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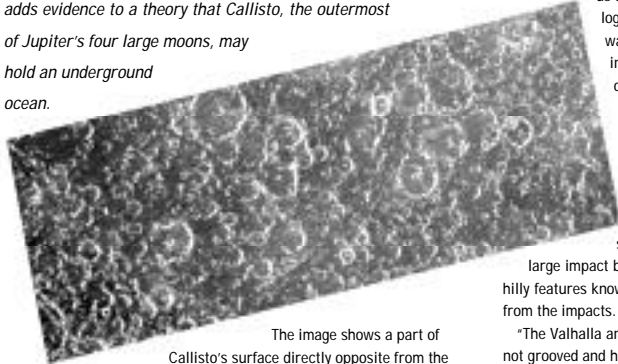
Galileo hints of possible Callisto ocean

By Guy Webster

This image, taken from a distance of about 20,000 miles, shows details at Valhalla antipode down to a size of about 1,250 feet across.

SOLAR SYSTEM

A RECENT IMAGE FROM JPL'S GALILEO SPACECRAFT adds evidence to a theory that Callisto, the outermost of Jupiter's four large moons, may hold an underground ocean.



The image shows a part of Callisto's surface directly opposite from the Valhalla basin where Callisto was punched by a major collision. The opposition point shows no effect from the impact. Points opposite major impact features on some similar-size worlds, such as Mercury and Earth's Moon, show lumpy terrain attributed to seismic shocks from the distant impacts.

The new image is consistent with a 1990s model proposing that a liquid layer could be acting as a shock absorber inside Callisto, said planetary geologist Dr. David A. Williams of Arizona State University. "Although there is a lot of uncertainty in the computer modeling of Callisto, it's good that this image supports the hypothesis presented a decade ago. But it's not a smoking gun, and a lot more evidence needs to be uncovered before we will know for sure whether Callisto has a subsurface ocean," Williams said.

"Galileo has given us indications, primarily from magnetometer data, of the possibility that Europa, Ganymede and Callisto—three of Jupiter's four large moons—have liquid-water layers," said Project Scientist Dr. Torrence Johnson of JPL.

"Liquid water is of interest not only for what it may tell us about the evolution of these bodies, but also for biological implications," Johnson said. Life relies on liquid water, but an ocean on Callisto would not draw as much interest in a search for life as one on Europa. An ocean on Callisto would be much farther below the surface than Europa's ocean. It would also be trapped between two layers of ice rather than sitting on top of a warm rocky layer, as models suggest for Europa.

Images taken of Valhalla's opposite point, or antipode, during a May 25, 2001, flyby of Callisto by Galileo, show the same type of cratered surface seen all over Callisto. In contrast, regions opposite large impact basins on the Moon and Mercury have grooved and hilly features known as "antipodal terrains" and attributed to shocks from the impacts.

"The Valhalla antipodal region on Callisto is cratered, but definitely not grooved and hilly," Williams said. He is processing and analyzing the Galileo Callisto imagery with James E. Klemaszewski and Dr. Ronald Greeley, also of Arizona State University. Williams presented a preliminary analysis last month at the annual meeting of the American Astronomical Society's Division for Planetary Sciences in New Orleans. Earlier computer modeling of Callisto by Greeley and his student Allison Watts suggested that if Callisto had a liquid water layer in its interior, this layer would have dispersed the seismic shock waves from the ancient Valhalla impact. These shock waves might otherwise have produced grooved and hilly terrain at the antipode.

Callisto is about the same size as Mercury. Its surface of ice and rock is the most heavily cratered of any moon in the solar system, signifying that it is geologically "dead." There is no clear evidence that Callisto has experienced the volcanic activity or tectonic shifting that have erased some or all of the impact craters on Jupiter's other three large moons. So, if the Valhalla impact billions of years ago had reshaped the landscape on the opposite side of Callisto, those effects would likely still be detectable.

Deep Space 1 says farewell



Dr. Marc Rayman

Deep Space 1, JPL's successful mission to test 12 advanced technologies in deep space to lower the cost and risk to future science-driven missions that use them for the first time, comes to an end Dec. 18.

Launched in October 1998, Deep Space 1 completed its primary mission in September 1999. An extended mission to fly by Comet Borrelly was achieved despite the loss of DS1's star tracker—which helps determine the spacecraft's orientation—on Sept. 22, 2001, providing researchers the best-resolution of the comet to date.

Project Manager Dr. Marc Rayman reflects on "the little spacecraft that could" and the legacies it will leave.

I remember when my grandfather died at an old age, a friend of mine from China said, "Oh, you should be happy." I immediately understood: rather than being sad he died I was happy he had lived so long. So I suppose I have the same feeling with Deep Space 1. While there certainly are sad feelings saying goodbye to this extension of ourselves, this event underscores what a wonderful mission it was. I'm not sad it's ending, I'm happy it accomplished so much! And the mission ends on our terms, with a graceful and planned termination after all objectives are complete.

I think we were able to accomplish so much because we had a small but extraordinarily capable and dedicated team. And I wouldn't exclude the star tracker problem from that. Indeed, the recovery from the loss of the star tracker was one of our finest accomplishments. With a small team we had the agility to respond quickly and efficiently. Our careful evaluation and

acceptance (not avoidance) of risk allowed us to have a very productive mission.

As I wrote in my most recent mission log (<http://nmp/ds1/mrlog.html>) with respect to the comet encounter, "With a small team and a very complex mission, too often we found ourselves having to choose which problems we would penetrate. For the others, it generally became necessary to go with our best estimate through a combination of specific and limited technical information and a strong dose of human judgment. But what if we had made a wrong choice in which areas to focus our greatest attention, or what if the less well considered decisions proved to be wrong in an important way? Well, in that case, I wouldn't be writing about the jubilation that followed a truly flawless encounter."

Indeed, the mission accomplished far more than I ever expected. I did not even anticipate that we would be able to test all 12 technologies in the primary mission. That is a large payload, and it required a tremendous amount of work to put them through their paces.

Many times I

thought that if the mission ended then, we could all be proud and happy with the results: Accomplishing NASA's

"minimum mission success" criteria (defined before launch), accomplishing and then surpassing the complete mission success criteria, recovering from the loss of the star tracker, etc. At each stage, we kept going and the team's pride

and sense of accomplishment only increased.

I think there are several legacies of Deep Space 1. Because of Deep Space 1's technology testing, many future missions that would have been unaffordable or even impossible now are feasible. I think that the results of the mission can contribute to a future with more frequent, affordable, capable, and exciting space and Earth science missions. Indeed, I've always maintained that the real science return from Deep Space 1 is in the future missions that are

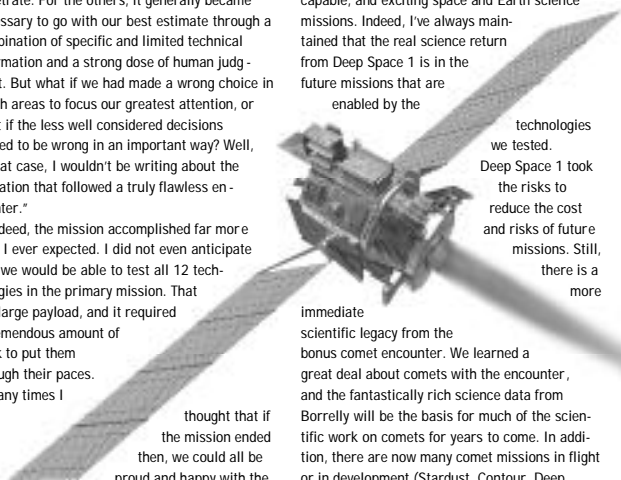
enabled by the

technologies we tested.

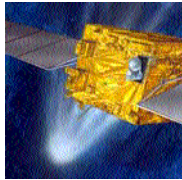
Deep Space 1 took the risks to reduce the cost and risks of future missions. Still, there is a more

immediate scientific legacy from the bonus comet encounter. We learned a great deal about comets with the encounter, and the fantastically rich science data from Borrelly will be the basis for much of the scientific work on comets for years to come. In addition, there are now many comet missions in flight or in development (Stardust, Contour, Deep Impact and Rosetta) that will benefit from our experience.

I think the mission inspired many people who saw it as JPL and NASA at our best—bold, exciting, resourceful and productive.



News Briefs



Artist's rendering of the Microwave Instrument for the Rosetta Orbiter.

Rosetta Instrument arrives in Europe

A lightweight instrument from JPL has arrived in the Netherlands, one step closer in its journey to examine how gases escape from the nucleus of a comet.

The Microwave Instrument for the Rosetta Orbiter is one of 17 instruments that will fly aboard the European Space Agency's major mission to a comet. Rosetta will be the first spacecraft to orbit a comet, and the microwave instrument will be the first of its type to be sent to any solar system object other than Earth.

"We'll look at the abundance of the gases, their temperatures, the speed at which they're coming off, and the temperature of the comet's nucleus," said Project Manager DR. MARGARET FRERKING of JPL.

The JPL-built device was incorporated into the main spacecraft structure in Italy, and arrived in the Netherlands to begin a series of tests by the European Space Agency. Next it will travel to Kourou, French Guinea, for a January 2003 launch. Rosetta will swing near Earth and two large asteroids before encountering Comet Wirtanen in 2011.

Rosetta will drop a lander onto Wirtanen's nucleus, and the orbiter will circle the comet at distances as close as 2 kilometers (1.2 miles).

From the orbiter, the microwave instrument will monitor how the release of vapors from the comet's icy nucleus changes as Wirtanen moves closer to the Sun. Gases and dust escaping from the surface of a comet form a cloud-like "coma" around the nucleus and a tail pointed away from the Sun.

"The spacecraft will remain in orbit around Wirtanen for 20 months as the comet moves in from Jupiter's distance from the Sun to about Earth's distance," said JPL's DR. SAMUEL GULKIS, principal investigator for the instrument. "During that time, the nucleus will warm significantly, and we'll be able to watch the whole process as the comet evolves from an inactive ice ball to having a fully developed coma."

For more information about Rosetta, log on to <http://sci.esa.int/rosetta>, for more on the microwave instrument, see <http://mirowww.jpl.nasa.gov>.

Lab kudos for waste reduction efforts

JPL has been honored by the state of California in recognition of its efforts in recycling and waste reduction.

The California Integrated Waste Management Board recently named the Laboratory a winner in the 2001 Waste Reduction Awards Program.

The board, one of six agencies under the umbrella of the California Environmental Protection Agency, works in partnership with local government, industry, and the public to reduce waste disposal and ensure environmentally safe landfills.

JPL recycling coordinator TAENHA GOODRICH, who accepted the award on behalf of the Lab, noted that JPL

was honored for reducing landfill by 52 percent from a 1996 baseline amount and for community outreach.

"We applaud your voluntary efforts to reduce, reuse, and recycle," the board said in its citation. "We look forward to your continued efforts and future improvements in waste reduction."

Award for Excellence nominations open

Nominations are now being accepted for the 2002 Award for Excellence, which recognizes individuals and teams who make exceptional contributions to the Laboratory. Award recipients may receive up to \$2,500 during a ceremony that will be held in May 2002. The Award for Excellence is an opportunity for any JPL employee to nominate any other JPL employee whose accomplishments are outstanding. Nominations will be accepted for individual and team accomplishments that occurred in FY 01 or in early FY 02.

Award criteria and the nomination form are available on the Employee Services and Recognition home page at <http://eis/sec614/reward> by clicking on Award for Excellence. Completed nomination forms should be submitted to MONICA GARCIA, mail stop T1720-B, by Friday, Dec. 21.

Coin Club seeks new members

Due to key officer retirements, the JPL Coin Club has been inactive for the past several months, but several club members are trying to gauge interest in reviving the club and are soliciting new members.

"We plan to conduct the monthly meetings at JPL on a day and time convenient to all members," noted club member BUD LOVICK.

One of the club's activities is making commemorative bronze and silver medallions that depict JPL milestone space events, and selling them through the ERC and at the JPL Open House.

If you are interested in reviving your membership or becoming a new member of the club, contact JOHN EYRAUD, ext. 4-5417, TOM FOUUSER (4-6996) or Lovick (4-9877) before Dec. 11.

NASA approves Phase B Pluto study

NASA has selected a proposal to proceed with Phase B (preliminary design studies) for a Pluto-Kuiper Belt mission, intended to explore the most distant planet in the solar system. The mission will also explore the Kuiper Belt beyond Pluto, a source of comets and believed to be the source of much of Earth's water and the simple chemical precursors of life.

The scientific value of this mission is highly dependent on a 2006 launch that achieves a flyby of Pluto well before 2020.

In order to ensure this launch date, NASA has established two conditions that must be successfully met at the conclusion of Phase B.

First, the mission must pass a confirmation review that will address significant risks such as schedule and technical milestones and regulatory approval for launch of the mission's nuclear power source. Second, funds must be available. Congress provided \$30 million in fiscal 2002 to initiate spacecraft and science instrument development and launch vehicle procurement; however, no funding for subsequent years is included in the administration's budget plan.

The mission, called New Horizons: Shedding Light on Frontier Worlds, is led by Principal Investigator Dr. S. Alan Stern of the Southwest Research Institute, Boulder, Colo.

If New Horizons is selected for development, JPL would provide Deep Space Network support.

Retiree gets asteroid honor

JPL retiree PHILLIPP NEUHAUSER was recently honored with an asteroid being named for him by JPL astronomer ELEANOR HELIN.

Neuhauser received the honor based on his 30 years of service to JPL's Public Affairs Office. The asteroid was discovered by Helin in 1992 at Palomar Observatory.

Special Events Calendar

Ongoing Support Groups

Alcoholics Anonymous—Meetings are available. Call the Employee Assistance Program at ext. 4-3680 for time and location.

Codependents Anonymous—Meeting at noon every Wednesday. 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

Polar Oceanography Group, will present "The Ends of the Earth: Examining the Arctic and Antarctic Ice Covers" at 7 p.m. in von Kármán Auditorium. Open to the public. For more information, see <http://www.jpl.nasa.gov/events/lectures/dec01.html> or call Public Services at ext. 4-0112.

Friday, December 14

The Great Trans-American Train Ride—This travel film will be presented at 8 p.m. in Caltech's Beckman



Building 111-117. Call the Employee Assistance Program at ext. 4-3680 or Randy Herrera at ext. 3-0664.

Auditorium. Tickets are \$9 and \$7. For information, call (626) 395-4652.

Parent Support Group—Meets the third Thursday of the month at noon. For location, call the Employee Assistance Program at ext. 4-3680.

Messiah Sing-Along—The Caltech Men's and Women's Glee Clubs will lead the audience in singing Handel's *Messiah* at noon in Dabney Lounge. Admission is free. For information, call (626) 395-4652.

Senior Caregivers Support Group—Meets the first Thursday of the month at noon. For location, call the Employee Assistance Program at ext. 4-3680.

Tax Deferred Annuity Deadline—Salary reduction agreements for 2002 annuities must be submitted by today to the Benefits Office.

Fri., Dec. 7-Sat., Dec. 8

Holiday Concert—The Caltech Men's and Women's Glee Clubs will perform music of the holiday season at 8 p.m. in Dabney Lounge. Admission is free. For information, call (626) 395-4652.

Von Kármán Lecture Series—Benjamin Holt, a research scientist in the Polar Oceanography Group, will present "The Ends of the Earth: Examining the Arctic and Antarctic Ice Covers" at 7 p.m. in the Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public. For more information, see <http://www.jpl.nasa.gov/events/lectures/dec01.html> or call Public Services at ext. 4-0112.

Monday, December 10

Tax Deferred Annuity Open House—Representatives from TIAA/CREF and Fidelity will be available from 9 a.m. to 3 p.m. in the 167 cafeteria to answer questions.

Saturday, December 15

Children's Holiday Party—The Caltech Women's Club is sponsoring this potluck at Caltech's Winnett Lounge from 10 a.m. to 1 p.m. Santa Claus, storyteller Jim Cogan, holiday arts and crafts and seasonal music are featured. Bring an appetizer or dessert. For more information, call Donna Burdick at (626) 798-0028.

Tuesday, December 11

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

Folk Music—Irish fiddler Kevin Burke will appear at 8 p.m. in Caltech's Winnett Lounge. Tickets are \$15 for adults, \$4 for children under 12. For information, call (626) 395-4652.

Tax Deferred Annuity Workshops—TIAA/CREF will discuss the Economic Growth and Tax Relief Reconciliation Act of 2001, a new tax law that affects the maximum amounts reflected in annuities for 2002. To be held in the 167 cafeteria at 11 a.m. and 1 p.m.

Tues., Dec. 11-Wed., Dec. 12

Microelectronics Reliability and Qualification Workshop—Section 514 will host at the Hilton Hotel in Pasadena. The purpose of the workshop is to provide a forum for open discussion in all areas of microelectronics reliability and qualification for high reliability and commercial applications. The format will consist of eight main technical sessions. Two keynote speakers each day will discuss latest results or work in progress in all areas of microelectronics device reliability and qualification methodologies. For registration and schedules, log on to <http://parts.jpl.nasa.gov>.

Tuesday, December 18

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

Thursday, December 20

Social Security—A representative is available from 9:30 to 11:30 a.m. in the 167 cafeteria. No appointment is needed.

Wednesday, December 26

JPL Toastmasters Club—Meeting at 5 p.m. Guests welcome. Call Joy Hodges at ext. 4-7041 for location.

Wednesday, December 12

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

Thursday, December 27

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

JPL Toastmasters Club—Meeting at 5 p.m. Guests welcome. Call Joy Hodges at ext. 4-7041 for location.

Wednesday, January 2

Associated Retirees of JPL/Caltech—Meeting at 10 a.m. at the Caltech Credit Union, 528 Foothill Blvd., La Canada.

Thursday, December 13

Von Kármán Lecture Series—Benjamin Holt, a research scientist in the

Thursday, January 3

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

Leonids over California



JPL astronomer Jim Young, who works at the Table Mountain Observatory, traveled north to Grandview campground near Bishop (elevation 8,600 feet) to capture this image of the Leonid meteor showers on Nov. 18. The image, also posted at <http://leonids.hq.nasa.gov/leonids/gallery>, was taken at about 3:30 a.m. Pacific time.

JPL'S NEW BUSINESS SYSTEMS TEAM

is currently preparing upgrades to the Oracle-based business software system employed at the Lab. Marc Montgomery, manager of the Institutional Business Systems Division, discusses the changes and their benefits to employees.

What is New Business Systems?

NBS is the business hub of the Lab—it is what allows JPLers to submit their time cards electronically, purchase our supplies and durable goods, and allows the Projects, Human Resources and others to perform their business functions. The suite of business applications that constitute NBS were implemented three years ago based on Oracle business modules and the Oracle database. There are now more than 60 applications in NBS: 13 Oracle applications, 10 by third-party vendors, and 38 developed by JPL.

Why is an upgrade necessary?

There are three major reasons. First, we'd like to have access to the new features and fixes that Oracle has made to the applications. Second, Oracle provides new technology that will open new possibilities for our custom applications to better meet our customers' needs. And perhaps most compelling, Oracle has announced "de-support dates" for our current application versions. That means we won't get the updates we need to run a payroll in January 2003, for example.

Who is affected?

In some ways the entire Lab is affected, although in many cases it is only indirectly. Primarily it is the people who use the NBS applications to do their daily work. The biggest change they will see is that the current non-Web applications will now be accessed through their Internet browser. The navigation is a little different, but we anticipate that most users will quickly recognize the functions they are familiar with, and should be up to speed in a few days if they are a frequent user. Sample navigation bars are available on the NBS website, for those who want to take a look.

What functions will be affected, and how?

The biggest changes will be on applications that are now operating in the client-server mode. These include apps like Project Accounting, Purchasing, Human Resources, Accounts Payable, etc. The applications that are currently accessed over the Web, like Timekeeping, will not be changing from the users' perspective, which will make the transition much easier. The architecture behind them is significantly different, but the users won't see that.

How long has the upgrade been planned?

We started the project plan in May 2000. We broke it into two phases. The purpose of Phase I, which we are on now, is to simply get the new software and database installed and working in our environment. Due to the architectural changes there has been a lot of effort in that for about a year. Phase II, which starts in January, is to leverage the new capabilities the upgraded system provides to enhance what we deliver to our customers. The most significant changes the users will see will come in Phase II.

How is this upgrade different from the original Oracle installation?

Fortunately, the differences are significant. One of the most critical is that an upgrade does not involve data conversion from a different system. All of the existing data is simply copied over during the upgrade. That simplifies things immensely. In addition, we have a reporting infrastructure in place we did not have before. The backbone of that is the Master Data Repository, which we designed and implemented to stabilize reporting after the first difficult months of the original implementation. The Master Data Repository and all existing tools and reports come across unchanged in the upgrade. A significant amount of our testing has been to validate the reports after each practice upgrade.

In addition, the applications are not all new to the users this time. That should make it easier for the users to be productive very rapidly.

Does that mean you expect to have no difficulties this time?

That would be a wonderful dream. It is inevitable that with an upgrade to a software system of this magnitude there will be problems. One issue we've been working has been response time. We're doing stress testing and tuning the system with good results, but until the entire user population is online in their normal mode we won't know for sure if we've fully addressed that issue.

Through our testing and user involvement we have been trying to make sure we find any of the big issues, but I'm sure something will jump out of the woodwork. What I do expect is that we will be able to address anything that does surprise us fairly quickly, and get everything stabilized in January. Our users can help by quickly letting us know through 4-HELP, Option 2, if something is not working. That way we can address it immediately.

What kind of support will be available for the users?

There will be several types. Of course, our Business System Support Help Desk (4-HELP, Option 2) will be geared up. In addition, each functional team has identified subject matter experts for their area (like Acquisition, Finance, Human Resources, etc.) who can provide more immediate hands-on support for their peers. Our Web site will describe the processes to follow during the dark period of the upgrade to get emergency business transactions done, and we're sending out a variety of e-mails with details on the subject. If all else fails, they can call their cognizant system manager for help, or call me directly at ext. 3-4864.

What does a "Dark Period" mean?

I am told that we should use a term other than "dark period" since it sounds so ominous. However, it simply will be the time that we are performing the actual NBS upgrade. Users will not be able to access most of the applications during that time. Exceptions are the reporting tools (e.g., Discoverer and Data Extractor, etc.), plus Timekeeping, Just-In-Time and P-Card. Those will still be available. If emergency business transactions are needed during the dark period, they will be captured on paper and input into NBS after the upgrade is complete. Our website (<https://nbs>) will have information on important deadlines and provide points of contact if there are questions on processing emergency transactions.

This also means that the data for reporting will be accurate up to Dec. 12, including November month-end. The next time all data through December will be available for reporting will be Jan. 2, when we return from the holidays. December month-end data will be available by Monday, Jan. 7.

Doing time

Week ending Dec. 16

Timecards due
Dec. 11, 5 p.m.

Week ending Dec. 23, Dec. 30

Timecards due
Dec. 20, 5 p.m.

Why upgrade?

Oracle support

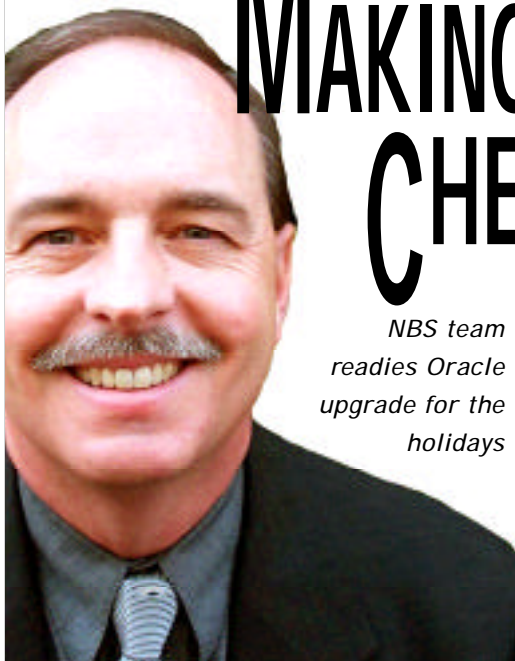
Support for current software version will soon be phased out

Commercial off-the-shelf strategy advantage

Ongoing improvements in software capabilities provided by Oracle

Improved technical platform

Provides new software applications and "technology stack" for future JPL enhancements



MAKING THEIR LIST, CHECKING *it* TWICE

*NBS team
readies Oracle
upgrade for the
holidays*

Why did you pick this time for the upgrade?

The primary driver is Payroll. There is a significant advantage if we can run our first payroll for calendar year 2002 on the upgraded system. Doing it later involves a lot more programming on our part. A secondary factor is that much of the Lab population will be on holiday and vacation during this time, which we hope will help minimize the impact on our users.

Do you feel ready?

I think the success of our dress rehearsal in November has given the team a lot of confidence. We have done a lot of testing, including parallel tests of critical processes such as Payroll. I know some issues will arise, but the bottom line is that we've got a great team that is ready to do whatever it takes to make this successful. They've worked really hard and I have a lot of confidence in them.

Next Universe

Due to JPL holidays coming up at year's end, this issue of Universe will be the last one published in 2001.

The deadline to submit classified ads for the Jan. 4 issue is Monday, Dec. 17 at 2 p.m.

For on-Lab news, log on to <http://dailyplanet>

View this and previous issues of Universe online

<http://universe.jpl.nasa.gov>

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Universe is published every other Friday by the Office of Communications and Education of the Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109.

Notice to Advertisers

Advertising is available for JPL and Caltech employees, contractors and retirees and their families. No more than two ads of up to 60 words each will be published for each advertiser. Items may be combined within one submission. Ads must be submitted on ad card ds, available at the ERC and the Universe office, Bldg. 186-118, or via e-mail to universe@jpl.nasa.gov.

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

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

Passings

ROBERT L. TAYLOR, a retired JPL engineer who worked at the Lab's former Edwards Air Force Base facility, died Aug. 19.

At Edwards, Taylor was involved in testing of JPL's Surveyor and Voyager spacecraft. For about four years after his retirement, he served served JPL's Solar System Ambassadors Program, giving lectures about NASA and its missions at schools and other locations in his hometown of Fort Worth, Texas.

ALEXANDER BRATENAHLE, 83, a retired member of the technical staff from the former Section 828, died of heart failure Oct. 15 at his home in Watsonville, Calif.

Bratenahle worked at JPL from 1962-76. He is survived by his wife, Roberta, two daughters and one grandchild.

MARJORIE SIMS, 61, an administrator in Section 281, died of cancer Nov. 19 at her home in La Crescenta. Sims had worked at the Lab since 1962. She is survived by her sister, Nancy, and niece Katherine Bayr. Services were held Nov. 27 at Forest Lawn Memorial Park in Glendale.

GEORGE RESCH, 61, a management systems engineer in Section 335, died of a heart attack Nov. 22 at Glendale home.

Resch had worked at JPL since 1974. He is survived by his son, Michael.

Memorial services were scheduled for Dec. 8 at Oakdale Memorial Park in Glendora.

Letters

I would like to thank my co-workers for the sympathy cards and donations given to me following the death of my sister Sharon. The donations will be given to charity in her name. In addition, I thank the ERC for the plant sent to my home.

Linda Fatico

Many thanks to my friends and co-workers for their support and expressions of sympathy following the recent passing of my mother. Thanks to the ERC for the lovely plant sent to my home.

Marilyn Pistoril

Retirees

The following JPL employees retired in December:

Phillip Brisendine, 45 years, Section 346; George Cleven, 44 years, Section 313; Leticia Eckert, 33 years, Section 134; Barry Levitt, 31 years, Section 331; Patricia Westerlund, 22 years, Section 349; Alfred Paiz, 18 years, Section 810.

Classifieds

For Sale

A-FRAME, welded steel pipe construction, assembles from 3 pieces to height of 10 ft. and max width of 9 ft., ideal for removing/in-stalling auto, truck and boat engines. \$50. CHAIN FALL, rated at 1,000 lbs., ideal for use with A-Frame. \$25. 790-1410.

BABY/TODDLER ITEMS. Peg Prego high chair, Evenflo playpen, Kiddie Pack carrier, Komfort car seat, support carrier, infant bathtub and infant carrier, all for the low price of \$200. 248-1056. Gordon or Cheryl. BASEBALL CARDS. 150K or more. WOOD STOVE, antique "Artic"; WATER HEATER, solar, 66 gal., and solar panels; PICTURES, Nagel collection; FISH POND, w/pump. rem7@dana.ucc.nau.edu.

BED, twin mattress & ash wood frame w/2 draw-ers, \$200; CHILD'S DESK, 44" x 18" x 30", chair, ash wood, \$150; HIGH CHAIR, \$15; STOVE, antique heating, \$150, all exc. cond. 790-6136.

BED FRAME, metal, rolling full/queen, \$15. 626/683-9951.

BEDRM. SET, 6 piece, queen, black, exc. cond., 2 lg. dressers, 1 w/circular mirror, 2 nstands, hope chest & bed; matching

ceiling fan avail., \$500/obo. 626/445-2551 or x3heater@yahoo.com.

BIKES, Diamond Back men's mt'n., \$50; Ladies Raleigh & Schwinn, \$40/ea. 626/289-2688.

BIYCICLES, assorted, good cond., \$50/ea. 952-5336.

CAMERAS, 35mm Voigtlander, 2 1/4 twin lens Ricoflex, Kodak 620 to 8mm movie cameras, Bell & Howell & Bolex, some accessories, best offer. 323/256-0445, Dave.

COMPUTER, Apple G3/233MHz, 32MB, 4GB HD, 24x CD-Drive, Apple 15", w/monitor, \$500/ obo, wio monitor \$450/obo; PRINTER, Apple Color Stylerwriter 2400, Inkjet, \$25; MODEM, PC external, 56K, US Robotics, brand new, still in original box (shrink wrap opened), \$30/obo. 626/229-9953.

COMPUTER TABLE, oak colored, exc. cond., \$75/obo. 368-7861.

CONCERT TICKETS, LA Philharmonic, Dec. 22, 8 p.m., Dorothy Chandler Pavilion, Verd'i's Requiem, 41 or orchestra level (M1-M4), \$27.50/ obo. 626/284-4080.

CRIB/DAYBED, Bellini "Milano" style, light brn. wood, w/ cot, \$275. 709-0208.

DESK, captain's trestle, with chair, solid honey colored maple, ideal for writing or as an accent piece, includes custom glass desk top, \$350/both pieces. 626/791-9154.

DESK, solid oak desk, 39 1/2" wide, 59" long, exc. cond., \$375/obo. 368-7861.

DESKS, 4, std. size, walnut, \$50/each; DESK, exc. size w/return, walnut, \$150; CHAIRS, 2, secretarial, \$15/each; BOOK SHELVES, 4, 6 ft. 2 shelf book cases, teak, \$20/each; BOOK CASES, 2, 21" 2 shelf, teak, \$15/each; CHAIRS, 12, Breuner Side, \$15 each; DINING TABLE, w/xt leaves, teak, \$25; FILING CABINET, 6 drawer, \$25. 626/793-1466.

FIREPLACE SCREEN/ACCESSORIES, black, \$50/all; COOLERS, 2 Coleman, 25" x 36", good cond., \$15/ea.; SHOVELS, 6, compact, sd point, \$5/ea.; CARPET SHAMPOOER, manual brush & handle, never used, \$5; BIYCICLES, 4, children's, \$15/ea. 626/357-8210.

HOME THEATER, Sony STR-GX995S FM stereo/FM-AM receiver & av/cont. ctr., provides powerful Surround Sound incorp. digital signal proc. & Dolby Pro-Logic decoding, includes Remote Commander with learning capability, exc. cond., original price \$900, now \$125; SPEAKERS, pair of Boston Acoustics satellites, passive sub-woofer, ideal as part of a home theatre system, \$100. 790-1410.

LOVESEAT/single sofa bed, off white/plum design, vg cond., \$250; Recliner Chair/w/raibator & heat, electric, plum teaced, vg cond., \$450. 951-3653.

MISC. car cover, custom weatherproof, for 1984-96 Corvettes, Calif. Car Cover Co., orig. \$400, now \$99; Handspring Visor Deluxe, new, used <10 hrs, orig. \$250, now \$119; camera, Eye Module 1, for Handspring Visor, \$39; metal stylus, pack of 10, multi colored for Visor or Palm, \$9.99; extra USB cable for Visor, \$19.99; phone, deluxe Nokia 6100 series, for AT&T network wire case, \$99; batt'r., for Nokia 5000 and 6000 series phones, \$15. 366-6134.

MOVING SALE: entire contents of home, incl. waterbed (queen), couch, din. rm set (6 chairs, 2 leafs), coffee table, end tables, chair and misc. pictures, make any reasonable offer. 626/914-1237, Gene.

PLAYHOUSE, solid wood, play gym/tee house, with slide and climbing ropes, \$400/obo. 626/357-3920.

RECORD ALBUMS, six of LP records, "The Land Of Smiles" Franz Lehar, "Die Fledermaus" Johann Strauss, "Gipsy Baron" J. Strauss, "Die Csardasfuerstin" Emmerich Kalman; "Bee-ihoven's Symphonies Nos. 1 & 9" Toscanini; Beethoven, Mendelssohn, Brahms, Tchaikovsky w/David Oistrakh, violin, Bruch, Lalo & more, + 36 classical LPs from '50s & '60s, perfect cond., reasonable price. 368-2245.

REFRIGERATORS, G.E., one is beige, 17 yrs. old, side by side, \$100, other is white, 15 yrs. old, freezer on top, \$100; DINING ROOM TABLE, w/xt leaf, cherry wood, black legs, 4 chairs, gd. cond., \$150; SOFA/SLEEPER, into qn. bed, abstract black, blue & mauve design, gd. cond., \$300. 626/357-8210.

SATELLITE SYSTEM, complete big backyard dish, general instrument 2650 R receiver, video cipher II, digital audio plus remote control and G1, 2000 PS antenna positioner power supply, \$650/obo. 626/794-0577.

SOFA, dk. brwn brocade, \$400/obo; COCKTAIL/COFFEE TABLE, ck. brn, \$225/obo; HUTCH, maple & table, \$325/frm; BED FRAME, pine, full sz., from Ikea, \$300; MATTRESS, full sz., \$75/frm; OIL PAINTING, large, of fisherman, gold frame, \$225; DESK, oak, large, 55 inches across, \$500/obo. 626/358-2036.

SOFA, sectional, like new, designer fabrics, neutral colors, cost \$1,500, sell \$650; ENTERTAINMENT CTR., cherry wood, beveled glass doors, will fit lg. TV, lots of space for stereo equip., lots of storage, cost \$1,850, sell \$600; BAR STOOLS, two, black iron, padded seat & back, \$125/pr. 701-0061.

Table (kitchen), oak, dark green tile top, 4 oak chairs, vg cond., \$200; DESK, rollout, large, good cond., \$100. 951-3653.

TOOLS, new Ryobi multi-tool craft set, \$75; hydraulic jack, new 2-ton, \$25; car ramps, \$20; mechanic's creeper, \$15; BOWLING BALL, man's, \$10. 353-5671, day or evening.

TOOLS, Shopsmith table saw, drill press, band saw, lathe in one compact unit, incl. accessories/manuals, \$400. 626/852-5895.

VACUUM CLEANER, upright, \$25; EDGER, gas, \$40; LAWN MOWER, gas, rear bag, \$60; PUSH MOWER, \$25. 626/289-2688.

VIDEO, Disney's Sleeping Beauty, VHS, new, sealed, limited edition masterpiece, fully restored w/HX sound, \$25. 562/420-2313.

WASHER, 575, FIREPLACE SCREEN, brass with glass doors, \$40. 243-8255.

Vehicles/Accessories

'83 BMW 633CSi, black orig. paint, well maintained & repaired, good records, \$5,000. 626/836-3931.

'93 CHEVY Suburban Silverado, exc. cond., 4 w/d, full pwr., \$9,900/obo. 661/296-9428.

'89 CHEVROLET Corvette, 6-sp manual, Z-51 handling package, hatchback coupe, metallic charcoal/black leather, P/NK, P/L, P/M, CD changer, tinted glass, matching paint fiber-glass targa tops, brand new tires & alternator: near mint, exc. mechanically & cosmetically, 68K mi., \$13,000/obo. 626/222-1725.

'99 FORD Mustang, white, exc. cond., 40K mi., orig. owner, leather interior, CD, cruise cont., 100K bumper to bumper, like new, \$12-13K. 909/971-9405, eves.

'96 FORD Mustang, exc. cond., air, pwr. steering/locks/windows, 48,000 mi., 6 cyl., stick shift. 626/285-0312.

'94 FORD Econo van conversion, V8, 85K mi., 4 speed automatic, override, navy blue, 4 captain chairs, dual A/C, 12 track CD, VOX TV, small cooler, mechanically sound, \$8,500. 626/334-0844.

'97 FORD F150 truck, 67,000 mi. orig. owner, longbed, camper shell, a/c, radio/cass., V-8, 5-sp. manual, heavy duty, geared for towing, white, gray interior, \$6,995. 626/798-1765.

'90 FORD F150 pickup XLT Lariat, 4 WD, ext. cab, 86K mi., orig. owner, 5.8L V8, vg cond., at. ac, tow pkg, loaded with many extras, \$6,900. 626/965-3704.

'99 HONDA Civic EX, exc. cond., loaded, moonroof, AM/FM/CD, A/C, cruise, pwr. windows/door locks, keyless entry, dual airbags, ABS, 89K ivg mi., maint. continuously, runs great, great mileage, \$12,900. 661/400-4434, Wendy.

'97 HONDA Accord EX coupe, 2 dr., automatic, a/c, cyl., 2.2 L. V. Tec., 73,200 mi., drk. grn., tan interior, a/c, ps, pw, pdl, tilt whl., cruise control, am/fm, cd, dual air bags, abs (4-wheel), sliding sun roof, alloy wheels, good cond., \$10,895/obo. 909/305-1111, Victoria.

'97 HONDA Civic hatchback, A/C, P/S, CD, automatic, alloy wheels, tinted windows, 57,500 miles, \$9,800 or take over payments \$256/mo, 909/597-4664, leave message.

'93 HONDA Accord LX, 4 dr., 5 spd., 1 owner, vg cond., 86K mi., a/c, am/fm/cass., cruise contr., pwr. window, \$6,600. 249-4602.

'92 HONDA Accord EX sedan, 4 dr., 106K mi., gd. cond., white w/blue int., auto., 4 cyl., 2.2 lit. front whl dr., a/c, ps/w/d, cruise contr., ABS, tilt whl., sun/moon roof, am/fm stereo/cassette, anti-theft, gd. tires, \$6,000. 626/296-9073, Patti.

'81 Honda Gold Wing GL 1100 L motorcycle, 180K, fully eq'd, incl. helmet w/speakers for intercom, extra custom leather seats, saddlebags & ferring. \$750/obo. 682-2392, I, msq.

'95 JAGUAR Vanden Plas, exc. cond., blue w/white leather, 69K mi., \$19,900. 626/291-2185.

'93 JEEP Wrangler, 4 x 4, 70K mi., oversized off-road tires, custom wheels, bumper running boards, grill protector, a/c, am/fm cassette, premium speaker, burwood bed, soft top, bikini top, snow chains, orig. owner, exc. cond., \$8,000. 701-0061.

'93 MERCURY Sable LS sedan, 4 dr., V6, 3.8 L, auto trans, 44,000 mi., mocha frost, gd. cond., a/c, pwr. steering/windows/door locks/antenna, tilt whl., cruise contr., AM/FM stereo/cass., 10 CD changer/stacker, dual front airbags, ABS (4 whl), leather seats & wheel, dual power seats, alloy whls., digital instr. panel, keyless entry, rear window defroster, \$5,349. 790-4379.

'97 NISSAN Altima, black cherry, 50K mi., gd cond., regular oil and maint., orig. owner, am/fm cass., air, gd. tires, tilt wheel, cruise contr., pwr. windows, \$7,500/obo. 626/359-0076.

'90 NISSAN 240SX SE Fastback, red, 5 spd, flip-up/removable sunroof, pwr steering, tilt wheel, cruise, AM/FM stereo, single owner, all records, 100K mi., good cond., \$3,200/obo. 626/347-4742.

'93 SUZUKI Intruder 800, exc. cond., 2,900 mi., lots of extras, \$2,950/obo. 661/296-9428.

'97 TRAILER LITE, Forest River Sierra, 17 ft., fully self-contained weekender, original owner, exc. cond., kept under carport, sleeps 4, full bath, microwave, radio cassette deck & speakers, forced air furnace, a/c, Domestic refrig, 3-burner stove, oven, dual kitchen sinks, dual propane tanks, awning, battery, spare tire, \$6,995. 626/798-1765.

'88 VOLVO 740 GLE, 4 dr. sedan, 200K mi., gd. cond., auto, a/c, ps, pwr. win/ck/mrs., sunrf slide/tilt, thr, ally whls, am/fm/cas/ graphic eq, cruise ctrl., ck w/Kelley Blue Book, \$2,250. 909/590-1876.

Wanted

GUITARS/accessories, electric/acoustic/amps/effects. 248-5253 or reverb2020@yahoo.com.

ANTIQUE LINENS, white on white, hand embroidered, preferably monogrammed (any monogram), must be in exc. cond. 980-1638.

ROOMMATE, mature female N/S, PT teacher, grad student, seeks to share residence, needs unprov. priv. rm. & priv. ba.: Pasadena, South Pas., east Altadena, Sierra Madre, Monrovia, Arcadia. 626/398-2702, eves.

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

TUTOR for upper division statistics, JPL/ Caltech area. 626/345-0681.

Free

CAT, black, beautiful long hair, bushy tail, 1/2 years old, neutered and up-to-date shots,

we have to give him up since my daughter developed bad allergy. 626/574-8476. COMPOSTING BIN, black. 957-5382.

For Rent

ALTADENA, rm. in Altadena Rubio Canyon area, priv. residence, kitchen & laundry ok, no smoking, no pets, \$400. 626/797-8082.

BURBANK HILLS, 3 bd., 1 ba., home on quiet tree-lined st., laundry HU, C/A, hardwood flrs, fireplace., fenced backyard, remodel kitchen, w/d/w, stove, fridge, a/c, maid, Dec., \$1,800. 952-1538.

GLENDALE, studio apt. attached to home, 1 ba., kitchen, brand new carpet, new kitchen floor, nice, safe neighborhood, walk to Galleria, no pets, water included, \$595. 323/256-0535.

LA CANADA/FLINTRIDGE, separate sm. rm. w/ba., walk to JPL, gated separate entrance, a/c, microwave, fridge, partially furn., temp. OK, very private, all util, paid, \$650. 790-1093.

MONROVIA HILLS, 2 large bd., 2 full ba., private family home, share kitchen and laundry, electricity, water, gas & cable included, 12 miles from JPL, no smoking or pets. \$475 for each bd. with ba. 626/558-7728.

PASADENA, fully furn. rm. in 4 bd., 2 ba. apt, laundry parking, close to PCC & Caltech, 6 mi./JPL, great for JPL co-op or student, avail. Dec. 18, \$495 + util. 626/351-9641.

PASADENA, spacious 2-story condo, 3 bd., 2.5 ba., prestigious community, beaut. inter., bright kitch., prof. landscap, ctrl. air & heat, close to shop., cozy LR w/FP, end unit, frm dr. h/dwd flrs., m/mac, cond., close to schls., \$1,750. 626/396-9024.

PASADENA condo, cent. located lg complex, 1 bd., 1 ba, 1 mile/Caltech, nr. Hilton, par-tially furn. incl. fridge, stove, dishwasher, parking, c. & weight rms., laundry, secure pool, \$1,150, unfurn. rental option. 626/793-1473.

SANTA ANITA OAKS house, beautiful r/m'gh/d'hd, 3 bd., 2.5 ba., large lr and dr. remodeled kitchen, \$3,900. 626/355-2030, Esther or 626/292-8731, Ann.

SOUTH PASADENA, 3 bd., 2 ba. duplex, hardwood floors, dishwasher, washer/dryer hookup, refrig., quiet street, 6 miles from JPL, \$1,525 + deposit. 626/440-0130.

SOUTH PASADENA, furn. guest house, 1 bd., lg. living/dining area, 1 ba., must like dogs, 5 mi./JPL/Caltech, util. incl., \$600. 323/258-4464.

SOUTH PASADENA, studio apt. 1718 Huntington Dr. betw. Marengo and Milan Sts, fully furn., util. pd., car space, laundry, no pets, non-smoker. \$750. 626/792-9053, Marilyn or Ray.

SOUTH PASADENA, manager's unit, deluxe 1 + 1 bedroom, fully furn., you pay electric/phone, \$1,000, \$100 for each add'l person. 626/792-9053, Marilyn or Ray.

SYLMAR, new home, rent to own, buy option, spacious 2,320 sq. ft., gated community, pool, nr. golf & mountains, corner lot, view, 20 miles to JPL, \$2,295. 626/584-6526.

Real Estate

LA CANADA house, 1,950 sq. ft., 2000 sq. ft. lot, built in 1964, many updates, copper plumbing, new roof, \$515,000. 957-8813.

MAMMOTH LAKES condo unit, 1 bd. + loft, 2 ba., exc. cond., newly redecorated & return, floor to ceiling firepl. in lv. rm., balcony has superlat Mammoth Inn. view, all elec. kitch., desirable location in complex, close to Canyon Lodge, rental income potential. 249-8524.

Vacation Rentals

CAMBRIA, ocean front house, sleeps up to 4, excellent view. 248-8853.

HAWAII, Kona, ocean front on Keauhou Bay, house/guest house comfortably sleep 6, 2 bd., 2 b.a., rustic, relaxing, beautiful: swimming, snorkeling, fishing, spectacu. vv., nr. restaur., golf and other attractions. 626/584-9632.

HAWAII, Maui condo, NW coast, on beach w/ ocean view, 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, micro-wave, dw. pool, priv. lanai, slgs. 4, 415-1214

1501/mite/2, 1215/414 3120/mite/2, \$15/mite/adult in person. 949/348-8047.

LAS VEGAS timeshare, avail. Dec. 27-29, 11, fully self-contained weekender, original owner, exc. cond., kept under carport, sleeps 4, full bath, microwave, radio cassette deck & speakers, forced air furnace, a/c, Domestic refrig, 3-burner stove, oven, dual kitchen sinks, dual propane tanks, awning, battery, spare tire, \$6,995. 626/798-1765.

'88 VOLVO 740 GLE, 4 dr. sedan, 200K mi., gd. cond., auto, a/c, ps, pwr. win/ck/mrs., sunrf slide/tilt, thr, ally whls, am/fm/cas/ graphic eq, cruise ctrl., ck w/Kelley Blue Book, \$2,250. 909/590-1876.

MAMMOTH, Chamonix condo, 2 bd., 2 full ba., slps. 6, newly redoc., fully eq'd elec. kitch., microwave & extras, fir and wood color TV, cable, FM stereo, VCR, old jazz, sauna; game, rec. & Indry rms., conv. to Canyon Lodge, lifts 7/8/16/17, shops, lifts, special events; daily weekly rates, special midwk. rates. 249-8524.

MAMMOTH, Courchevel, fully equipped unit, 2 bd., 2 ba., sleeps 6, a short walk to Canyon Lodge and ski lifts. 661/255-7958.

MAMMOTH, Snowcrack, 2 bd., 2 ba., + loft, sleeps 6-8, fully eq'd kitchen incl. microwave, DW, cable TV, VCR, phone, balcony view to mtns., Jacuzzi, sauna, steam, fishponds, close to Mammoth Creek, JPL discount. 626/798-922 or 626/794-0455.

OCEANSIDE condo, fully furn., 2 bd., 2 ba., fireplace, full kitch., quiet, relaxing, beach setting at beachside: BBQ, pool, spa, game rm., great ocean view; 5571 walk to pier & restaur., slps 6, avail. weekly or monthly. 909/981-7492, Darlene or dthaug@yahoo.com.

PACIFIC GROVE hse, 3 bd., 2 ba., fp, cable tv, pwr. stereo/CD, well-eq'd kit w/microwave, bsaut. furn, close to golf, beaches, 17 Mile Dr., Aguar., Cannery Row. JPL discount. 626/441-3265.