Jet Propulsion Laboratory

Universe

Pasadena, California Vol. 29, No. 8 April 16, 1999

JPL Director Dr. Edward Stone, above, addresses staff who gathered to celebrate the successful ISO audit, as one employee, below, signals victory.

PHOTOS BY DUTCH SLAGER / JPL PHOTO LAB

ISO 9001: We're there!

By FRANKLIN O'DONNELL

The team of auditors had spent four days asking tough questions, and now they were delivering the results. Most of the JPLers in the audience thought the Laboratory was in good shape, but some were tense as a list of minor transgressions flashed on the auditorium screen.

Finally, the verdict. On the screen appeared an international symbol whose meaning is obvious in any language:

A happy face.

With that, JPL learned that the Laboratory would be recommended for ISO 9001 certification—the culmination of a two-year effort to put JPL in the company of the world's best engineering organizations.

"This has clearly been a tremendous Laboratory-wide effort," JPL Director Dr. Edward Stone told the auditorium audience after the team of auditors concluded their debriefing April 1.

Developed by the International Organization of Standards, the ISO 9001 standard requires organizations to create and maintain documentation that describes how they function—or, as one slogan puts it, "Say what we do, do what we say and prove it!"

In 1996, NASA Administrator Daniel Goldin stipulated that all of the agency's centers must be ISO 9001-certified by September

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'ISO' cream, music greet staff celebrating successful audit

By MARK WHALEN

In what began as a chilly, cloudy day in which ice cream cones might best be used as hand warmers, several hundred JPLers came out to the mall April 8 to celebrate JPL's impending ISO 9001 certification.

By the time the variety of "ISO-cream" treats began to be handed out to employees at 1 p.m., the clouds overhead parted, as if on cue, to signify the bright and positive payoff following months of preparation for the Lab's certification audit the last week of March. Tim Moyer and his band added to the festive mood.

In his brief remarks to the gathering, JPL Director Dr. Edward Stone congratulated and thanked staff members, comparing the ISO certification effort to a spacecraft launch, except that in this case, "the involvement of every single person on Lab was a major part of the success we had. Everyone really did their homework."

Stone reminded employees that like a space mission, "it's not over when you launch," noting that auditors will return to JPL every six months to perform a surveillance audit.

"The credit goes to all of you," said JPL Chief Engineer John Casani, who led the certification effort. He specifically thanked ISO team members Jerry Suitor, "whose team built the structure for this;" Richard Brace, "who met with representatives from every organization on Lab weekly;" Peter Barry, who led the Lab's internal assessment coordinators and "who did a yeomans' job;" Kim Shepard and the DMIE team, "who created between 400 and 500 documents since January, virtually mistake-free;" and Tom Komarek, "who organized all the DNP (Develop New Products) players." ❑

News Briefs

A post-doctoral student who will combine and process light from multiple telescopes to take super-sharp pictures of stars is the first recipient of a fellowship from NASA's Origins Program, which is administered by JPL.

Rafael Millan-Gabet will conduct research on the blossoming technology of interferometry, which uses multiple telescopes, at the Center for Astrophysics at Harvard University, Cambridge, Mass. He'll work at the Infrared Optical Telescope Array at Mount Hopkins, Ariz., and the Center for High Angular Resolution Astronomy array at Mount Wilson.

The Michelson Fellowship Program is funded through Origins and the Space Interferometry Mission at JPL. "Our goal is to support the science community by developing expertise in interferometry," said **Dr. Rudolf Danner** of JPL, who's developing the fellowship program. The program is named for the "father of interferometry," Albert Michelson, the first American to win a Nobel Prize in Physics.

The fellowship, to be awarded annually, is offered for two years with a possible one-year extension. It covers a stipend of approximately $42,000, with fringe benefits and a $10,000 research budget per year. The program also offers

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Special Events Calendar

Ongoing

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

Codependents Anonymous—Meeting at noon every Wednesday. For more information, 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. For more information, call employee assistance counselor Cynthia Cooper at ext. 4-3680 or Randy Herrera at ext. 3-0664.

Parent Support Group—Meets the fourth Tuesday of the month at noon. For location, call Jayne Dutra at ext. 4-6948.

Senior Caregivers Support Group—Meets the second and fourth Wednesdays of the month at 6:30 p.m. at the Senior Care Network, 837 S. Fair Oaks Ave., Pasadena, conference room #1. For more information, call (626) 397-3110.

Friday, April 16

"Chemistry, Catalysis and Life"—Caltech professors John Richards and Mark Davis will give this free lecture at 4 p.m. in the campus' Baxter Lecture Hall. An abstract and list of other seminars are available online at http://www.cco.caltech.edu/~koonin/CCE0_1seminars.html.

JPL Dance Club—Meeting at noon in Building 300-217.

Von Kármán Lecture Series—Dr. Pamela Conrad of JPL's Astrobiology Research Element will speak at 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

Sunday, April 18

Chamber Music—The Viklarbo Chamber Ensemble will give a free concert at 3:30 p.m. in Caltech's Dabney Lounge. For information, call (626) 395-4652.

Tuesday, April 20

Associated Retirees of JPL/ Caltech—Members will begin a three-day trip to Jean and Laughlin, Nev., with stops at several casinos. Cost: $25 per person (double) or $40 per person (single). For information, call Lila Moore at (818) 790-5893.

"Commercial Deep Space Missions: A Cheaper and Less Risky Approach?"—The Caltech Manage-ment Association presents Jim Benson, chairman and chief executive officer of SpaceDev, Inc., who will speak at 11:45 a.m. in von Kármán Auditorium.

Wednesday, April 21

"From Dust to Us: The Birth of Stars and Planets"—Caltech astronomy professor Dr. Anneila Sargent will give this free lecture at 8 p.m. in Caltech's Beckman Auditorium. For information, call (626) 395-4652.

JPL Drama Club—Meeting at noon in Building 301-127.

JPL Hiking Club—Meeting at noon in Building 238-543.

Russian Language Workshop—Meets from 7 to 9 p.m. on the Caltech campus. Some knowledge or previous study of the language is essential. For location and further information, call Joyce Wolf at ext. 4-7361.

Thursday, April 22

Caltech Architectural Tour—The Caltech Women's Club presents this free service, which is open to the public. The tour begins at 11 a.m. and lasts about 1 1/2 hours. Meet at the Athenaeum front hall, 551 S. Hill, Pasadena. For information and reservations, call Susan Lee at (626) 395-6327.

Friday, April 23

"Chemistry of the Environment"—Caltech professors Mitchio Okumura and Geoffrey Blake will deliver this free lecture at 4 p.m. in the campus' Baxter Lecture Hall. An abstract and list of other seminars are available online at http://www.cco.caltech.edu/~koonin/CCE0_1seminars.html.

JPL Dance Club—Meeting at noon in Building 300-217.

Saturday, April 24

Lazer Vaudeville—Laser beams spotlight juggling, acrobatics, magic tricks and black-light rope in this Family Faire event, to be held at 2 p.m. in Caltech's Beckman Auditorium. Tickets are $10 for adults, $5 for children. For information, call (626) 395-4652.

Sunday, April 25

Chamber Music—Winners of the annual Coleman Chamber Ensemble Competition will perform at 3:30 p.m. in Caltech's Ramo Auditorium. Tickets are $10. For information, call (626) 395-4652.

Wednesday, April 28

JPL Drama Club—Meeting at noon in Building 301-127.

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

Russian Language Workshop—Meets from 7 to 9 p.m. on the Caltech campus. Some knowledge or previous study of the language is essential. For location and further information, call Joyce Wolf at ext. 4-7361.

Thursday, April 29

JPL Golf Club—Meeting at noon in Building 306-302.

Friday, April 30

JPL Dance Club—Meeting at noon in Building 300-217.

Fri., Apr. 30–Sat., May 1

Capitol Steps—This ensemble of current and former congressional aides that presents political satire in the form of song parodies will perform at 8 p.m. in Caltech's Beckman Auditorium. Tickets are $32, $28 and $24. For information, call (626) 395-4652.

JPL's ISO 9001 success was due to many factors. Some perspectives along the way

How did Section 349 survive 28 audits?

Housed primarily in Building 103, the Electronic Packaging and Fabrication Section 349 was the target of more ISO 9001 audits, 28, than any other organization on Lab during the last week of March.

Section manager Carl de Silveira discusses the audits and their effect on section staff.

PHOTO BY SCOTT CHAVEZ

Carl de Silveira

Question: *Why did your section receive more ISO audits than any other?*

Answer: Those who were involved in the ISO audit seemed to be very much interested in final product, which is what is shipped to the customer. Most of what we do here in this section falls into that category. That makes us the prime candidate for ISO audits.

Stories by MARK WHALEN

The good news is that this is one of the few places on Lab where when a project arrives here, it becomes enmeshed in our process; they use our processes for the most part, and not their own. We've been rather process-based, and closer to what you would call an ISO 9000 kind of activity, for most of our existence.

Specifically, in what ways did ISO help hone the staff's processes and work?

Some of the activities associated with our interaction with other areas on Lab have had more of a "tribal" influence—we did things by common knowledge, common understanding, and long-time, heretofore agreed-upon ways of doing business that we knew to be right. These things were not in error in any way, but they didn't line up with an overarching procedure providing guidance anywhere.

We had to find out where any deficient areas were, and we got help from several sources.

Which methods of preparation helped the most?

The cognizant ISO representatives in each section met with individuals in their sections and talked about things that were relevant to that person's job, in terms of records and procedures and what they do.

We also did a lot of self-audits; we've had an ISO team in the section for more than a year. Part of the fabrication effort includes people in this building from Section 506, which is a quality-assurance organization; they are part of the team. We are really partners with them, , as this activity is a team effort. We worked together with them to help prepare us for this audit. It really helped.

What was the breakdown of audits in the building?

ISO!

We had 21 direct audits, one quality-assurance person was audited, and six "thread" audits, which came from projects, machine shops or other areas, where personnel are following drawings or other directions. The auditors sometimes checked out activities in Building 179, the spacecraft assembly facility, then came back here and asked, for example, about how we mixed epoxy for a project; where the samples and mix records are, where the procedures are, and so on.

How did the audits proceed?

Most of the audits were done in the same day. There were some duplications; auditors didn't talk to 28 people. They sometimes talked to the same person four or five times.

Every one of these discussions during the audits represented a significant number of questions about things that went right and others that did not. We had been digging for these kind of findings ourselves, but they (the auditors) are really good, as they found more minor things.

Based on the section's preparation, did you feel strongly that the audit would not uncover any major findings?

I wasn't completely convinced they wouldn't find anything major. I felt they might uncover one or two major findings on the lab, based on the practice audit they had here last fall. They found what they called a major finding that I didn't feel was major. The example was where certain procedures in one of our labs were required to be tracked in a logbook, but the log was kept on a computer, not in a book. This deviated from what the procedure said. If this type of thing had occurred again, this would have been a major finding, based on what we saw in the fall.

With audits to proceed every six months, are you expecting more audits in your area?

I think we will have some activity on every audit. We are prepared for similar audits, if that's what it comes to. The auditors will likely go to the projects that are building things, and those audits will lead right back here. We perform a lot of the rework and integration activities directly on the spacecraft while it is being tested and assembled. We create the infrastructure and own the processes that govern those assembly activities.

How will you prepare for future audits?

What I'm looking forward to, and what I

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Research scientist's readiness pays off

Despite the fact that Dr. Joy Crisp didn't expect to meet with any of the ISO 9001 auditors at the end of last month, that didn't deter her from being prepared for the eventuality, just in case.

PHOTO BY SCOTT CHAVEZ

Dr. Joy Crisp

As chance would have it, Crisp, deputy project scientist for the Mars 2003/2005 Sample Return Project, was, in fact, approached by a team of auditors as she walked to her office in building 241, in the late afternoon of March 31.

Question: *How did you meet up with the ISO auditors?*

As I crossed the street, I saw a group of about half a dozen people, some of whom had "DNV" (the third-party auditing company) on their shirts, and they asked me to stop. One of the auditors asked, "What is JPL's quality policy, in your own words?" I said, "I thought this was an open-book test; may I please go to my office and look it up in my ISO notebook?" They asked again, very forcefully, so I stated the quality policy in my own words right there on the spot, and they seemed happy with that. Then they asked me, "Who is your customer?," and I asked them again if I could refer to my ISO notes in my office, and they finally acced-

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ISO!

Simple approach proves effective

In considering its role in JPL's ISO 9001 certification efforts, the Observational Systems Division 38 literally decided to keep things simple.

In fact, said deputy division manager Gregg Vane, "What ISO is all about is to say what you're going to do in as simple a way as you possibly can, and then follow through and do that. The simpler you say it, the easier it is to document what you're doing."

PHOTO BY SCOTT CHAVEZ

Gregg Vane

Question: *How was your approach different than some others?*

Answer: Tom Fraschetti, the division manager, had the idea that as the Lab goes toward ISO certification, we should take a slightly different approach and consider our division a small, self-contained business, and ask: What is the absolute minimum set of procedures we need in order to work in a quality way? What's the minimum for the kind of work we do in this division, which is build flight instruments, process and archive science data, and develop new technologies?

It was pretty much starting from scratch. We decided there were only nine procedures that were really required to cover most of the work we do here in the division in the flight instruments area, and just two procedures to cover our work in the "Develop Needed Technologies" and "Generate Scientific Knowledge" domains.

What are those procedures?

In the flight instrument area, they are: Design control; planning; material control; integration, test and calibration; science data archive and distribution; document data and record control; procurement; science instrument operations; and software development standards. For our work in the Develop Needed Technologies and Generate Scientific Knowledge domains, we simply invoke the Lab's procedures in these areas, which themselves are simple and easy to understand.

We kept our own division procedures short and simple, a total of about 70 pages. We will view these as a safety net; this is the minimum below which we will not go as an organization, because we could not otherwise assure our customers and ourselves of quality output.

What if a customer's processes differ from that of the division?

If a project comes to us with their own procedures that require more than what ours do, we say fine, you're the customer. But customers must understand that our requirements are the minimum to which they can expect us to perform.

Is the division's revision of its processes solely in response to ISO?

Yes. But we also came to realize that as we've embraced the spirit of "faster, better, cheaper" at JPL over the past five or six years, we've thrown out a lot of documentation and procedures we probably should have kept. There was an attitude in the past that there was too much paperwork, so we said, "throw it all out." It was an overreaction.

ISO has brought us back to recognize that there is value in having some things documented, as long as they're documented at a level that doesn't become burdensome.

What else did you take into account?

The division's approach was to ask: Who are these documents for? They are for our peers, so we don't have to write everything out to the nth degree. We don't have to come up with lots of procedures for dealing with every possible contingency; rather, give them the overview, the bare bones, and assume the people using them are as smart as we are and that's all they need to go on.

Along with the nine overarching division procedures, a second set of layers of localized procedures was created, such as how to run a thermal vacuum chamber or calibration facility. Again, the idea was to keep them simple and easy to follow. But it does establish a baseline, a culture if you will, of how we do business and do it in a reputable fashion.

Have division staff bought into this?

Virtually everybody in the division really got enrolled in it. People saw, for the first time, a simple approach they could grasp quickly. This was definitely not the case before, where there was a proliferation of procedure everywhere, and people simply didn't know what to do. It wasn't that people weren't willing to do the best they could; they were simply overwhelmed. Making it simple was the key."

What other factors helped employees to feel that this would work?

We held very aggressive training sessions, required of all section managers and group supervisors. There also was a series of all-hands meetings for division personnel that didn't go into great detail, but gave everyone an overview of the division approach.

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Casani reflects on the team effort

JPL Chief Engineer John Casani was the management representative responsible for the definition, development and implementation of ISO 9001 at the Laboratory.

Question: *Besides JPL's requirement to implement ISO 9001, why else is it a good way to do business?*

DUTCH SLAGER / JPL PHOTO LAB

John Casani

Answer: In a very real sense, it's helping us fill the void that was created when the big projects went away and we were given the challenge to do a lot more projects, a lot faster.

In that respect, is it more appropriate to have implemented ISO now than it might have been five or 10 years ago?

Yes. The big projects were able to create and sustain the infrastructure they needed to implement. The smaller, faster projects don't have the time or resources to do the same. They need to rely much more on the institution for ready-to-go processes and tools.

If the institution provides the infrastructure, won't that tend to constrain the creativity needed for faster, better, cheaper projects?

That's a good point. We have to allow for innovation, for projects to come up with new approaches. At the same time, you don't want people to have to recreate stuff that should be routine, that could easily be procedurized or mechanized. We've got to continually innovate, but also to retain and improve the stuff that works.

How did it help that this effort involved such a broad cross-section of the Laboratory?

It has emphasized the point that Ed Stone has stated many times, that interdependency must play a critical role in how we work together in the future. With such a broad cross-section of the Lab involved, it created a sense of community, a sense that all can be involved in pursuit of a common goal.

Processes and process owners are integral elements of the line organizations. Their products are the processes and process documentation, and the customer for those products are the projects.

We can't do it all ourselves; we have to rely on the skills and resources of people in other organizations to get our individual jobs done.

Project managers and people working on projects have to realize that they are customers of these processes and products. The line organizations and projects must work together in a customer/supplier relationship.

What was the key to the successful audit?

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Most of Deep Space 1's technologies successfully demonstrated

By FRANKLIN O'DONNELL

JPL's Deep Space 1 mission has successfully demonstrated most of its exotic technologies in space—including an ion engine that is expected to be 10 times more efficient than conventional liquid or solid rocket engines—proving they are ready for use in science missions of the 21st century.

Of the 12 advanced technologies onboard the spacecraft, seven have completed testing, including the ion propulsion system, solar array and new technologies in communications, microelectronics and spacecraft structures.

"We've taken these technologies around the test track, and now they're ready for the production line," said Dr. Marc Rayman, deputy mission manager and chief mission engineer at JPL.

Launched Oct. 24, 1998, Deep Space 1 is the first mission under NASA's New Millennium Program, which features flight testing of new technology, rather than science, as its main focus. These new technologies will make spacecraft of the future smaller, cheaper, more reliable and more independent of human control.

By summer, engineers expect to have finished testing all 12 advanced technologies aboard the spacecraft.

Testing of two technologies that make Deep Space 1 less reliant on humans is 75 percent complete, while testing of a third is scheduled to begin in May. These technologies include a robotic navigator, called AutoNav, that will guide the spacecraft to a rendezvous with asteroid 1992 KD on July 29 without active human control from the Earth.

In addition, Deep Space 1's two advanced science instruments—a combination camera/spectrometer and an instrument that studies electrically charged particles emitted by the Sun and other sources—are on schedule, having finished 75 percent of their tests.

"What has pleased us more than anything is how well the technologies have been working in general," Rayman said, noting that their performance is remarkably close to engineers' estimates developed before launch.

"Of course, everything hasn't worked perfectly on the first try," Rayman added. "If it had, it would mean that we had not been sufficiently aggressive in selecting the technologies.

"Diagnosing the behavior of the various technologies is a fundamental part of Deep Space 1's objective of enabling future space science missions."

When the ion propulsion system was first activated Nov. 10, the engine shut itself off after 4-1/2 minutes, and engineers were unable to restart it later that day. During the next attempt two weeks later, however, the engine started up easily and has performed flawlessly since then, logging more than 1,300 hours of operation.

Engineers believe the problem was caused by a piece of grit stuck to high-voltage grids within the ion engine. The grit was later dislodged, they believe, when parts expanded and contracted as the ion engine was exposed alternately to sunlight and shade.

Engineers also discovered after launch that stray light enters the camera/spectrometer, resulting in streaks of light when pictures are taken with a long exposure. The streaks are a result of how the instrument was mounted on the spacecraft, Rayman said.

The camera should be able to take acceptable pictures when Deep Space 1 flies by aster-

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Asteroid honorees, from left, Dr. Alan Chamberlin, Dr. Chen-Wan Yen and Carl Sauer Jr.

Three asteroids named for JPLers

Three JPL employees have been honored for their work by having asteroids named after them.

Dr. Alan Chamberlin, a senior engineer in the Navigation and Flight Mechanics Section 312; Carl Sauer Jr., a principal flight mechanics engineer in Section 312,; and Dr. Chen-Wan Yen, a senior analyst in the Mission and Systems Architecture Section 311; were all nominated for the honor by Dr. Donald Yeomans, manager of JPL's Near-Earth Object Program Office.

The asteroids were officially named by the International Astronomical Union at Yeomans' recommendation.

Chamberlin's research work has centered on the search for gaseous emissions from suspected defunct comets and the uncertainties associated with the Earth-Close approaches of the so-called potentially hazardous objects.

For New Millennium's Deep Space 1 spacecraft that was launched on last Oct. 25, Chamber-lin is responsible for the ephemeris development for both the mission targets and the two dozen well-observed asteroids that will be used by this spacecraft to autonomously navigate to its targets.

Chamberlin joined JPL in 1996. His asteroid is known as "9250 Chamberlin."

Sauer, with JPL since 1952, has been a leader in the development of the analysis tools used for designing the ballistic and low-thrust spacecraft missions that explore the solar system. His work has included mission designs for advanced spacecraft propulsion systems, including solar electric ion propulsion, nuclear propulsion and solar sailing. His database of potential spacecraft trajectories to hundreds of comets and asteroids is an invaluable resource for mission design work at JPL, Yeomans said.

Sauer's asteroid is named "9248 Sauer."

Yen was honored for her crucial work in the development and application of mathematical techniques to optimize the interplanetary trajectories flown by JPL's robotic exploration spacecraft. The five kilometer- (three mile-) diameter asteroid, called "9249 Yen," resides in the so-called "main belt" of asteroids that populate a region between Mars and Jupiter.

Yen, who has worked at JPL since 1972, has also contributed to the success of interplanetary trajectories designed for the Cassini mission to Saturn, the Galileo mission to Jupiter and the Magellan mission to Venus. ❑

Crisp

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ed and we went to my office.

What were you expecting to happen?

I had been selected to work with JPL pre-audit assessors in recent months, so I was somewhat familiar with what to expect. Also, the Division 32 office was instrumental in supplying research scientists with a lot of information for their employee notebooks.

Did you do anything more to prepare?

I also created a document on my computer called "Joy's ISO Notebook," with my job description, training history, organization charts, and links to processes and procedures applicable to my job.

Whenever I received material for the binder notebook, I put it in the online notebook. I'm a web person; I thought it would be easier to have links to go to rather than pages in the book.

How did the auditors react to this?

They (the audit team) just glanced at it; they were impressed that I had prepared this, and didn't ask any more questions.

Why do you think you were questioned by the ISO auditors?

I assumed I was being checked randomly. The auditors did spend 1 1/2 days across the hall in Building 241, where quality assurance for flight projects is performed. It was 4:30 p.m.; perhaps it was the fact that the auditor was almost done for the day and needed to do a random check that day.

What were your impressions when it was over?

I think the auditor was surprised he found a scientist, out of all the people he was meeting on Lab. He wanted to know if the scientists, in addition to the engineers, were taking ISO seriously, and probably in his mind the conclusion was, "Yes, even the scientists, who aren't making parts that go through quality assurance, do understand this." ❑

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1999. At JPL, Chief Engineer John Casani has lead a team working on the effort for the past two years.

NASA hired the Norwegian-based firm Det Norske Veritas (DNV) to conduct audits and issue certificates for all of the agency's centers. DNV auditors visited JPL for a pre-registration audit in November, followed by the full-scale audit March 29–April 1.

The auditors wrote up a total of 22 minor problems, or "non-conformity notes," but said that as soon as JPL responded to them the Laboratory would be recommended for ISO 9001 certification.

"We did not have any major hiccups in the system, any processes that we felt were out of control," said DNV lead auditor Tom Dadson. "In an organization as complex as this one, and also as large as this one, to be able to come up with just two non-conformity notes in doc[ument] control is a fantastic thing."

Over the course of the four-day visit, auditors interviewed a total of 135 JPLers—in some cases, stopping them on Laboratory sidewalks for a pop quiz on JPL's Quality Policy. They also examined the Laboratory's manuals and work documentation, and visited various work sites.

JPL's effort to prepare for the audit involved the work of hundreds of employees, including about 20 working full-time on ISO 9001 as well as 140 internal assessors and many others.

Before the auditors' preliminary visit in November, JPL held a series of internal assessments and put considerable effort into creating a product delivery system manual—the centerpiece document of the ISO 9001 approach. Based on the auditors' November visit, corrective action items were assigned, with major ones going to members of JPL's Executive Council to oversee. JPL then held two more internal assessments in January and February, followed by a management review.

"The most challenging part was trying to get a whole lot of very independent thinkers thinking in a structured way," said Dr. Jerry Suitor, a member of JPL's ISO 9001 team.

"We have a history here of independence in terms of our project managers and their leadership," he added. "We have to merge that kind of independence with the requirements that the ISO standard places on us, some rigor we have to apply to the way we do business. We had so many people helping us from so many different directions that the coordination effort was really a challenge."

The auditors also praised JPL's "team-building" in preparation for their visit. They were struck by the fact, for example, that when they arrived on-Lab the guards at the front gate knew who they were and what they were here for.

Once JPL receives its ISO registration, auditors will return twice a year to monitor the Laboratory's compliance with the international standard. Each three years, a more thorough "certificate extension audit" is conducted.

And the auditing team advised JPLers to keep it up. "This is just the start," said auditor Michael Monaghan. "We come back every six months.

"Stay with it. If you make it a way of life rather than something add-on, it will work for you." ❑

De Silveira

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constantly applaud, are the JPL self-audits that Peter Barry's group puts forth. They know how to do audits; they came down here and looked at things from a totally fresh point of view. I want to see more of these self-audits; I think they will keep us more toned up for the next audit to come in the fall.

How has ISO caused employees to think and work in a new way?

I'm convinced that we at JPL are not being asked to do anything different; ISO does not impose any procedure on you that you didn't impose on yourself.

I don't think anything onerous came out of this. I certainly think it's been better for my operation. In talking to section managers and my other peers, they feel it's been beneficial and has helped them to get a better view of things.

Where do you think ISO fits into the bigger picture of how JPL works?

For JPL to be able to work successfully on multiple projects as we do now, we must embrace process-based management to enable the smaller projects to survive without the large infrastructure that the large projects had provided in the past. I think ISO has forced us to look at ourselves as an institution and to decide what processes and procedures we should be using that can be beneficial.

We had been transforming into a process-based organization at the same time the ISO activities hit us. Those are difficult things to do concurrently. I don't think we've quite gotten there, as far as process-based management, but ISO has helped us to understand it better. ❑

Casani

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Once people accepted that this activity was something our customer demanded of us—the same customer that gave us the opportunity to launch six spacecraft in six months—I think people's attitudes began to change.

Is it true that the auditors called this the cleanest audit they had come across?

In interviewing Dr. Stone at the close of the audit, the lead auditor, Tom Dadson, noted this was the fifth or sixth audit in which he had participated as lead auditor, and not only was this the cleanest one, it was also the most complex system of the audits he had done. That was quite a compliment.

How will you remember this in terms of your whole career?

For me, the greatest work has been the project work. It some ways, the ISO effort has some of the same characteristics; it's never been done before, at least not around here. I enjoyed doing it. But like every job I've done, it's the teamwork and people involved that make the difference. ❑

DS1

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oid 1992 KD this summer, because it will use short exposures.

Despite such glitches, the great majority of the advanced technologies have worked extremely well, according to Rayman. "Mission designers and scientists can now confidently use them on future missions," he said.

Deep Space 1 will continue testing technologies until its prime mission concludes on Sept. 18. NASA is considering a possible extended mission that would take the spacecraft on flybys of two comets in 2001. ❑

Briefs

Continued from page 2

undergraduate fellowships. ❑

JPL's Educational Affairs Office seeks employees who have rooms or apartments (preferably furnished) available for rent to out-of state summer interns.

Housing is needed from approximately May 26 through Oct. 12. Contact **Juliet Ellis** at ext. 4-0726. ❑

The next JPL/Red Cross blood drive will be held in von Kármán Auditorium on May 11 from 10 a.m. to 12:45 p.m. and 2 to 4 p.m. and May 12 from 7 to 9 a.m. and 10:15 a.m. to 1 p.m.

Sign-up sheets are available at Occupational Health Services, Building 263, prior to the blood drive. If you have not signed up ahead of time or wish to change your appointment, call the Red Cross at (626) 799-0841, ext. 630. Signup is also available through Occupational Health Services' home page at http://eis/medical . ❑

A new voice mail feature that allows more capability to callers from remote sites will debut next week.

Beginning Monday, April 19, when you call JPL from a remote site to access your voice mail, the new feature will allow exit from the JPL voice mail system and will dial a JPL phone number directly without having to hang up and dial again.

To access the system from the voice mail main menu, press star. Three choices will then be offered, allowing callers to enter another mailbox, dial another extension or select an attendant.

For more information about voice mail at JPL go online to http://icis.jpl.nasa.gov/iis/tele/vm.htm . ❑

Several JPLers are scheduled to make presentations at the California Science Center's "Talk Science" spring series in the coming weeks.

The interactive, Sunday-afternoon discussion series at the center, located in Exposition Park in Los Angeles, will include **Dr. Charles Beichman**, director of the Infrared Processing and Analysis Center (IPAC) at Caltech, on April 18; **Dr. Richard Terille**, chief scientist for the Outer Planets/Solar Probe Program on May 16; and **Dr. Michael Klein**, manager of the Deep Space Network Science Office, on May 23.

Each presentation, which will include activities for children 7 and older, will begin at 2 p.m.

Tickets for adults are $8 in advance, $10 at the door; for children ages 7-17, tickets are $3 in advance, $5 at the door. California Science Center members are admitted free.

To sign up for any of the talks, send your name, address, phone number, date(s) you'd like to attend, number of adults/children, and payment via to Membership Office, California Science Center, 700 State Drive, Los Angeles, CA 90037.

For more information about the center, go online to http://www.casciencectr.org . ❑

Vane

Continued from page 4

Division personnel were then asked to work with their management, whom we had trained at much greater depth, to determine which of our procedures pertained to their work.

The training sessions showed ISO's general philosophy, how it can be of value if you use it the right way, and how we will incorporate ISO into our culture in a way that minimizes the pain and maximizes the gain.

How can ISO improve efficiency for your division?

We're soon going to start a division-wide quality council that will include representatives from each of the six sections in the division. I'm virtually certain that we'll find ways to improve our efficiency here as well.

My personal challenge is to find ways that each of our people can reduce the amount of time they work by one hour per week and still meet their work goals. If we could get one hour of savings for each person in doing their jobs, I would declare victory. It may be a stretch goal, a vision, but that's what I'd like to do as a start. If we can achieve that much initially, who knows where this could lead? Maybe we could even someday do "faster, better, cheaper" during a normal work week. ❑

LETTERS

My family and I would like to thank my friends and co-workers in the SIRTF Project for the beautiful flowers sent to my home during the recent passing of my father. I would also like to thank the ERC for the wonderful flowers they sent. All is appreciated very much.

Kirk Bilby

FOR SALE

A/C/HEATER UNIT, 3-ton Heil, fully enlarged and working, removed for new construction, $1,000/ obo. 957-2173.

AUDIO EQUIPMENT, Yamaha pre-amp, Dolby surround sound decoder, many a/v inputs, univ. remote, exc. cond, $99/obo. 909/592-2279.

AUDIO EQUIPMENT, top of the line Philips, FR 940, 100W stereo receiver w/variable digital delay, Dolby Pro Logic w/full function remote for complete system; CDC 935, 5-disk carousel CD changer w/digital output and favorite track selection; FC 930, dual-well double auto-reverse cassette deck w/4-motor operation, like new, $325. 626/359-7666.

BED, Simmons Majesty mattress, box spring, full-sized, $45; frame, full, $25; Fieldcrest comforter, dust ruffle, pillow sham set, full, $25. 626/577-8107.

BICYCLE, girl's Schwinn 10 speed, light blue, like new, $100/obo. 626/965-1387.

BURIAL LOTS: 2 ea. in the "Eternal Love Section" of Forest Lawn, Hollywood Hills, $3,400 ea; 4 ea. in the "Veterans Honor Section" of Forest Lawn, Covina Hills; buy 3 @ $990/ea. and get the veterans lot free. 909/886-2615.

CAMERA, Minolta 35mm, model XG7 body plus 55mm and 35mm lens, $100/obo. 365-3799, Dave or Lucy.

CANOE, Old Town Hunter, 13-ft. Royalex, $250. 626/794-4592.

CANOES: Dagger white water w/saddle and air bags, $450; 17.5-ft. kevlar Seda Wander, $350; 14-ft. kevlar Mad River Quest, $250. 805/252-5497.

CHILDREN'S ITEMS: Huffy Walk n'Ride bicycle trailer, $100; 2 toddler booster/car seats, $30 for both; double stroller, $80; Swedish baby buggy/stroller, dark blue w/white tires, $225/obo. 542-5082.

CHINA SET, 60 pieces for $70/obo. 909/592-0780, Ana.

CLOCK RADIO, portable, large LCD display, with emergency light; battery or AC operation; in original box, Lloyds model J144, $15. 548-9151.

COMPUTER, Mac Performa 550, 32MB RAM, Epson laser printer, Iomega Zip drive, fax modem, turbo mouse and various software, good starter set $350. 626/335-0253.

COMPUTER, Intel Pentium 120 MHz, 2 GB WD hard-disk, 32 MB RAM, 1.44" floppy, 2 serial, 1 parallel, 1 game port, 15" MAG Monitor, Yamaha speakers, 33.6 K USRobotics modem, keyboard, MS Mouse, 12X CD-ROM, SoundBlaster sound card, HP660C dual cart. Inkjet printer, Windows 98, exc. cond., 2 yrs. old, all for $599. 909/592-2279.

COMPUTER, Leading Edge, model D, 2 FD, 5.25," 360 KB, MS DOS 3.10, Phoenix 8088 ROM, BIOS V.E, 649K RAM, 14" Amber monitor, working, $25. 541-0062.

COMPUTER, Mac II FX, Conner 30170E HD, 780 KB 3.5" FD, 1.4 MB 3.5"; Global Village Teleport 33.6 fax/modem; system 7.5.3; Netscape Communicator Pro 4.04; 20 MB RAM, 32-bit addressing memory; 14" color monitor; $250. 541-0062.

COMPUTER STAND, like-new condition, $30. 548-3442.

CROCK POT square by Rival with Corningware, $15/obo. 626/568-8298.

CROCK POT, Rival, slower cooker, $10. 213/617-2398.

DESK, light oak, 7 drawers, 32"w x 60"l x 30"h, vg condition, ~3.5 years old, $300; matching 2-drawer FILE CABINET, $100. 957-2898, Keith Naviaux.

DINETTE SET with corner benches, table & 2 chairs, $125; DRYER, Sears Kenmore electric, 4 yrs. old, exc. cond., $175; MICROWAVE, Sears Kenmore, lg. capacity, auto defrost, $75. 626/358-2134.

DINING ROOM FURNITURE: Queen Anne formal dining room set from Ethan Allen, including table (60" x 40" x 29") with 2 leaves (18" each), 6 side chairs, server (40" x 21" x 34"), all in cherry, custom table pads, exc. cond., $2,600/obo; unrelated 5-piece dinette set (table dimensions 48" x 36" x 29"), $75. 626/577-8107.

DINING ROOM TABLE and 6 chairs, pecan wood, round table opens to oval size, 1 leaf, $400/obo. 626/256-6242.

DISHWASHER, Kenmore, black, three settings, new pump, works well, about 3 years young, may be able to deliver for you, $150/obo. 909/482-4425.

DRESSES, new; Halston, black, floor-length, size 12; Julian Taylor, royal blue suit dress, size 14, $65/$35/obo. 626/398-4960.

DRUMS, 6-pc. Perl set, great cond., sabian and zildjian cymbals, DW double bass pedal, etc.; new cost $2,500, sell for $1,000 + hardware. 909/592-5165, Steve or e-mail guiwits@earthlink. net.

EXERCISE EQUIPMENT, rowing machine, Precor, model 615e, with LCD readout and adjustable power stroke settings, $28. 548-9151.

FIGURINES, Florence; maple end table, wooden folding screen room divider, maple pull up chair, plus much miscellaneous. 626/585-8213.

FILE CABINET by Harper Company, 4 drawer, lateral style, holds legal and standard size files, commercial-heavy duty construction, $150. 213/617-2398.

FILE CABINETS, 2 metal, 4-drawer, light gold, heavy duty, $40/ea.; 2 furniture-grade medium oak cabinets, 2-drawer, vg to exc. cond., $80/ea. 352-9957.

GUITAR, classical, nylon strings, beautifully carved wood, with nylon padded carrying case, by Yamaha, never used, $200. 249-4561.

JEWELRY, costume (some vintage)/earrings, brooches, necklaces; varied prices. 626/398-4960.

LASER DISC PLAYER, Magnavox, good condition, $100/obo. 626/281-8195, Frank.

MILK, 1-yr. supply, (~120 gallons), powdered, nitrogen packed & sealed in 3 six-gal. containers, tastes perfectly fresh, stores 5 yrs., "Provident Pantry" brand, replaces store trips, $270. 323/344-9158.

MODEM, Apple Geoport adapter fax/modem, model M1694 express, new, $25. 541-0062.

OVEN, Thermador electric, w/sep. microwave; black w/glass chrome; self-cleaning, gd. cond., $350/obo. 352-9957.

PHOTOGRAPHS, 40" x 30", color, framed, 2 tall-ship pictures taken by prof. photog., vg cond.; 1 of Spanish tall ship in SF Bay, 1 of German tall ship taken near Puerto Rico; $75/each, $130 for both/obo. 626/568-8298.

PIANO, '82 Kimball upright, vg cond., mahogany finish, orig. owner, $1,000/obo. 323/258-4188.

PICTURE FRAMES, three made of brass, 22" x 28", $7/each, $18 for all three/obo. 626/568-8296.

PRINTER, Xerox Diablo 630 with wheels/ribbons, excellent condition, $20/obo. 626/568-8298.

ROAD BIKE FRAME and fork, GT, 58 cm, newly painted, $350/obo; bedroom set, Italian lacquer, Cal King bed and mirror head board, 2 matching nightstands and dresser w/mirror, $400/obo. 542-5082.

SANDWICH MAKER, electric, $10. 213/617-2398.

SOFA BED, $175; DINING SET, walnut, $275; RUG, 9 x 12 wool, $75; REFRIGERATOR, GE 18 cu. ft., 6-yrs old, $425. 241-9979.

REFRIGERATOR, Kenmore, white, freezer on bottom, 21 cf, 2 years young, excellent condition, extra shelves, may be able to deliver for you, $500/obo. 909/482-4425.

REFRIGERATOR, small, 4.8 cubic feet, very clean, fairly new, exc. condition; 33" tall, ideal for bar, guest house, cabin, or dorm room; $100/obo. 323/227-7799, Martin.

SOFTWARE: Microsoft Publisher 97 ($19), Microsoft Picture it ($19), new hands free kit for Nokia 2100 series cell phone ($25), new NiMH extended-life battery for Nokia 6160/6190 ($39), Word

Continued on page 8

97 ($19), Eudora 4.0 ($15), Adobe PhotoDelux ($12), PhotoStudio ($12); BRIEFCASE, never used, leather ($50), CELL PHONE, Motorola, with case/charger ($49), Motorola Goldflex alphanumeric pager ($89); TREES, 6-foot silk ficus ($25). 366-6134.
STOVE, Thermador electric almond cooktop, 4 burners w/center grill/griddle for built-in counter cooking; vg cond., $250/obo. 352-9957.
STOVE-TOP: drop-in, MagicChef, white, gas, 4 burners, 36" x 21", 1 year young, $100/obo. 909/482-4425.
TABLE, dining room, round, mahogany, sits 8 with two extensions, almost new, comes with 6 matching chairs, picture on ERC board; $650/obo; matching China buffet, $950/obo; all for $1,400/obo. 909/592-0780, Ana.
TABLES, glass, four 2-shelf tables with brass feet, three make up a coffee table (one round 2.5-ft. dia., two "half-moon"), fourth is a round end table (2.5-ft. diameter), $125/obo. 909/592-0780, Ana.
TELEVISION, 25" Hitachi remote control color, in simulated wood cabinet, $60; DRYER, 220-volt Maytag, $60; COMPUTER CABINET w/doors, perfect condition, $300. 951-4123.
TELEVISION, Deluxe portable 5" B&W, 82-channel VHF/UHF tuner, telescopic antenna, compact design (weighs only 5 lbs,) AC converter included or uses D size batteries; never used, still in box; $50. 626/791-7645.
TELEVISION, RCA ColorTrak, 25-in., $50; indoor TV antenna (rabbit ears), rotating type, RCA, $12. 626/577-8107.
TYPEWRITER, Smith-Corona mechanical portable, vg cond., new ribbon, $30. 626/793-1895.
VIDEO GAME, Sega Genesis CD and cassette system, 4 controllers, 21 cartridges and CDs, $200 for all/obo. 626/309-0429.
VIDEO GAME, Super-Nintendo set, System, 2 controllers, 7 games, exc cond., $49. 909/592-2279.
WASHER, Whirlpool heavy-duty; DRYER, gas, white, vg cond., $100/set. 626/398-4960.
WASHER/DRYER, stackable Maytag, model LSG7800AAL, gas, vg cond. 626/403-1599.
WEDDING DRESS, excellent condition, used once, kept in garment bag; white straight dress with long sleeves, bow in the back, $40/obo. 626/568-8298.

VEHICLES / ACCESSORIES

'81 BAKER custom ski boat, 18' low profile, 115 Merc. ski bar, exc. cond., $4,500. 562/947-2732.
'87 CADILLAC Brauham d'Elegance, 99K mi. RWD, exc. cond., smog/license paid, new tires, brakes, $3,000/obo. 548-3442.
'90 CHEVROLET Camaro, white, very low milege, $5,500 firm. 626/794-0455, Tues./Thurs. evenings, or daytime Sat./Sun.
'89 CHRYSLER New Yorker, auto, all pwr., auto door locks, digital instrumentation, premium sound system, minor body work needed, must sell, $2,200/obo. 626/795-1687.
'95 FORD Explorer, Eddie Bauer, very clean, low miles, loaded, must sell, $15,500/obo. 504-4905.
'91 FORD Taurus, a/t, a/c, cruise, new tires/transmission, 98k miles, $4,200/obo. 626/447-4028.
'89 FORD Probe GT, 2.2L turbo, 5 sp., very clean, $4,500. 790-5604.
'85 FORD Tempo, 4 dr., rebuilt engine 17,000 mi., am/fm/cassette, good cond., $1,300/obo. 563/433-9621 or 626/965-2387.
'74 FORD pickup, ¾ ton V8 360/390, 4 gear manual, needs minor repair, $800/obo. 323/262-7685, Frank.
'91 HONDA Prelude 2.0 Si, white 5-speed, exc. condition, am/fm/CD, moon roof, power locks and windows, alarm,120k miles, $7,800. 626/963-7197.
'93 JEEP Wrangler Sport Utility 2D 4WD, exc. condition, 5-speed manual, 4.0L inline 6 cyl., soft-top, blue two-tone paint, running boards, power steering & brakes, tilt wheel, AM/FM cassette stereo, premium sound package & overhead speakers, locking trunk, alarm w/microwave proximity sensor, 55k miles, $9,500/obo. 626/398-6356.
KAWASAKI Jet Skis, 2 for the price of 1, '94 750 SS and '95 Kawasaki 900ZXI (sit down versions), includes long run trailer; excellent condition, very low miles, only used 2 times last year, always garaged, $7,500 total price for both. 353-5649.
'93 MAZDA Protege DX, a/t, 73 k miles, $4,200/obo. 626/447-4028.
'95 TOYOTA truck, exc. cond., a/c, 4 new tires, green, 76K miles, $6,300/obo. 562/947-2732.
'94 TOYOTA pickup, black, 80k mi.; new: clutch, tires, bedliner; raised w/oversized tires; custom stereo w/CD, amp, subwoofer; $6,995/obo. 790-2710.
'91 TOYOTA Camry, 4 door, auto, 85K, A/C, am/fm/cd, new brakes, PS/PB, alarm, remote entry, exc. cond., $6,500. 909/624-3181.
'89 TOYOTA Supra Turbo, 5 speed, cruise, ABS, power steering/windows/locks, tilt, am/fm/stereo cass., sport roof; 102,700 miles; good condition, $6,500/obo. 626/449-2007, Max.
'85 TOYOTA 4Runner SR5, $2,000. 626/296-4092.
'86 VW Golf, 5 speed, 2 dr., gd. cond., very well maintained, ideal get-around car, superb gas mileage, $1,800. 626/683-7018.

LOST & FOUND

Found: small palm-tree charm in parking lot behind Bldg. 300. Call ext. 3-1135.

FREE

DOG, German shepherd mix, female, spayed, 14 mo. old, lovable pet used to other dogs/cats, quiet but lively life partner. 626/915-1826.
ORANGES/LEMONS, you bring your own picking tools and containers and pick 'em, good for juicing. 626/795-0499.

WANTED

BBQ, used gas grill, old/ugly OK, just needs to work. 626/794-9470.
HOUSE for lease or rent in La Canada, available now through June, 3 bd. preferred. 626/794-2758, Betsy Wilson.
HOUSE SITTER in Kailua-Kona, Hawaii for about 3 mo. this spring/summer (sched. is negot.); up to 2 people; responsible adults only; very comfortable house across st. from beach; priv. pool; will be responsible for watering, for feeding and walking small dog and for feeding cat and koi; references required. 626/584-9632.
PET SITTING, 2 dogs & 1 cat, will trade beautiful home near Caltech 3-4 weeks before June 15. 626/449-8035.
SPACE INFORMATION/memorabilia from U.S. & other countries, past & present. 790-8523, Marc Rayman.
VANPOOL RIDERS, #3 from Fontana, Rancho Cucamonga, Upland, Claremont, La Verne area to JPL main facility. Ext. 4-8343, Mike Taylor or 4-5831, Rhea Clearwater.
VOLLEYBALL PLAYERS, coed, all levels of play, Tuesday nights 8-10 at Eagle Rock High School, $4/night. 956-1744, Barbara.

FOR RENT

ALTADENA house for lease in nice neighborhood, 2 bd., 1 ba., 1,300 sq. feet, front & back yards, available (about) May 6, $1,300./mo + utilities. 626/794-6926.
ALTADENA, 4 bd., 1¾ ba., large lot, hardwood floors, Jacuzzi, remodeled kitchen, quiet st., $290,000. 626/798-3838, Robert.
ALTADENA, quiet rm, non-smoking/drinking, $280. 626/398-8109.
ALTADENA rear house, 1 bd., 1 ba., small kitchen, fenced yd., off-street parking, avail. 1st week of May, pets OK, $500. 626/398-8109.
ARCADIA, cozy, furnished room, includes laundry, kitchen privileges, pool; no smokers, $350. 626/448-8809, Shary.
EAGLE ROCK, spacious & sunny, 2 bd. + office, hardwood floors, a/c, yard, view, 5812 Tipton Way, avail. April 25, $1,100. 626/794-7281.
GLENDALE, darling, large 1-bd. apt. with small bonus rm., newly re-decorated, wall to wall carpets, air conditioning, dishwasher; $650 incl. water, gas and basic cable. 241-9448.
GRANADA HILLS, looking for 1 person to share home; gardener, c/a, cable, fireplace, hardwood floors, recessed lighting, patio, BBQ, new appliances, washer/dryer, spa; rm. has 2 windows, recessed lighting w/dimmers, attached ba.; only 20 minutes from JPL; $495 + ½ util. + deposit; no smoking, no pets. 366-6134.
LA CRESCENTA, guest quarters w/private entrance & parking, 1-bd. suite incl. living room, full ba., din. room, min. kitch. fac., priv. patio & laundry, cent. a/c all utilities & cable, shared cost; no smoking/pets, $850. 957-2173.
MONTROSE, roommate wanted to share 2-bd. apt., 5 minutes from JPL, $370 + 1/2 util. 541-0794.
PASADENA condo, spacious 2 bd., 2 ba., Sierra Madre Blvd., rent w/option to buy, quiet 2nd-level unit in security bldg. w/intercom, a/c, w/w carpeting, wet bar, balcony, LR, modern kitch., covered parking, $895; first 6 months' rent can be used as down payment on purchase. 626/584-6526.
PASADENA studio condo, fully furnished, gated complex at 1115 E. Cordova, 2 blocks north of Caltech at Wilson Ave.; carport, pool, patio and laundry facilities on premises, non-smoker, no pets, $675 plus electric. 626/792-9053, Marilyn.
SOUTH PASADENA, furnished studio apartment, 1718 Huntington Dr. between Marengo and Milan; units on 1 level, parking space, laundry facilities, utilities paid, on bus lines, convenient shopping; non-smoker, no pets; $565. 626/792-9053, Marilyn.

REAL ESTATE

BIG BEAR, new cabin 2 blocks from lake, 2 bd., 2 ba., mud/laundry room, $129,000. 909/585-9026.
LA CANADA, 3 bd., 2 ba., Spanish style home in uniquely private verdant setting; near Montrose shops, park with tennis ct.; solar water for house and spa; hardwood floors, Berber carpets, Corian kitchen, cul de sac; central heat/air; La Canada schools; $397,000. 249-8088.
LA CRESCENTA, 8-rm. ranch home, Glendale schools, 4 bd., 2 ba., lg. priv. park-like yard w/pool, brick patio, attached garage, on cul-de-sac, $429,000. 248-1997.
PASADENA condo, spacious 2 bd., 2 ba., Sierra Madre Blvd., rent w/option to buy, quiet 2nd-level unit in security bldg. w/intercom, a/c, w/w carpeting, wet bar, balcony, LR, modern kitch., covered parking, $895; first 6 months' rent can be used as down payment on purchase. 626/584-6526.
SAN DIMAS, secluded Via Verde area, 4 bd., 3 ba., 3-car garage, marble floors, large landscaped backyard with automatic sprinkler system, barbecue area, Spanish fountain, automatic wireless outdoor lighting, palm trees, covered patio, red brick pathways/walls, built in 1988, $500,000. 626/568-8298.

VACATION RENTALS

7-DAY TIMESHARE EXCHANGE (Thurs.-Thurs./ Fri.-Fri./Sat.-Sat.) anywhere in the U.S. including Hawaii and Mexico; 1 bd. accommodates 4 persons/6 max., $100/day; rates may vary for Canada, Caribbean and Europe. 626/337-3957.
BIG BEAR cabin, quiet area near village, 2 bd., sleeps 8, completely furnished, F/P, TV/VCP, $75/night. 249-8515.
BIG BEAR, 7 mi. from slopes; full kitchen, f/p, 2 bd., 1 ba., sleeps 6; reasonable rates; 2-night minimum; no smokers, no pets; exc. hiking, biking, fishing nearby. 909/585-9026, Pat & Mary Ann Carroll.
BIG BEAR CITY, 4 miles/slopes, 2-bd., 1-ba. cabin, nicely furn., sleeps 8; fireplace, TV, full kitch., microwave; $100 refundable cleaning dep.; $75/nite weekdays, $250/weekend (2 nites). 909/982-2986.
BIG BEAR LAKEFRONT lux. townhome, indoor pool/spa, nr. skiing, beaut. master bdrm. suite, sleeps 6. 949/786-6548.
CAMBRIA, ocean front house, exc. view, sleeps up to 4. 248-8853.
CORNWALL, ENGLAND, August 1999 total solar eclipse; prime location campsite on the path of totality; includes lecture series by Caltech, JPL and UK astronomers; http://www.ctg-windows.co.uk/ eclipse.html. 626/356 2998.
HAWAII, Kauai, 2-bd. condo, Embassy Suites (4 stars), sleeps 6, available in May & Sept., 7-night stay, breakfast & cocktails incl,, $1,400 (usually $395/night). 626/683-9331.
HAWAII, Kona oceanfront condo on Big Island of Hawaii; 1 bd., 1 ba., sleeps 4, 50 yards from ocean, two pools, private beach, all amenities and good restaurants nearby; week of July 9-16 only (timeshare), $500/week. 790-8069.
HAWAII, Kona, on 166 feet of ocean front on Keauhou Bay, private house and guest house comfortably sleep 6; 3 bd., 2 ba.; rustic, relaxing and beautiful; swimming, snorkeling, fishing, spectacular views; near restaur., golf courses, other attractions; low season rates begin May 1. 626/584-9632.
HAWAII, Maui condo, NW coast, on beach w/ocean vw., 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, microwv., dishwasher, pool, priv. lanai, slps. 4, 4/15-12/14 rate: $95/nite/2, 12/15-4/14 rate: $110/nite/2, $10/nite/add'l person. 949/348-8047.
HAWAII, W. Maui beach luxury condo, fully furnished, 2 bd., liv. rm., kitchen, $140/day. 805/646-0810.
MAMMOTH condo, studio + loft, 2 ba., fireplace w/ wood supplied, Jacuzzi, sauna, game rm., color cbl. TV/VCR, full kitchen w/microwave, terrace, view, amen. 714/870-1872.
OCEANSIDE, on the sand, charming 1 bd. condo, panoramic view, walk to pier or harbor, pool, spa, game rm., sleeps 4. 949/786-6548.
PACIFIC GROVE house, 3 bd., 2 ba., fp, cable tv/vcr, stereo/CD, well-eqpd. kitch. w/microwv., beaut. furn., close to golf, beaches, 17 Mile Dr., Aquarium, Cannery Row, JPL discount. 626/441-3265.
ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, pool, tennis, short walk to beach on priv. rd., 18-hole golf course 6 mi. away, priv. secure parking. 626/794-3906.
SAN CLEMENTE COVE timeshare, 1 week beg. Sun., May 16, sleeps 4, kitchenette, beach, surfing, $500. 626/836-3931.
S. LAKE TAHOE Keys waterfront home, 4 bd., 3 ba., slps. 12+, 2-lev. frplacs, decks overlk. priv. dock/ski lifts, gourm. kitch., bikes, boats, color TVs, VCR, ster. w/tape/disk, pools, hot tub & bch.; tennis, 10 min./skiing, casinos/golf, 1 hr./wine cntry; $995/wk. hi seas. [15 June to 15 Sept; 22 Nov. to 1 March]; + $90 clean fee; 3-day min. 626/578-1503, Jim Douglas.

NOTICE TO ADVERTISERS

All housing and vehicle advertisements require that the qualifying person(s) placing the ad be listed as an owner on the ownership documents.

Universe

Editor
Mark Whalen

Photos
JPL Photo Lab

Universe is published every other Friday by the Public Affairs Office of the Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109.

Advertising is a free service offered only to JPL, Caltech and contractor employees, retirees and immediate families.

Ads must be submitted on ad cards, available at the ERC and the Universe office, Bldg. 186-118, or via e-mail to **universe@ jpl.nasa.gov**. E-mail ads are limited to six lines.

Ads are due at 2 p.m. on the Monday after publication for the following issue.

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