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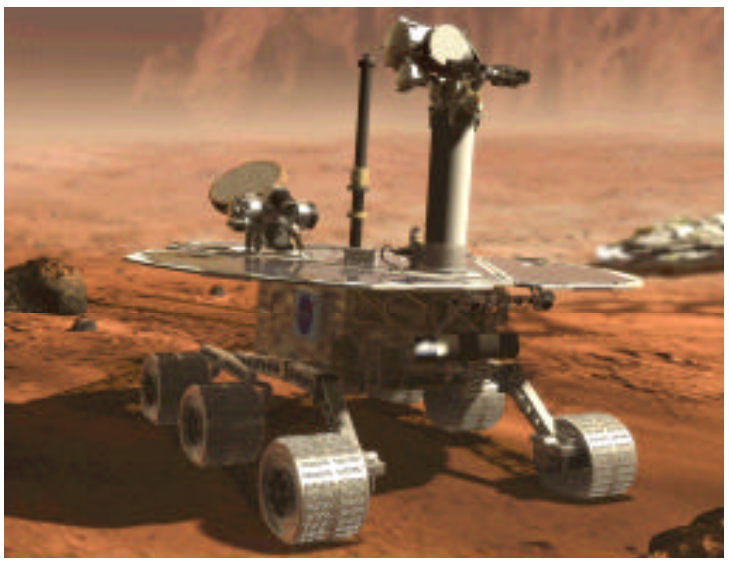
Inside

JPL will build Mars rover to fly in '03

NASA also weighs flying two rovers



The 2003 rover, above, will be able to travel almost as far in one Martian day as the Sojourner rover did over its entire 90-day lifetime.

In 2003, NASA plans to launch a relative of JPL's 1997 Mars Pathfinder rover. Using drop, bounce and roll technology, this larger cousin is expected to reach the surface of the red planet in January 2004 and begin the longest journey of scientific exploration ever undertaken across the surface of that alien world.

JPL will build the new Mars Exploration Program Rover and prepare it for launch in June 2003.

Dr. Edward Weiler, NASA associate administrator, Office of Space Science, announced that the Mars rover was his choice from two mission options that had been under study since March.

The decision for the rover rather than an orbiter option "was an extremely difficult decision to make," Weiler said. "At the same time, we want to look into what could be an amazing opportunity, as well as a challenge, by sending two such rovers to two very different locations on Mars in 2003 rather than just one.

"I intend to make a decision in the next few weeks so that, if the decision is to proceed with two rovers, we can meet the development schedule for a 2003 launch," Weiler added.

The new rover will have far greater mobility and scientific capability than the Pathfinder Sojourner rover. The new robotic explorer will be able to trek up to100 meters (110 yards) across the surface each Martian day, which is 24 hours, 37 minutes. The rover will carry a sophisticated set of instruments that will allow it to search for evidence of liquid water that may have been present in the planet's past, as well as study the geologic building blocks on the surface.

"This mission has the potential for breakthrough scientific discoveries, but also gives us necessary experience in full-scale surface science operations which will benefit all future missions," said Scott Hubbard, Mars program director at NASA Headquarters. "A landed mission in 2003 also allows us to take advantage of a very favorable alignment between Earth and Mars."

After launch atop a Delta II rocket and a cruise of seven and a half months, the spacecraft would enter the Martian atmosphere Jan. 20, 2004. In a landing similar to that of the Pathfinder spacecraft, a parachute will deploy to slow the spacecraft down, and airbags will inflate to cushion the landing.

Upon reaching the surface the spacecraft will bounce about a dozen times and could roll as far as about 1 kilometer (a half mile). When it comes to a stop, the airbags will deflate and retract, and the petals will open, bringing the lander to an upright position and revealing the rover.

Where the Pathfinder mission consisted of a lander with science instruments and camera, as well as the small Sojourner rover, the Mars 2003 mission features a design that is dramatically different. This new spacecraft will consist entirely of the large, long-range rover, which comes to the surface inside a Pathfinder landing system, making it essentially a mobile scientific lander.

Immediately after touchdown, the rover is expected to provide a virtual tour of the landing site by sending back a high-resolution 360-degree, panoramic color and infrared image. It will then leave the petal structure behind, driving off as scientists command the vehicle to go to rock and soil targets of interest.

This rover will be able to travel almost as far in one Martian day as the Sojourner rover did over its entire 90-day lifetime. Rocks and soils will be analyzed with a set of five instruments. A special rock abrasion tool will also be used to expose fresh rock surfaces for study.

The rover will weigh about 150 kilograms (about 300 pounds). Surface operations will last for at least 90 sols (Martian days), extending to late April 2004, but could continue longer, depending on the rover's health.

"By studying a diverse array of Martian materials, including the interiors of rocks, the instruments aboard the rover will reveal the secrets of past Martian environments, possibly providing new perspectives on where to focus the quest for signs of past life," said Dr. Jim Garvin, Mars program scientist at NASA Headquarters.

One aspect of the Mars rover's mission is to determine history of climate and water at a site or sites on Mars where conditions may once have been warmer and wetter and thus potentially favorable to life as we know it here on Earth. The exact landing site has not yet been chosen, but is likely to be a location such as a former lakebed or channel deposit—a place where scientists believe there was once water.

A site will be selected on the basis of intensive study of orbital data collected by the Mars Global Surveyor spacecraft, as well as the Mars 2001 orbiter and other missions.

The alternative mission that had been under consideration for the 2003 opportunity was a Mars scientific orbiter with a camera capable of imaging objects as small as about 60 centimeters (2 feet) across, an imaging spectrometer designed to search for mineralogical evidence of the role of ancient water in Martian history, and other science objectives.

Teams at JPL and Lockheed Martin Astronautics in Denver conducted separate two-month studies of the missions. Weiler credited them with doing "an absolutely superb job in preparing these proposals in a very compressed time frame."

"This project can be accommodated within the president's budget request for NASA, and we will spend the next few weeks refining our budget estimates and other requirements, plus the impacts and the consequences of sending two rovers to Mars instead of one," Hubbard added.

Pacific temps may be influenced by two cycles

By Rosemary Sullivant

The large-scale fluctuation in the Pacific Ocean called the Pacific Decadal Oscillation may be more than a single shift in ocean temperatures every 20 years or so. This huge ocean feature, which has dramatic effects on Earth's weather and climate, may well be made up of two cycles: one relatively short, 15 to 20 years, and the other, a much longer cycle of about 70 years, according to a JPL researcher.

If El Niño were a brief sonata, then the Pacific decadal oscillation would be a bigger symphony. Understanding this complex ocean-atmosphere event is a key to creating better models to predict Earth's weather and climate.

JPL oceanographer Dr. Yi Chao and colleagues Michael Ghil and James McWilliams of UCLA have found evidence of the trend's two-part structure in a study of the past 92-year record of sea surface temperatures in the north and south Pacific. The results of their study will appear in the Aug. 1 issue of Geophysical Research Letters.

"The El Niño is well-defined," Chao said. "We know when it is born, can see its rise and fall, and measure its strength. We can forecast its consequences. But the Pacific Decadal Oscillation is larger, longer and more difficult to visualize. An explanation might be that it isn't just one thing—it's potentially two big events going on."

Chao and his colleagues found large-scale temperature oscillations taking place in the Pacific basin approximately every 15 to 20 years. "While we are only talking about a one- to two-degree centigrade difference in sea-surface temperature," Chao said, "we are talking about a huge area. This temperature difference has a big impact on the climate of North America."

The change in location of cold and warm water in the Pacific alters the path of the jet stream, the conveyor belt for storms across the continent. Chao's study supports and expands the previous studies by University of Washington researchers that gave a name to the phenomenon only five years ago.

But in addition to this regular and relatively short fluctuation in the Pacific basin's temperature, Chao also found evidence of another temperature shift that appears to take place on a much longer time scale, about 70 years. Sea-surface temperatures seem to gently drop to a low in the 1930s, gradually rise again until the 1970s, and then begin a similarly paced decline to the present. "While we were only able to see one cycle in our data, tree-ring records, which go back 200 to 300 years, and fishery data show a similar time-scale shift," he said.

"Looking into the future," he added, "we are now analyzing the temperature below the sea surface. The goal is to get a three-dimensional picture of the Pacific Decadal Oscillation that might help us reach the ultimate goal, a realistic computer model linking the ocean and the atmosphere that will help us predict Earth's climate."

News Briefs

JPL's Phillip Barela, left, receives award from NASA Administrator Daniel Goldin at NASA's quality management conference.

AIRSAR to help study Pacific Rim

The JPL-designed and built Airborne Synthetic Aperture Radar (AIRSAR) is the primary instrument onboard a recently deployed mission being conducted over the next 2 1/2 months by NASA and a team of scientists from several research institutions.

The PacRim 2000 program will collect data in more than 15 countries around the Pacific Rim, the most volcanically active region in the world. AIRSAR is flying onboard NASA's DC-8 Flying Laboratory from Dryden Flight Research Center at Edwards, Calif.

Among the areas where data will be collected during the NASA Earth Science Enterprise mission are Cambodia's Angkor Wat Temple, French Polynesia, Papua New Guinea, the Philippines and the Australian coastal wetlands.

"The mission includes gathering geographic and atmospheric data for coastal analysis and oceanography, forestry, geology, hydrology and archaeology," said ELLEN O'LEARY, PacRim 2000 mission coordinator at JPL "This mission will provide a great deal of valuable information to each of the countries in which we are gathering data."

AIRSAR is NASA's radar technology testbed and is used to demonstrate technology for spaceborne radar missions, such as the Shuttle Radar Topography Mission that flew on the space shuttle in February 2000, said DR. DAVID IMEL, JPL's AIRSAR project manager.

AIRSAR also collects data for Earth science research and is an all-weather imaging tool, able to see through clouds and collect data at night. The instrument's longer wavelengths can also penetrate into the forest canopy, providing scientists with data at different levels in the forest.

The AIRSAR radar antenna panels are mounted on the outside of the aircraft and the instrument looks to the side of the flight path. The radar transmits microwaves and the return signal is collected after the Earth reflects it.

Lab instrument aids German satellite

A German scientific satellite launched last month carries an instrument designed and built by JPL.

The Challenging Minisatellite Payload (CHAMP) and its instruments were working well after the successful launch on July 15. CHAMP was one of three European satellites launched from Plesetsk in northern Russia. It is on a five-year mission for geophysical and atmospheric studies.

JPL contributed an instrument, a "BlackJack" global positioning system (GPS) flight receiver, that will be used in several ways. GPS data from the instrument's upward-pointed antenna will be used to determine the satellite's orbit precisely in order to improve knowledge of Earth's gravity field. Data from a second antenna pointed to Earth's horizon will be used to make precise measurements of atmospheric temperature, pressure and moisture for studies of climate change. Finally, GPS data from a third antenna pointed straight down will allow scientists to test the possibility of using reflected GPS data to acquire information about ocean height and sea-surface winds.

NASA is one of three international partners on the mission. The others are the Centre National des Études Spatiales (CNES), France, and the U.S. Air Force Research Laboratories.

Quality assurance team honored

JPL's Quality Assurance Section (506) recently won the "Administrator's Exemplary Continual Improvement Team Paper Award" at NASA's Continual Improvement and Reinvention Conference on Quality Management. The conference provides a forum for NASA and its contractor partners to share success stories and lessons learned.

The 400 attendees represented senior management from all NASA centers and NASA contractors. This year's spotlighted accomplishments came from JPL, the Glenn Research Center, Kennedy Space Center and Marshall Space Flight Center. NASA Administrator DANIEL GOLDIN selected and presented the Team Paper Award at the conference.

PHILLIP BARELA, manager of the Quality Assurance Section, presented JPL's winning paper, "Breakthroughs in the Assurance Research Process." He discussed the successful collaborative teaming structure developed by the JPL team to leverage intellectual and capital resources from industry, academia and other government organizations. The resulting collaborations have led to a 4-to-1 leveraging of NASA funds and a participation by 87 partners. The collaborations focused on new and advanced electronic packaging technologies.

Other members of the JPL team were GENGI ARAKAKI, SAVERIO D'AGOSTINO, DR. REZA GHAFFARIAN, THOMAS GINDORF, DR. NAMSOO KIM, GEORGE LUTES, DR. RAJESHUNI RAMESHAM, DR. ANDREW SHAPIRO, MANNO SIMEUS, IRENE STERIAN, and PHILLIP ZULUETA.

ACMA members appointed

Five new members have been appointed to JPL's Advisory Council for Minority Affairs (ACMA).

TOM MAY, manager of the Business Opportunities Office 264, is the new chairman of the organization. The other new members are ERICA BOURNE, Section 642; JAMES BLACK, Section 642; REGINA SAKURAI, Section 323; and TOBY SOLORZANO, Section 195.

ACMA advises JPL management and provides input into the development of JPL practices, policies and processes that promote equal opportunity; monitors progress on behalf of ethnic minorities; and provides feedback to JPL management and the minority community for the overall improvement of JPL.

"For this committee to be successful, it must establish and focus on meaningful initiatives and provide feedback to the JPL community on a consistent basis," May said.

Blood drive coming up

The next JPL/Red Cross Blood Drive will be held in von Kármán Auditorium on Aug. 8 from 10 a.m. to 4 p.m. and Aug. 9 from 7 a.m. to 1 p.m.

JPL's Occupational Health Services Office said the Red Cross is experiencing a critical shortage of type O blood.

Sign-up sheets will be available prior to the blood drive at Occupational Health Services, Building 310, and their home page at *http://eis/medical/blood_form.html.*

If you have not signed up ahead of time, or wish to change your appointment, call the Pasadena Red Cross at (626) 799-0841, ext. 630.

Occupational Health Services noted that the Red Cross collected 136 pints of blood in the May blood drive, from which more than 400 lives will benefit.

Special Events Calendar

Ongoing Support Groups

Alcoholics Anonymous—Meeting at 11:30 a.m. Mondays, Tuesdays, Thursdays (women only) and Fridays. Call Occupational Health Services at ext. 4-3319.

Codependents Anonymous—Meeting at noon on Wednesdays. Call Occupational Health Services at ext. 4-3319.

Gay, Lesbian and Bisexual Support Group—Meets the first and third Fridays of the month at noon in Building 111-117. Call the Employee Assistance Program at ext. 4-3680 or Randy Herrera at ext. 3-0664.

Parent Support Group—Meets the third Thursday of the month at noon in Building 167-111. Call Greg Hickey at ext. 4-0776.

Senior Caregivers Support Group—Meets the meet the first Tuesday of each month in Building 167-111. For information, call the Employee Assistance Program at ext. 4-3680.

Tuesday, August 8

JPL Stamp Club—Meeting at noon in Building 183-328.

Wednesday, August 9

JPL Toastmasters Club—Meeting at 5:30 p.m. in the Building 167 conference room. Guests welcome. Call Mary Sue O'Brien at ext. 4-5090.

Saturday, August 12

Western Music—New West will perform ballads and up-tempo Texas swing during its appearance in Caltech's Dabney Lounge at 8 p.m. Tickets are $12 for adults, $4 for children. Call (626) 395-4652.

Mon., Aug. 14—Wed., Aug. 16

Investment Advice—A TIAA/CREF representative will conduct one-on-one meetings in Trailer 1720. Call (877) 209-3140, ext. 2614 to schedule an appointment.

Wednesday, August 16

Retirement Plans—TIAA/CREF will enroll employees newly eligible to participate in the key staff and staff plans. Investment options information and assistance in completing the enrollment form will be available. To be held at noon in Trailer 1720.

JPL 2000 Lecture—Richard B. Miller of the TMOD Plans and Commitments Office will present "DSN: Roadmap for the Future" at 11 a.m. in von Kármán Auditorium.

Thursday, August 17

JPL Astronomy Club—Meeting at noon in Building 198-109.

Friday, August 18

Employee Assistance Program Lecture—Jae Weiss, outreach coordinator for Haven Hills Shelter, will discuss "Domestic Violence: Its Effect on the Community and Workplace" at noon in von Kármán Auditorium.

NOVA awards

The following employees received JPL's Notable Organizational Value-Added (NOVA) awards in April:

Section 212: Ca Turpin.

Element 3211: Hanh Milam. *El - ement 3231:* Eugene Serabyn. *Element 3232:* Ronald Howe, Jose Landeros. *Element 3233:* Catherine Quinn. *Element 3251:* Pamela Conrad. *Element 3252:* Evan Fishbein. *Element 3274:* Kevin Bowman.

Section 354: Mary Jayne Adriaans, Paul Finley, Jeffery Hall, Melora Larson, FengChuan Liu, Yuanming Liu, Alfred Nash, John Panek, Jose Rodriguez, Jo Tillis.

Section 367: Dorothy Crawford, Barbara Engelhardt, Tara Estlin, Amir Fijany, Mark James, Ryan Mackey, Han Park. *Section 368:* Ted Specht. *Section 369:* Shirley Ann Cizmar.

Section 388: Robert Ando, Brian Chafin, Richard De Baca, Jeffery Hall, Helen Mortensen, Mike Smyth, Shigeru Suzuki, Jan Yoshimizu.

Section 642: John Beedy, Ross Curtright, Henry Roehner, Frances Taylor. *Section 643:* Barbara Amago, Raymond Hewitt. *Section 644:* Aurora Aguilar, Jerry Beener, Roger Carlson, Judith Dedmon, Paul Gaytan, Kathy Lynn, Dennis Moran, Larry Palkovic, Daina Parlee, Jeanne Washington, Chris Weaver.

Section 795: Consuelo Gennaro.

following contractors were o awarded NOVAs as part f JPL teams: Aurora Aguilar, Jerry Beener, Paul Finley, Paul Gayton, Dennis Moran, John Panek, Chris Weaver.

The following employees ived NOVAs in May: on 253: Pearline

Section 311: Michael Stoloff. *Section 313:* Jefferson Hall, Julie Webster. *Section 314:* Brian Paczkowski, Steven Wissler.

Element 3233: Candice Hansen.

Section 331: Timothy Pham. *Section 333:* Jeff Berner, Scott Bryant. *Section 335:* Dale Boggs, Mary Brancheau, Debra Coler, Charles Naudet, George Resch, Edna Villareal.

Section 352: Donald Bickler, Gary Bruner, Michelle Coleman, Alexander Eremenko, Bryce Gardner, Marshall Gram, Timothy Ho, David Levitt, Donald Moore, Richard Rainen, Bruce Scardina, Kendra Short, Jason Suchman, Michael Thelen, Walter Tsuha, Christopher Voorhees.

Section 368: Son Ho. *Section 369:* Sheila Davis, William Duquette, Phan Lee, Katherine Levister, Jeanne Makihara, Felicia Sanders, Marianne Shaw.

Section 905: William Hurd.

Section 920: Allen Berman, Patrick Beyer, Albert Chang.

Section 930: James Hodder.

Section 960: Andrea Murrell.

Section 970: Cruzita Abellana, Charles Stelzried.

Continued on page 4

Deep Space 1 repaired from afar

By Martha Heil

Deep Space 1 is on its way to a planned September 2001 encounter with Comet Borrelly after JPL engineers radioed software to the spacecraft to reprogram the camera on board to serve as a replacement for the lost star tracker.

Without the star tracker, Deep Space 1 did not know in which direction it was pointed and thus couldn't thrust in the direction of the comet. Use of the newly developed camera method allowed the spacecraft to regain full three-dimensional control.

Deep Space 1, now about 320 million kilometers (about 200 million miles) from Earth, met or exceeded all of its primary mission objectives of testing 12 advanced, high-risk technologies in September 1999.

"The talented Deep Space 1 folks at JPL are working hard to squeeze a bonus science mission, an encounter with Comet Borrelly, out of this already successful mission," said Paul Hertz, NASA Headquarters program executive for Deep Space 1. "Trying for the comet makes much more sense than just turning the spacecraft off."

"We had to rebuild a significant part of the spacecraft from hundreds of millions of kilometers away and complete it to begin ion-powered flight in time to keep our date with Comet Borrelly," said Project Manager Dr. Marc Rayman. "In a very short time, the spacecraft operations team developed a very complex and innovative new system that gives Deep Space 1 a new chance to try to reach the comet. I think this is one of the most impressive in-space rescues ever completed."

Rovin' BACK TO MARS

By Mark Whalen

Four months into his new job as Mars Program Manager, Dr. Firouz Naderi discusses the state of the program with Universe.

QUESTION **Last week, NASA announced selection of a lander for the 2003 Mars opportunity. How did the agency come to this decision?**

A **Over the last 10 weeks, JPL conducted two fast-track feasibility studies looking at the final candidates for the 2003 Mars opportunity—a lander and an orbiter. The science for both missions, while different, were deemed excellent by the science community. The cost also turned out to be a non-discriminator. So the choice was difficult. A factor in the decision was that in 2003 there will be three other orbiters around Mars—NASA's 2001 orbiter, the European Space Agency's Mars Express and Japan's Nozomi. On the other hand, we would have not had any landers since Mars Pathfinder.**

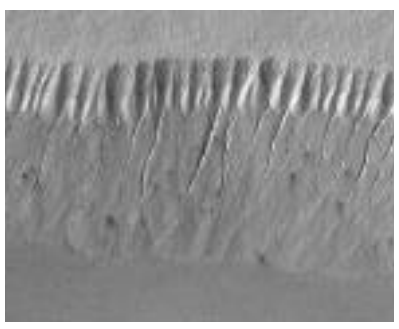
QUESTION **In selecting a mission similar to Mars Pathfinder are we being conservative in going to a tried and true landing method rather than something than new and different?**

A **For a lander mission you should not only look at the landing technique but also the assets you deliver to the surface and what you do with it after landing. It is true that the 2003 mission will use the same landing technique as Pathfinder. Indeed, having shown the utility of an airbag landing for this class of missions it would have been wasteful not to use a proven technology.**

However, after landing, this mission is starkly different (far more capable) than Pathfinder. If you look at the progression of Mars landers, with Viking we did surface science but did not have mobility; with Pathfinder we had mobility but very modest science; with the 2003 mission we will have long-range mobility and extensive science capability.

QUESTION **Mars Global Surveyor recently discovered some sites with the possibility of near-surface water. Can the 2003 lander go to one of these sites?**

A **No. To go to one of those sites we need pinpoint landing capability. Even though the 2003 lander will have—to a factor of two—a more precise landing capability than Pathfinder, still the uncertainty in its landing site is approximately 150 kilometers, the distance between Los Angeles and Santa Barbara, while the range of its rover is about 1 kilometer.**



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We are now investing in technology of a class of smart landers capable of landing within a few kilometers of the desired target and having the smarts to recognize and avoid hazards and/or be hazard tolerant.

QUESTION **What is on the drawing board beyond 2003?**

A **NASA's plan is looking toward a two- to three-decade horizon. You can think of the plan in three phases with considerable overlap. The first phase—which will encompass the next several opportunities—will continue the scientific quest to better understand Mars, including its past and current climate and its geological makeup. Within that context, we also want to understand if there is, or ever was, life on Mars. In order to understand all of this, we need to search for water, past or present.**

Bob Brown / JPL Photos

The second phase will be to put in an infrastructure for human habitation. Examples would be making oxygen and fuel, and installing power plants and habitable Mars outposts.

The third phase will be the human exploration of Mars.

We are working with NASA Headquarters on a plan with a fair degree of specificity for the first phase, which will span the next decade. The plan should be available by the end of summer or early fall.

QUESTION **But NASA has not formally committed to human exploration, have they?**

A **No, not yet and not formally. As of now, neither NASA, Congress nor the Administration has fixed a timeframe for human exploration. There has not been a Kennedy-esque proclamation that "we'll put astronauts on Mars and safely return them to Earth by (fill in the blank) time frame." But while we are undertaking scientific missions to study Mars, we are also laying the groundwork for human exploration by gathering knowledge and developing technologies needed for it.**

QUESTION **How are preparations going on the 2001 orbiter, which is set to launch next April 7?**

A **The project is looking good for an April launch. A recent "red team" review suggested a number of recommendations that the team will be working on prior to shipment to the Cape in December.**

QUESTION **Do you feel that the program has rebounded well from the Mars '98 missions?**

A **Like everything else in life, you learn from your successes as well as your failures. In 1996 we launched two spectacularly successful missions, Mars Pathfinder and Mars Global Surveyor. However, in the next Mars opportunity in 1998 we did not succeed. You learn and you go on.**

The analogy I use is that of a mountain climber. You hammer in your pick and pull yourself up the side of the mountain, and then once in a while, maybe because your grip isn't quite firm, you fall back 20 or 30 feet. At that point, you have two options—either pack it in and go to the base camp at the foot of the mountain or regroup, get a firmer grip, and work your way back up toward the summit. JPL as an institution has never been about base camps. We strive for summits and have seen our fair share of summits. And I think this is the way most people who work on the Mars Program at JPL feel about it.

"You learn from your successes as well as your failures. The analogy I use is that of a mountain climber… JPL as an institution has never been about base camps. We strive for summits and I think this is the way most people who work on the Mars Program at JPL feel about it."

— Dr. Firouz Naderi, JPL Mars program manager

AWARDS *continued from page 2*

The following employees received NOVAs in June:

Section 194: Dean Oisboid. *Section 195:* Jennifer Honda, Arne Strout.

Section 230: Mary Ellen Robertson. *Section 234:* Phil LaFond. *Section 236:* Yvonne Bornhauser, Cindy Rowland.

Section 253: Teresa Bingham.

Section 261: Cliff Findley, Martha Molodowitch, William Kert, Patrick Thompson, Cheryl Wysocki. *Section 262:* Dorothy Jean Hinton, J. Mark Arias. *Section 263*: Michael Kleine, Stanley Packard. Geoffrey Pomeroy.

Section 331: Kenneth Andrews, Payman Arabshahi, Andrea Barbieri, Christine Chang, Michael Connally, Ann Deveraux, Dariush Divsalar, Nasser Golshan, Andrew Gray, Jon Hamkins, David Hansen, Anil Kantak, Aaron Kiely, Matthew Klimesh, Clement Lee, Long Tuyen Ly, Andre Makovsky, Dave Morabito, Ryan Mukai, Leslie Paal, Angel Portillo, Keith Wilson. *Section 334:* Eric Belz, Andrew Berkun, Ed Caro, Bruce Carrico, Samuel Chan, Stephen Durden, Dave Escoto, Don Farra, William Fletcher, Adam Freedman, Eric Gudim, Gary Hamilton, David Imel, Rolando Jordan, Ron Kwok, Greg Neumann, Mimi Paller, Shirley Pang, Brian Pollard, Jim Rasmussen, Richard Riehl, Ali Safaeinilli, Scott Shaffer, Yuhsyen Shen, Phil Smith, Fred Stuhr, Samuel Tauch, Louise Veilleux.

Section 344: Ken Hayworth. *Section 345:* Guillermo Rodriguez. *Section 346:* Stephanie Cowans, Evan Davies, Chris Evans, Mike Fitzsimmons, R. Scott Flores, Amanda Green, Virginia Guzman, Eric Jones, Robert Kowalczyk, James Lamb, Gisela Lin, John Liu, Michael Martinez, Flavio Noca, Patricia Patter-son, Rao Surampudi, Hugo Velasquez, Doug Waltman, Victor White, Dean Wiberg, James Wishard.

Section 353: John R. Anderson, Glenn Aveni, Todd Barber, Brian Blakkolb, John Blandino, John Brophy, Steven Carnes, Ramon Garcia, Ram Manvi, Gary Mulhern, Allison Owens, Charles Phillips, Robert Shotwell, Witold Sokolowski, Tricia Sur, Shonte Wright.

Section 387: Bruce Chippindale, Nadine Chrien, Brian Cooke, Valentina, Grigoryan, Dennis Harding, Rebecca Heninger, Samuel Larson, Dominick Miller, Lawrence Scherr, Manuel Solis, Jose Tamayo.

Section 661: Steven Benson, Jan Beyer, Jose Coito, Myrna Snitowsky.

Section 823: Ranty Liang.

Section 830: Thedra McMillian.

Section 860: Letty Eckerle.

Section 870: Esther Rodriguez.

Section 893: Ken Wolfenbarger.

The following contractors were also awarded NOVAs as part of JPL teams: Sandra Edwards, Linda Knobel, Denise Pride.

Letters

Many thanks to my JPL colleagues and friends for your support at the passing of my father. The expressions of sympathy and concern were greatly appreciated.

Amy Walton

My family and I would like to express our appreciation and thanks to my coworkers for their kind sympathy and support at the passing of my mother. Thanks to the ERC for the lovely plant, it was most appreciated.

Craig Peterson

Thank you to Division 32 for your support and thoughtfulness during the past two weeks with my surgery and then the passing of my brother. The many cards, the beautiful flowers and the plant from the ERC, along with the big plant basket, will be a lasting remembrance of your kindness.

Sharon Chapman

My family and I appreciate the many expressions of condolences from friends and coworkers at JPL for the recent passing of my father. Our thanks is also extended to the ERC for the beautiful plant.

Gus Taix

Classifieds

For Sale

ARMOIRE/DRESSER, child's, 6 drawers, closet area & 3 shelves, solid pine 42"wx49"hx16"d, exc. cond., perfect for baby/child's rm., $350/obo. 626/303-2808.

BASSINET/CRADLE/CRIB in one, white wood, sheet, blanket, bumper guards, barely used for grandchild, $100. 246-7365.

BED, full sz., Ikea-style, black metal frame w/matt., $80; FUTON, wood crate style w/arms, 2 plws., $75; DESK, computer, w/two 3-drawer side units, black, $30; end tables, chairs, kitch. items & much more. 626/791-3924, JM or Teri.

BED for toddler, convert to crib set, 2 big drawers, chester drawer doubles as changing table, sm. dresser, white set w/pastel trim, $295/obo. 249-3115.

BICYCLES, men's & women's 10 spd., 27", exc. cond., like new, $150/both. 626/793-7879.

BIKE/SKI RACK, Thule 451 roof rack for 2 bikes or 6 skis, very sturdy, locks securely, for Subaru Legacy but fits many cars w/o rain gutters, $80/obo. 626/797-6121.

BOOTS, western, HH West, ladies 6 1/2 med., palomino color, all leather, exc. cond., like new, $25. 249-1523.

COMPUTER, 486/33 MHz, 470 HD, 24X CD-ROM, Colorado 250 backup, ATI monitor, make offer; CALCULATOR, HP-48S, w/manual, make offer. 626/798-8777, Paul.

COMPUTER, Power Mac 7100/80, 80 MB RAM, 1.1 GB HD, 17" mon., MS Word, Excel, Claris, Photoshop, 14.4 modem, $550/obo. 957-4617.

COUCH, 3 pc. off-white leather sectional, gd. cond. $125/obo. 626/791-9049, Suzi or Paul.

CLAY POTS, lg. round, 2'dia., $50 ea./obo, 3' dia., $60 ea./obo. 626/398-3480.

CD PLAYERS, top of the line, CDP-CA8ES Sony, 5-disc capacity, 6 play modes, 6 repeat modes, wireless remote ctrl./program., many more features, used about 5 times, $275/obo; LASER DISK PLAYER, Pioneer CLD-D501 CD CDV, remote, w/numerous features & functions, orig. price $700, sell $250/obo; LASER DISK, Jurrasic Park, letterboxed ed., played twice, $30. 790-1410.

COUCH & LOVE SEAT, matching, exc. cond., taupe, $495. 626/584-0860, Donna.

CRIB, lg., white wood w/matt., pad, sheet, bumper guards, coverlet, adj. exc. cond., $150. 626/285-9103.

DINING ROOM table + 6 chairs & matching buffet, $750/all. 790-6491.

DINNER PLATES, 6, Franciscanware, 10 1/2", circa 1940, no chips, $18/ea.; PERCOLATOR, coffee, party, 40 cup, stainless steel, VG cond., $24. 626/793-1895.

DRYER, Maytag, 12 yrs. old, $75; STOVE, elec., white, $35. 626/359-3561, Jan.

EXERCISE MACHINE, NordicTrack Achiever, elec. speedometer, calibrated resistance settings, adj. slope, calorie calc., oak/walnut finish, storage bag, used less than 10 times, orig. $900, sell $250/obo. 790-1410.

EXERCISE MACHINE, Pro-Form crosswalk w/arm exercise option, like new, $200. LAWN SWEEPER, Craftsman, $75; SPREADER, fertilizer, $20 (free w/lawn sweeper; DEHUMIDEFIER, new, 40 pint, $100; DINING TABLE, antique rattan, & 4 chairs, $75. 661/253-1183.

FILE CABINET, 5 drawer, vert., lock, gray/green, incl. 150 hang-file folders, gd. cond., $70/obo. 909/593-4046, vivdavies@starquest.net.

GO-KART, 5 HP Honda motor, with padded roll bar, adjustable seat, exc. cond., for adults and children, paid $1,098, sell $950/obo. 661/251-7738.

GUITARS: 1 Hohner steel string acoustic, case, exc. sound & finish, $100; I Yamaha nylon string classical, hard case, VG cond., $100; both sound better than new guitars of same price, great for beginners. 626/573-2564, Mary, after 6 p.m.

HONEY, fresh, pure comb, chunk or liquid gold in honey bear bottles, jars. 626/584-9632.

JETSCOOTERS, 10, brand new, blue or green, adjustable hts., steering handle, soft foam grips, in-line skate wheels, powerful rear function braking, folds flat quickly, $80 ea./more for disc. 626/274-5893, Ryan.

MATTRESS, Sealy, queen sz., exc. cond., $225; FOOD PROCESSOR, QuisinArt, gd. cond., w/blades, $100. 626/798-8071.

MOVING SALE, leaving country, entire contents of apt. avail. Aug. 15, much only 8 mos. old: sofa+chair, dining set+5 chairs, coffee tables, bed, queen+match. dresser, refrig. lamps, TV, vacuum, etc, $1,150 the lot or sell separately. 661/799-3837.

POOL TABLE, bar sz., all acces., $700/obo. 248-3546, Ted.

SATELLITE DISH, Sony, w/receiver, $120; REFRIGERATOR, Kitchen Aid, 20.7 cu. ft., auto-defrost, glass shelves, ice maker, $450; STAND MIXER, Kitchen Aid, 4.5 qt., $100; MICROWAVE oven, Panasonic, 1,000 W, $100; FAX/PHONE, Panasonic, $100; DRESSER, Ikea, white, $140; TABLE, Ikea, round, 54", $100; FUTON sofa bed, brown wood frame queen matt., $150. 626/795-1610.

STROLLER, twin, w/Evenflo car seats, unique double-decker, lightwt., compact, move babies w/o disturbing sleep, gently used, ordered from Twins mag. $200.626/357-7901.

TELEVISION, Panasonic, 25" diag., wood cab. remote, 8 yrs. old., $150/obo. 626/398-3480.

Vehicles / Accessories

'95 ACURA Legend LS coupe, black, auto, 106K mi. mostly fwy., mint cond., black leather, s/r, heated seats, alloy whls., CD changer, remote keyless entry, $16,000/obo. 626/584-3204 day, 909/952-0780, eve/weekend.

'83 ALFA ROMEO Spider Veloce, black, 90K mi., runs but needs some maint., paint & new top, incl. shop manual & some parts. $1,500/obo. 626/584-6518.

'83 ALFA ROMEO Spider, gd. cond., 72T, orig. owner, $3,000. 626/797-0704.

'94 BMW 325I, 4-dr. sedan, calypso red, exc. cond., only 34,500 mi., very well maint., all records, orig. owner, tan leather, moonroof, alloy whls., remote keyless entry, alarm, more, $19,200/obo. 626/795-1610.

'95 BUICK Skylark, 4 dr., custom sedan, auto, air, cass., 110K mi., airbags & more, exc. cond., $5,400. 661/252-8470.

'83 CHEVROLET El Camino, blue, V8, 100K mi., reduced, $3,000/obo. 626/284-2025.

'80 CHEVROLET utility van, strong motor & trans., for hauling cargo, $600. 341-1798.

'72 DATSUN 240Z convertible, yellow ext., blk. int., 6 point roll-bar, Chev. 350 V8/turbo 350 engin./trans. combo, B&M mega shifter, very cool cruiser, $4,000/obo; APT at JPL, need money for school. 323/259-8279.

'95 DODGE Neon Highline 4 dr. sedan, 5 spd., a/c, cc, Panasonic CD/Infinity Kappas, pwr. locks, recent timing belt, one owner, 67K mi., $5,500 firm. 626/355-4376, Geoff, leave msg.

'84 DODGE D-50 pickup truck, VG cond, auto, 2.6L, bedliner, shell, new batt. & carb., very clean, well maint., all svc. records, 139K mi., orig. owner, $2,800. 626/332-2682, Steve.

'96 FORD Escort LX, exc. cond., 5 spd., 2 dr., 57K mi., a/c, am/fm/cass., $6,900/obo. 909/323-3640.

'93 FORD Thunderbird LX, midnight blue metallic with black int., 3.8 EFI V6, a/c, stereo, spd. ctrl., remote alarm, p/s/b/ant./l, elec. remote mirrors, cast alum. whls., full console, elec. temp. ctrl., more, VG cond., 20 mpg city, 100k mi. $5,995. 661/424-9348.

'72 FORD Bronco, V8, 75K mi., dual limited slip diff., $6,000/obo. 626/284-2025.

'66 FORD Mustang classic 289, V8, auto, all orig., strong eng., alarm, very clean, int. & ext. in exc. cond., must see to appreciate, $5,000/obo; see at: http://www.oxy.edu/~lundeen/mustang_auction.html. 626/379-0971, slundeen@pacbell.net.

'93 HONDA Accord LX, 86K mi., auto, AC, pwr./b/w, burgundy, kept garaged, exc. cond., $9,300. 626/963-7098, after 5 p.m.

'87 HONDA Accord LX, orig. owner, gd. mech. cond., 4 dr., auto, a/c, cc, pwr./w/l, 144K mi., $3,500. 626/282-7022.

'83 KOMFORT 5TH wheel trailer, 26', full tub & shower, refrig./freezer, a/c, furnace, $4,500. 352-7091.

'99 LEXUS ES 300, loaded, leather, CD player/changer, sunroof, 7K mi., like new, Nakamichi audio sys., $25,000. 909/599-3230.

'85 OLDSMOBILE cutlass supreme, white, V6, air, am/fm/cass., new tires, $2,800/obo. 661/297-8108.

'85 PINNACLE motor home, 31', class A, 34K mi., 6.5 KW generator, dual roof a/c, sleeps 6, custom 7' bed, hydraulic levelers, micrwv., lg. side awning+individual window awnings, loaded, exc. cond., $13,000/obo. 949/470-0484.

'95 SUBARU Legacy, 4-dr. sedan, 56K, single owner, exc. cond., AWD, ABS, auto, pwr. sunroof, locks, windows, a/c, am/fm/cassette, cc, alloy wheels, $10,500/obo. 626/355-5662.

'89 TOYOTA Camry, exc. cond. auto, a/c, pwr./w/l, 96K mi., $4,499. 626/579-7403.

'95 TOYOTA Tacoma SR5 truck, a/c, pwr./w/l, JVC radio, 12 CD changer, shell. 790-5229.

Wanted

BED, child's or single, prefer headboard & drawers underneath. 626/355-6558.

CAR, to purchase, luxury, '99/'98, low mi., Acura Legend or Lexus GS-300 or LS-400. 236 4869, eves, Harold.

CAR,'62-'63 Chevrolet Nova, resonable, gd. mech. cond. 626/960-0034.

CARPOOL, need to share expensive gas prices until late Sept., from Saugus, work M-F, 7:30-4:00. 661/297-8108.

OUTBOARD MOTOR, small size. 626/584-9632.

SLIDE PROJECTOR, any make/model, single slide ok. 626/798-8777, Paul.

SPACE INFORMATION/memorabilia from U.S. & other countries, past & present. 790-8523, Marc Rayman.

TOOLS: anvil, blacksmith. 626/798-6588.

TO RENT, professional & USC grad. student/married couple looking for affordable rental or house-sitting opportunity, Pas. or surrounding areas, mature, quiet, no children. 626/461-1000, rfilback@esimail.org, Rob.

Free

CAT, gorgeous, black & white "tuxedo", 1 yr. old, F, playful, affectionate, spayed, all shots, very clean & healthy, needs to be an only cat. 248-2855, Dave & Kelly.

DOG, rescued beautiful black lab/chow mix, 3 yr. old male, trained, healthy/shots, needs loving family, great companion. 661/257-5817.

DOG named "Cera", free to good home, lab/cocker spaniel, black, spayed, all shots, good health, very friendly, moving. 790-0047.

PHOTOCOPIER CARTRIDGES: Canon A30 black, for copier models 1 thru 3, 5 thru 8, 11, 12, and 65; one unopened, one used for couple of test copies, one about half gone. 626/405-8981.

WASHER, Maytag, 12-yrs. old, needs new belt? 626/359-3561, Jan.

For Rent

ALTADENA, share charming 2 bd. house in quiet neighborhood, Altadena Estate area, near New York Dr. & Allen, huge yard, patio, off-st. pkg., garage, storage, all privileges, avail. 8/28, $625, all util. pd. 626/797-3354, bpeterson@huntington.org.

ALTADENA, lg. furn. rm., cable, also share 3 bd., 3 ba., quiet hilltop house, pool, patios, view (incl. JPL), c/a/h., all amen., kitch., d/w, laundry, priv. off-st. pkg. spot, 11 min./JPL, smoking ok (owner smokes), $480, incl. all util. + dep. 626/794-1050, Harry, after 7 p.m.

GLENDORA house, 4 bd,. 1 ba., garage, yard, near 210 fwy., $1,000. 626/967-0946.

LA CANADA guesthouse, 1 bd., separate street address/mail serv., priv. off-str. pkg., shared access to tennis court, gardeners/water incl., 2 mi. from JPL, $840. 952-1304.

LA CRESCENTA house for lease, 3 bd, 1 3/4 ba., quiet cul-de-sac, c/a, 2-car attached garage, wood floors throughout, beautiful yard, no pets, $1,850 first/last, incl. gardener/water/trash collec. 248-3546, Ted.

LA CRESCENTA, 1-bd. guest house w/priv. entr./pkg., patio, fridge., laundry, cent. a/c, quiet nbrhd., no smoke/pets, basic cable, util. incl., credit checked, avail. Aug. 10, $695. 957-2173.

LA CRESCENTA, roommate wanted to share 2 bd. apt., non-smoker, female preferred, $410 + 1/2 util. 249-9739, Susan.

N. ALHAMBRA, large 1 bd. duplex in gd. residental area, 700 sq. ft., clean, hrdwd. flr., 1-car gar., stove, window, a/c, washer/water/trash/gardener provided, avail. Aug. 15, $650. 683-9935, eves.

PASADENA, rent w/buy option, spacious 2-bd., 2-ba. condo.on Sierra Madre Blvd. near Colorado, security bldg., w/w carpet, balcony, wet bar, 2nd level, $895. 626/584-6526, Fred.

PASADENA, sm. studio house, refrig. & stove, water pd., 1607 E. Villa, no pets/smoke, $500. 626/791-8113.

SOUTH PASADENA, fully furn., 1 1/4-bd. apt., nice area at 1718 Huntington Dr., btwn. Marengo & Milan Sts, laundry facility on premises, util. pd. except elec., no smoke/pets, $1,000 + $1,000 sec. dep. 626/792-9053, Marilyn.

SW PASADENA, mature lady seeks clean, non-smoking roommate to share modern condo, female preferred, furn., twin bed, 2 night stands, dresser, desk, sm. refrig., microwv., 13" color TV, private bath, a/c, indoor lndry., secure pkg/bldg, pool, spa, Jacuzzi, exercise & rec. rm., $480, exc. phone & cable + $480 sec. dep., references req., no pets. 626/793-3019.

Real Estate

LA CANADA house, 4 bd., 1 study, 3 full ba., family rm., living rm. w/skylights, big yard, front & back, 2 car gar., remodeled & expanded in 1992, 5 min./JPL, satellite, Brinks security, reduced, $450,000. 626/744-3243.

LA CANADA, traditional charmer, 4 bd., 1.75 ba., great open kitch./fam. rm., LC schools, 1,790 sq. ft., $449,000. 949-5211, Pam.

LA CANADA-FLINTRIDGE, view home, 4 bd., 2.5 ba., c/a, 2,778 sq. ft., 2-car gar., lg. driveway, 15-ft. swim spa, LC schools, very quiet street/neighbrhd., 53,954 sq. ft. on 2 lots w/oak forest & creek, 2.5 mi./JPL; see www.realtor.com, "La Canada", "Ca", MLS ID=G202353, $849,500. 952-9654.

PASADENA executive condo, next to Caltech, total remodel, 2 bd., 1 3/4 ba., 1,200 sq. ft., newly refinished hrdwd. flrs. in dining rm., newer appliances, carpet & paint, top floor unit in park-like setting, walk to Caltech & S. Lake Ave., nice pool & spa. 626/585-9048.

Vacation Rentals

BIG BEAR cabin, walk to village, nice quiet area, 2 bd., slps. 8, compl. furn., TV/VCP, $75/nt. 760/246-7754.

BIG BEAR LAKE cabin, near lake, shops, village, forest trails; 2 bd., sleeps up to 6, f/p, TV, VCR, phone, mcrwv., BBQ & more, JPL disc. from $65/nt. 909/210-9182.

BIG BEAR LAKEFRONT, lux. townhome, 2 decks, tennis, pool/spa, beaut. master bd., suite, sleeps 6. 949/786-6548.

HAWAII, Kona, on 166 ft. of ocean front on Keauhou Bay, priv. house & guest house comfortably sleeps 6; 3 bd., 2 ba., rustic, relaxing & beautiful, swim/snorkel/fish, spectacular views, near restaurants/golf/other attractions. 626/584-9632.

LAKE TAHOE, north shore, 2 bd., 2-1/2 ba. condo, slps. 6-7, private sandy beach, pool, great loc., all amens., hike/golf/fish, 2 mi. to casinos, special reduced rate for Aug 19-26, $600/wk. 626/355-3886, Rosemary or Ed.

MAMMOTH, Chamonix condo, 2 bd., 2 full ba., slps. 6, fully equip. elec. kitch. w/mcrowv. & extras, f/p & wood, color TV, VCR, cable, FM stereo, pool & sun area, o/d Jacuzzis, sauna, game, rec. & laundry rms., play & BBQ areas, convenient to hiking, shops, summer events, daily/weekly rates. 249-8524.

MAMMOTH, Snowcreek, 2 bd., 2 ba., + loft, sleeps 6-8, fully equip. kitch. incl. mcrwv., d/w, cable TV, VCR, phone, balcony w/view to mtns., Jacuzzi, sauna, streams, fishponds, close to Mammoth Creek, JPL disc. 626/798-9222 or 626/794-0455.

OCEANSIDE, on the sand, charming 1-bd. condo, panoramic view, walk to pier & harbor, pool/spa, game rm., slps. 4. 949/786-6548.

PACIFIC GROVE house, 3 bd., 2 ba., f/p, cable TV/VCR, stereo/CD, well-eqpd. kitch. w/microwv, beaut. furn, close to golf, beaches, 17 Mile Dr., Aquarium, Cannery Row, JPL discnt. 626/441-3265.

ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, pool, tennis, short walk to beach on private rd., 18-hole golf course 6 mi. away, private secure pkg. 626/794-3906.

SAN FRANCISCO, Nob Hill honeymoon suite (sleeps 2 max), full kitch., maid service, concierge, $125/nite; $750/wk., reserve early. 626/254-1550.

SOUTH LAKE TAHOE KEYS waterfront, 4 bd., 3 ba., 1 bd. & liv. rm. upstairs, hcp. access fair, slps. 12+, f/p's, decks, gourmet kitch., boats, TV's, VCR, stereo, in & o/d pools, bch., tennis/ski/casinos/golf, 3-day min., $1,195/wk. [1 June-15 Sept; 22 Nov- 1 April], $595/wk. low seas., + $90 clean fee. 949/515-5812.

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Universe

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