 1853; **Greg Goodson**, 39 years, Section 382A; **Tonja Cooper**, 37 years, Section 3012; **Michael Nieto**, 36 years, Section 284; **Jody Brown**, 28 years, Section 2500; **Sella Moursalian**, 21 years, Section 2201; **Che Zhang**, 10 years, Section 356F; **Harmodio Gray**, 14 years, Section 5128.

Classifieds

Ads submitted Sept. 24 to 30.

For Sale

BALL GOWN, never worn, all white Tulle (Florence by Maggie Sottero), purchased originally at Panache Bridal in Pasadena for \$1,200; garment bag and Sottero gown certificate included; a bridal size 20, which is optimum for alterations; Swarovski belt sold separately, a Grosgrain belt is included; \$950/obo. 626-354-2002, call or text.

DESK for student, with 7 drawers, \$50. 818-957-8614, Mina.

MISC.: ski wear M/L/SL, mini steam iron, Rollerblades (men's 8), Bloody Mary set, stemless decanter set, board games. 818-272-3262.

Vehicles / Accessories

'12 **CRUISER RV Fun Finder X-139** ultra-light travel trailer, 15' long, 7' wide, 6' 4" inside height, single axle, refrig, furnace, M/W, AC, TV, BBQ, water heater, toilet, inside and outside shower, dinette/bed, fold down bunk, 2 propane tanks, 2 batteries; pictures on request; \$9,000. nvanwickle@gmail.com, 626-298-4199, Fred or Nancy.

Wanted

GUEST HOUSE OR APARTMENT sought by female JPLer; "affordable" one-bedroom, cable ready with a fridge, stove and central air within a 15-mile radius to JPL; looking to move in mid-November, would prefer utilities to be included in the rent. 757-303-6724.

SPACE INFO/memorabilia from U.S. & other countries, past & present, for personal use (see <http://www.youtube.com/watch?v=S7PvjGp7mCU>). mrayman@alumni.princeton.edu, 818-790-8523, Marc Rayman.

UPRIGHT BASS CASE, hard, ¾ size, for air travel. 818-437-3513, Susan.

Real Estate for Sale

DUARTE, 4 bdrm, 2 bath, 1,800 sq. ft. home on 7,100 sq. ft. lot, pool and lovely outdoor area, near trails and large park; see www.3476deerlanedrive to be connected to the realty page; many JPLers and a Gold Line station are

within 1 mile of this lovely home. 626-359-3854, mab-t@charter.net, Mary Ann Brewer-Nolan.

LEBEC-area mountaintop retreat, spectacular views, 4 br./2 ba., 3,210 sq. ft. custom-built house on 20 acres, surrounded by vast fields of wildflowers in spring, but stunning year-round; only about an hour from JPL north on I-5; includes spacious workshop or artist's studio; see <http://www.tourfactory.com/idxr1308594>; \$549,900. 805-358-1626 or Robert.A.Preston@icloud.com.

For Rent

ALTADENA (91001), furnished 2-bedroom, 2-bath home completely remodeled in 2012; ideal layout for roommates -- bedrooms / baths are at opposite ends of the house; kitchen with refrigerator + microwave, plates, pots/pans, utensils, etc.; washer and dryer; gated parking in driveway and carport; nearest cross-st. is Fair Oaks/Calaveras; long- or short-term lease avail.; renter pays utilities excl. trash, \$2,000/mo., small pet OK for additional monthly fee. mpauken@gmx.com, 818-237-0645.

PASADENA, furnished room in a lovely 4-bd./2-bath house, big backyard, hardwood floor, big closet, shared bathroom, kitchen and laundry privileges; 2 miles to JPL, close to public transportation; short- or long-term lease available; must like dogs and be very clean; \$900 + \$900 deposit. 818-960-8654.

TUJUNGA (91042), 2-bedrm., 1-bath house, 1-car garage; quiet, residential neighborh'd; new professionally designed kitchen w/peninsula, lg. enclosed yd. w/mature trees, patio, gazebo, extra storage shed; low-maint. landscaped front yard, hardwood floors, updated bath, washer, dryer, stove, some furnishings & gardener included; pets considered; Open House Oct. 16; \$2,100/mo. 818-516-2989.

Vacation Rentals

JACKSON HOLE, WY: Luxurious bed & breakfast on 3 acres of solitude on Snake River near Jackson Hole Mountain Resort and Grand Teton Natl. Park; see <http://www.bentwoodinn.com/>; JPL discount. info@bentwoodinn.com, 307-739-1411.

MAMMOTH, Snowcreek, 2 bd., 2 ba. + loft, sleeps 6-8, fully equip'd kitchen incl. microwave, D/W, cable TV, VCR, phone, balcony w/mtn. vw., Jacz., sauna, streams, fish-ponds, close to Mammoth Creek, JPL discount, no pets. 626-798-9222, 626-840-3749 or valeriee@caltech.edu.

MAMMOTH, Snowcreek, beautiful updated condo, 2 bd., 2 ba. + loft (sleeps 6-8), great location by pond/meadow, new appliances, TVs, DVD players, free wireless Internet and washer/dryer, no pets. 818-952-2696 or BigMtnPrettySky@gmail.com.

MAMMOTH, remodeled 2 bed/2 bath + loft, short walk to Canyon Lodge; Courchevel 6 features full kitchen, cable/Internet TV, DVD, Blu-Ray, wireless hi-speed Internet, 2-car garage, Jacuzzis, grill, pool; no pets. <http://Courchevel6.com>.

MEXICO (1 bedrm.): Mayan Palace: Acapulco, Nuevo Vallarta, Riviera Maya, Puerto Vallarta; Sea Garden: Acapulco, Nuevo Vallarta, Mazatlan; trades available with II and RCI. 818-272-3262.

OCEANSIDE white-water view beach condo; see <http://www.previewfirst.com/mls/33034>; 2 bd., 2 ba., sleeps 6; boogie boards, wet suits, full kitchen, all linens, beach towels; Wi-Fi ready, flat-screen TVs, daily paper, grocery stores nearby; 2-min. walk to the sand, no roads or stairs; rates: winter \$1,495/week, summer \$2,495/week; JPL discount, monthly and nightly rates; reserve with \$500 credit card refundable security/reservation/cleaning deposit. Grace, 760-433-4459 or Ginger 831-425-5114.



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Universe

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