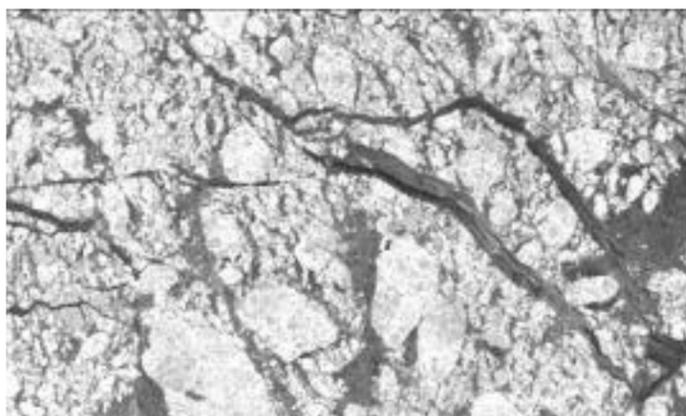
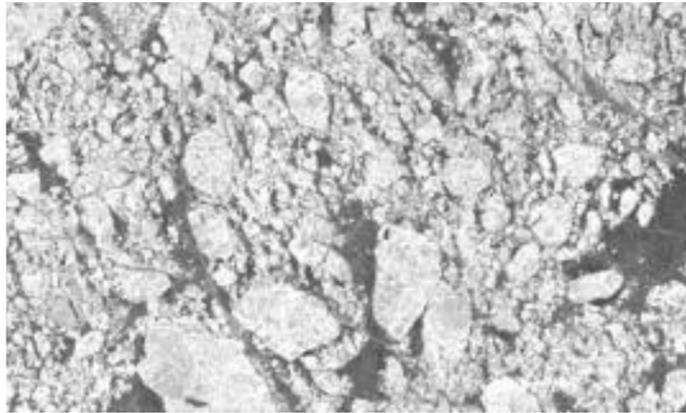


News Briefs 2	Integrity First 3
Special Events Calendar 2	Letters, Passings 4
Next Generation in Design 2	Classifieds 4

Shifting Arctic ice a key to climate change

By Susan Mitgang

The two Radarsat images above were taken nine days apart; the earlier image is shown at the top. Within the nine-day span, large and extensive cracks in the ice cover have formed due to ice movement. The brighter features are older thicker ice and the darker areas show young, recently formed ice.



Researchers have new insights into the mysteries of Arctic sea ice, thanks to the unique abilities of Canada's Radarsat satellite.

The Arctic is the smallest of the world's four oceans, but it may play a large role in helping scientists monitor Earth's climate shifts.

Using Radarsat's special sensors to take images at night and to peer through clouds, JPL researchers can now see the complete ice cover of the Arctic. This allows tracking of any shifts and changes, in unprecedented detail, over the course of an entire winter. The radar-generated, high-resolution images are up to 100 times better than those taken by previous satellites.

Using this new information, JPL scientists can generate comprehensive maps of Arctic sea ice thickness for the first time.

"Before we knew only the extent of the ice cover," said Dr. Ronald Kwok, JPL principal investigator of a project called Sea Ice Thickness Derived From High Resolution Radar Imagery.

"We also knew that the sea ice extent had decreased over the last 20 years, but we knew very little about ice thickness."

"Since sea ice is very thin, about 3 meters (10 feet) or less," Kwok explained, "it is very sensitive to climate change."

Until now, observations of polar sea ice thickness

have been available for specific areas, but not for the entire polar region.

The new radar mapping technique has also given scientists a close look at how the sea ice cover grows and contorts over time. "Using this new data set, we have the first estimates of how much ice has been produced and where it formed during the winter. We have never been able to do this before," Kwok said.

"Through our radar maps of the Arctic Ocean, we can actually see ice breaking apart and thin ice growth in the new openings."

Radarsat gives researchers a piece of the overall puzzle every three days by creating a complete image of the Arctic. Scientists then put those puzzle pieces together to create a time-lapsed view of this remote and inhospitable region. So far, they have processed one season's worth of images.

"We can see large cracks in the ice cover, where most ice grows," Kwok said. "These cracks are much longer than previously thought, some as long as 2,000 kilometers (1,200 miles). If the ice is thinning due to warming, we'll expect to see more of these long cracks over the Arctic Ocean."

Scientists believe this is one of the most significant breakthroughs in the last two decades of ice research. "We are now in a position to better understand the sea ice cover and the role of the Arctic Ocean in global climate change," Kwok said.

Radar can see through clouds and any kind of weather system, day or night, and as the Arctic regions are usually cloud-covered and subject to long, dark winters, radar is proving to be extremely useful. However, compiling these data into extremely detailed pictures of the Arctic is a challenging task.

"This is truly a major innovation in terms of the quantities of data being processed and the novelty of the methods being used," said Verne Kaupp, director of the Alaska SAR Facility at the University of Alaska, Fairbanks.

The mission is a joint project between JPL, the Alaska SAR Facility and the Canadian Space Agency. Launched by NASA in 1995, the Radarsat satellite is operated by the Canadian Space Agency. JPL manages the Sea Ice Thickness Derived From High Resolution Radar Imagery project for NASA's Earth Science Enterprise.

TOPEX data show Pacific Ocean calming down

After three years of El Niño and La Niña with their often devastating climate consequences, the Pacific is finally calming down in the tropics but still shows signs of being abnormal elsewhere, according to the latest satellite data from the JPL-managed U.S.-French TOPEX/Poseidon mission.

These data, taken during a 10-day cycle of collection ending Aug. 17, show that tropical Pacific sea surface heights, which indicate how much heat is stored in the ocean, have returned to near-normal after three years of dramatic fluctuations. See <http://www.jpl.nasa.gov/elniño>.

But as summer ends in the Northern Hemisphere, remnants of the past few years remain embedded in the upper ocean. Above-normal sea surface heights and warmer ocean temperatures still blanket the far-western tropical Pacific and much of the mid-Pacific. This contrasts with the Bering Sea and Gulf of Alaska, where lower-than-normal sea levels and cool ocean temperatures continue, although this pattern is also weakening.

Looking at the entire Pacific basin, the Pacific Decadal Oscillation's (PDO) characteristic warm horseshoe and cool wedge pattern is still evident in the TOPEX sea-level height image. The PDO is a long-term ocean temperature fluctuation of the Pacific Ocean that waxes and wanes approximately every 10 to 20 years. Most recent National Oceanic and Atmospheric Administration (NOAA) sea-surface temperature data also clearly illustrate the persistence of this basin-wide pattern.

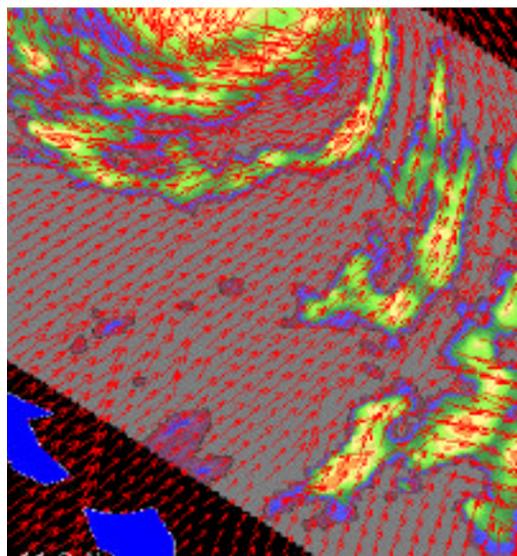
"The present calming started three to four months ago when the La Niña faded away," said JPL oceanographer Dr. William Patzert. "It appears that the global climate system is finally recovering from the past three years of dramatic swings from the extra-large El Niño of 1997-98, which was followed by two unusually cool and persistent La Niña years."

"The good news is that we're finally out from under the El Niño and La Niña of the past three years," Patzert said. "Unfortunately, in the longer term, the reality is that the PDO pattern still dominates the Pacific and, in the short term, the atmosphere is still acting as though La Niña remains. The western U.S. continues hot and dry, and a larger than normal number of hurricanes are forecast by NOAA for both the Pacific and the Atlantic."

Catching nature's fury in the act

JPL Earth science instruments showed some of the most devastating forces of nature last month

This image shows massive Typhoon Bilis' most devastating components—rain and wind—as Bilis bore down on Taiwan Aug. 21. The image shows the surface winds, measured by SeaWinds on QuikSCAT's radar scatterometer, as arrows. The wind data are superimposed on rainfall measurements made by the microwave imager on the Tropical Rain Measuring Mission (TRMM). The two instruments passed over the same location about one hour apart.



News Briefs



Tom Duxbury

Duxbury named Stardust manager

TOM DUXBURY, mission manager and acting project manager for the Stardust mission for more than a year, has been named the mission's project manager.

"I look forward to an exciting six years of flight with an Earth flyby, the comet Wild 2 encounter, Earth return and landing in Utah and possibly other small planetary body encounters along the way," Duxbury said.

Duxbury earned bachelor's and master's degrees in electrical engineering at Purdue University, Indiana. His first job at JPL was in optical navigation on Mariner 5 and 6.

In addition to his new Stardust role, he is currently a member of Mars Global Surveyor's Mars Orbiter Laser Altimeter science team, the European Space Agency's Mars Express Orbiter and Lander science teams, and is the Mars Exploration Office lead scientist for geodesy and cartography.

Paper highlights Europa ocean

A paper published last month in the journal *Science* amplified JPL's announcement last January that Galileo researchers have uncovered the strongest evidence yet that Jupiter's moon Europa hides an ocean of water underneath its icy coat.

"The direction that a magnetic compass on Europa would point to flips around in a way that's best explained by the presence of a layer of electrically conducting liquid, such as saltwater, beneath the ice," explained DR. MARGARET KIVELSON of UCLA, principal investigator for Galileo's magnetometer instrument, and co-author of the *Science* paper.

Kivelson announced that conclusion when she first received telltale readings from the Galileo magnetometer after the veteran spacecraft flew near Europa in January. Her team details its theory about the liquid layer *Science's* formal report.

"We have good reason to believe the surface layers of Europa are made up of water that is either frozen or liquid," Kivelson said. "But ice is not a good conductor, and therefore we infer that the conductor may be a liquid ocean."

Pictures from Galileo flybys show patterns that scientists see as evidence of a hidden ocean. In some, rafts of ice appear to have shifted position by floating on fluid below. In others, fluid appears to have risen to the surface and frozen.

However, those features could be explained by a past ocean that has subsequently frozen solid, said Galileo's project scientist, DR. TORRENCE JOHNSON of JPL. "The evidence is still indirect and requires several steps of inference to get to the conclusion there is really a salty ocean," he said. "A definitive answer could come from precise measurements of gravity and altitude to check for effects of tides."

Less chance of quake along NoCal fault

JPL has participated in a study that found less chance of a major quake originating along northern California's Hayward fault than previously thought.

The study uses new techniques for monitoring earthquake fault activity, including technology developed by JPL.

With the help of radar interferometry and data from Global Positioning System (GPS), plus analysis of repeating microquakes 10 kilometers (6 miles) below the surface, UC Berkeley researchers concluded that the deep portions of the fault steadily slip at about the same rate as the surface. This means the rocks deep below the surface aren't locked and building up strain that could be released in a catastrophic quake.

The techniques used by the researchers to study activity along the fault have just recently become available. Only within the past few years has interferometric synthetic aperture radar from satellites been used to measure ground motion along faults. With data taken in 1992 and 1997 by a pair of European satellites, ERS-1 and ERS-2, plus analysis software developed at JPL, the surface creep was able to be determined within a few millimeters along the northern Hayward fault.

"The global coverage of the European radar satellites allows the same interferometry technique used in this study to be applied to active faults in other parts of the world," said paper co-author DR. ERIC FIELDING, a JPL geophysicist. "There are few places in the world that have the detailed ground information that was available for this study, but radar satellites image nearly everywhere. This allows us to study active faults in regions such as Turkey, Iran and Tibet to learn more about how faults behave."

The findings were reported in the Aug. 18 issue of *Science* magazine.

Special Events Calendar

Ongoing Support Groups

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

Codependents Anonymous—Meeting at noon 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 Building 111-117. Call the Employee Assistance Program at ext. 4-3680 or Randy Herrera at ext. 3-0664.

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

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

Tuesday, September 5

JPL Gamers Club—Meeting at noon in Building 301-227.

JPL Genealogy Club—Meeting at noon in Building 301-271.

Wednesday, September 6

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

"Exploration Through Innovation"—JPL Director Dr. Edward Stone will discuss the challenges and opportunities for JPL in the coming decade in this Caltech Management Association-sponsored event. Held at the Athenaeum, reception is at 6 p.m., dinner at 7 and program at 8:15. Reservations: \$38 for CMA members and their guests, \$48 for non-members. Call Alice Tangney at ext. 4-7702.

Music on the Mall—El Mariachi Garibaldi will perform the traditional sounds of Mexico starting at noon. A drawing will be held at 12:35 p.m. to award four winners with 4 tickets each to Disneyland.

Thursday, September 7

Investment Advice—A Fidelity representative will provide investment information and one-on-one counseling in T-1720. To schedule an appointment, call (800) 642-7131.

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

Monday, September 11

Adobe Demos—Company representatives will demonstrate new publishing, web design and web graphics software. Three 50-minute sessions will be held from 1 to 4 p.m. in conference room 180-101. For details, see http://icis.jpl.nasa.gov/iis/overview/wht_evtm#events.

Tuesday, September 12

Investment Advice—A TIAA/CREF representative will present two workshops in Building 180-101. At 10 a.m., retirement income options will be discussed for employees within seven years of retirement. At 2 p.m. will be an introduction of the Asset Allocation Advice System. Staff who want a customized portfolio proposal can complete a questionnaire either during or after the meeting.

For employees newly eligible to participate in the retirement plan, an enrollment meeting will be held at noon in Building 180-101.

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

Wednesday, September 13

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

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

Prostate Cancer Screening—The test will be offered for men 40 and over from 8 a.m. to noon at Occupational Health Services, Building 310-202. Given on a first-call basis, screening fees are \$25 for JPL employees, \$35 for affiliates. To schedule an appointment, call ext. 4-3320. Allow up to 30 minutes for the screening.

Team brings spacecraft, instrument design to new heights

By Gabrielle Birchak-Birkman

The Next Generation Payload Development Team's concurrent design process allows customers to see a visual demonstration of the design as a whole, providing a big-picture perspective of the craft or instrument, especially at the component level.

State-of-the-art design has risen to a new level at JPL thanks to the Next Generation Payload Development Team. The "concurrent design" process employed by the team helps scientists and engineers create, design and repair computer-generated dedicated spacecraft, probes and payloads in the early design stages, all in real time.

The processes and environment used by the team were created by Dr. Knut Oxnevad in close cooperation with customers, engineers, scientists, the Space and Earth Science Programs Directorate and the Develop New Products team.

Depending on the complexity of the project, the size of the team varies from nine to 11 individuals.

"This team is three years ahead of other programs," Oxnevad said. "Most similar integrated design teams have not been able to use high-end computer tools in a real-time environment."



The team successfully provided engineering designs for JPL's Deep Sea Loihi Probe, which took its first dive near Hawaii last September. Thanks to the design team, said Lloyd French,

JPL's project lead and system architect for the probe, he was able to go from concept to engineering drawings within three weeks. "First we integrated subsystems, and then started targeting orientations, cable harnessing and optics," he said. "I thought it was beneficial because I didn't have to wait very long. I needed results right away, because I was designing and building all in the same week."

Team members cram into a small room in Building 301 to brainstorm about various aspects of the design cycle. Computers and design tools—including three-dimensional geometry—are linked together, making data transfer smooth and effective. "Scientists can define the data they want generated and provide initial input parameters," Oxnevad said. "In the case of prototypes, the design team has actually provided machine shop-ready engineering drawings."

Instead of having breaks of time in design stages, the design cycle is compressed into a simultaneous event consisting of two to three "concurrent" sessions of 3.5 hours each. Customers see a visual demonstration of the design as a whole, providing a big-picture perspective of the craft or instrument, especially at the component level. Engineers and scientists can then study thermal, mechanical, and structural issues—in real time—and jointly make design decisions taking into account environmental, science and engineering parameters.

This allows for instantaneous corrections and adjustments on an instrument. Scientists and engineers are able to see how a spacecraft would hold up in space, or how a submersed probe would withstand tons of pressure near the bottom of the ocean. In these cases, they are able to make corrections while viewing worst-case scenarios.

"Consequently, creativity increases, time and cost is saved, and the quality of design decisions goes up," Oxnevad said. "Customers claim time and cost savings by factors of between four and 10."

The team's design tools are of such quality that their output can be used for the later parts of the design cycle, Oxnevad said. "As a consequence, the artificial barriers between the various design phases can be reduced or eliminated, and the whole design cycle can be dramatically compressed."

Software packages utilized by the team include optical infrared/violet/ultraviolet analysis and design, mechanical analysis and design, electronics analysis and design, radiometry analysis, rigid body dynamics, and surface mobility simulations, and others. Millimeter wave analysis capabilities were developed through interfacing with a JPL-developed system called MODTool. Costing, scheduling, mass and power summaries are also provided to customers.

The design team's customers include the proposal managers for the remote sensing payloads for the Europa Orbiter, the Pluto Orbiter, and for a number of Discovery missions. For the Mars Outpost study, the team designed a concept for a long-range rover with a radar sounder and a 200-meter, lander-based drill system.

**Ethics Office
helps employees
stay with the
program**

INTEGRITY FIRST

By Mark Whalen

JPL employees are encouraged to follow a code of ethical conduct that includes such factors as conducting business with fairness, honesty, and integrity; avoiding even the appearance of a conflict of interest or any other impropriety; and treating fellow employees honestly, fairly, and with dignity and respect.

Roy Harris, who worked at General Dynamics for 35 years, was an engineering section manager when he was selected to be the ethics director of the company's Pomona Division in 1986. He has managed the JPL Ethics Office since 1995.

Harris discusses the Laboratory's ethics program with Universe.

QUESTION *When and why was JPL's Ethics Office formed?*

A The program was formed in 1991, following a JPL study group's report that new laws and audits about ethics issues were becoming increasingly applicable at the Lab. The group focused on such issues as procurement, gratuities, employee privacy and disclosure of proprietary information. Many of the issues—but not all of them—were covered through existing JPL policies, while others required more attention.

Human Resources and other business-oriented organizations on Lab were handling ethics issues, but the lack of a structured program made it difficult for the staff to keep current on policies. It was found, for example, that employees and contractors needed more information about reporting responsibilities.

Gerry Tembrock was the first manager of the office. Doug Sanders, who was part of the study group, joined Gerry early in the program and Tom West later joined the office from Caltech Internal Audit. When Tembrock retired, I was brought in to replace him.

QUESTION *What does the Ethics Office do?*

A The office has several roles. We are a service organization, designed to listen and answer questions, conduct investigations when concerns about wrongdoing are brought to our attention, and most importantly, communicate. I believe that through annual refresher training, new employee orientation, and the quarterly *Ethics Briefs* newsletter, we perform a valuable service keeping the Laboratory sensitive to the ethical aspects that are part of almost everything we do here at JPL.

QUESTION *How often do employees call you about ethics issues? What kinds of calls do you get?*

A Total calls increased again in 1999. We received 680 calls specifically related to ethics issues. Almost 90 percent of these calls were for advice on how to handle certain situations. The other 75 calls were serious enough concerns that an investigation seemed appropriate. In addition, we reviewed 274 new or renewed applications for outside employment.

More than 70 percent of the calls we get involve four categories: Outside Interests, Gifts and Gratuities, Conflict of Interest, and Use of Resources. They range across a broad spectrum. What do I need to do if I want to spin-off Caltech intellectual property and start my own business? The ethical implications of this venture are only part of the issue. A vendor just dropped a basket of goodies on my desk. What do I do? My brother-in-law has a small business on the outside. Why can't I have him do some of the work I need done? Is it OK if I agree to conduct a private tour of the Lab as a prize in a raffle our club is conducting.

QUESTION *What kinds of issues are investigated the most?*

A Year after year, Use of Resources is the largest category. This is not unique to JPL. Typically this category is the largest at most organizations. Another large category is Conflict of Interest. Together these two categories make up more than 60 percent of our investigation activity. If you turn the questions asked above into allegations you can get a feel for the kinds of issues we get involved in.

QUESTION *What is meant by inappropriate use of JPL resources?*

A There are several examples that come up often. Many violations involve people who violate the conditions the Laboratory has established for use of JPL computers for activities unrelated to their jobs. An example is using the computer on your desk for a personal business activity or to share your views on religious, social or political issues.

Another example is unauthorized use of the JPL letterhead. If an employee uses JPL letterhead to say we've used a vendor's product for years and we think it's the best product on the market, all of a sudden JPL—not the employee—is endorsing this product. This letter written by an employee could show up on a vendor's advertising, letterhead and all. And we don't do that.

Sometimes, people misuse mail services. People have sent personal letters and packages through the JPL mail services, not only expecting JPL mail personnel to handle them but also to put postage on them. When we hear about this, we'll have a conversation with the person, letting them know why this is inappropriate. Typically, it's nothing more than that. But if somebody repeats the violation, we'll go to his or her management.

QUESTION *It seems as though many of the violations result from people simply not thinking about them, not realizing what they're doing might be wrong.*

A Yes, and that's why we do training. It's the most important thing we do.

QUESTION *How does the training take place? Is it for everyone?*

A Training is not mandatory as a matter of Labwide policy, but the Executive Council encourages everyone to attend. Some directors and managers have strongly encouraged their staff to attend.

Generally we go to regularly scheduled staff meetings at the division or section level. The sessions take about an hour. We try to make it interesting by discussing some case studies and situations that have come up. I believe that people are more comfortable contacting somebody whom they've heard talk, is a little self-deprecating, and has let you know all he wants to do is help and will respect your confidentiality.

QUESTION *Besides training, what other methods do you use to make people aware of ethics issues?*

A Our web site (<http://www.jpl.nasa.gov/ethics>) outlines all of the Lab's ethics policies. It also includes an archive of all articles published in *Ethics Briefs*.

QUESTION *What happens when people make an honest mistake that turns out to be an ethics violation?*

A We receive several calls each year from employees who fear that they may have unintentionally violated one of our ethics policies. Our job then is to help them fix the problem and understand why it happened in the first place. Anyone who finds themselves in this type of situation and comes to us for help is not going to be disciplined for making an honest mistake.

I'm proud of the fact that the Laboratory doesn't have many people who purposely do things wrong. The vast majority of the issues that we get involved in occur because the employee just didn't think about it.

QUESTION *What about when one employee accuses another of ethics violations? How often do you receive false accusations?*

A We almost never get false accusations. When we do we treat them very seriously.

QUESTION *What's the purpose of the hotline?*

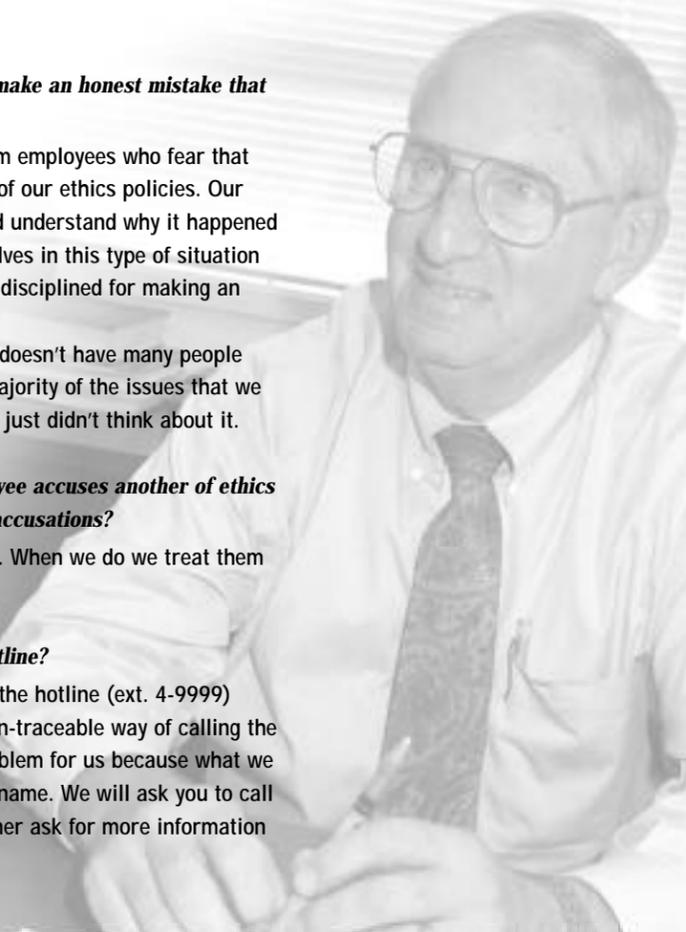
A Although we receive very few calls on the hotline (ext. 4-9999) each year, it does give employees a safe non-traceable way of calling the ethics office anonymously. This is not a problem for us because what we really care about is your concern, not your name. We will ask you to call us back in a couple of weeks so we can either ask for more information or brief you on our findings.



Dutch Slagter/JPL Photos

"I believe that ... we perform a valuable service keeping the Laboratory sensitive to the ethical aspects that are part of almost everything we do here at JPL."

— Roy Harris, manager of JPL's Ethics Office



ISO audit coming up this month

View this and previous issues of Universe online <http://universe.jpl.nasa.gov>

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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 cards, 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.

JPL is preparing for an ISO 9001 surveillance audit that will be conducted on Lab Sept. 18 to 21.

An auditor from JPL's auditing company Det Norske Veritas will conduct the audit, which will focus on product identification/traceability, and process control.

"Product identification is all about the suitable identification of deliverable product from its receipt — as components, subassemblies, subsystems, and systems—through all stages of build, integration and operations," according to Bob Kerr, the Lab's ISO 9001 consultant from Quality Assurance Services North

America. "Product traceability of deliverables deals with the requirements and actions taken to assure that specific products, including subcomponents and consumables, have a solid, recorded history behind them."

JPL corrective/preventive action manager Peter Barry cited the need to discriminate between the ISO sense of process control and JPL "processes." "ISO takes the local view of 'process control' as those good engineering practices that directly affect product quality during build, assembly, test and operations. ISO process control is

not about control of overarching JPL process architecture."

Barry said the following elements will also be reviewed by the auditor: management responsibility (management review in particular), product delivery system, document and data control, corrective/preventive action, and internal assessments. He further noted that the Det Norske Veritas auditor will be accompanied by two JPL employees: a guide and a scribe. "The guide will see that the auditor gets where they need to go, while the scribe takes notes on the nature and context of the interviews be-

tween the auditor and JPL employees. Both are JPL internal assessors conversant in the ISO 9001 standard."

To help employees find out what the auditor will be looking for, the chances of being audited and what can be done to prepare, a briefing will be offered Sept. 12 at 9 a.m. in the Building 167 conference room.

Other resources are available through the ISO 9001 web site at <http://iso.jpl.nasa.gov>. Employee notebooks that can be used to coordinate audit information are available for pickup at Building 125-204.

Letters

My family and I would like to express our appreciation and thanks to my colleagues for their sympathy and support at the passing of my father. Our thanks also to the ERC for the lovely plant.

Ronald Hall

I want to thank my co-workers and friends for the beautiful plant and support and condolences on the passing of my father. Thanks to ERC for the ficus plant.

Barbara Mendoza

Passings

ROBERT GRAHAM, 79, a retired electrical technician in Section 357, died of a heart disease May 17 in Ojai. Graham joined JPL in 1958 and retired in 1986. He is survived by his wife, Beulah, daughter Barbara and son Robert.

Services were held at Rose Hills Memorial Park in Whittier.

BARBARA MONHOFF, 57, a senior engineer in Section 349, died of cancer Aug. 4 at her home in Lebec.

Monhoff had worked at JPL since 1983. She is survived by her daughter, Monika, six grandchildren and one great grandchild.

Burial was held at Green Lawn Memorial Park in Bakersfield.

HOWARD MARTENS, 80, a retired member of the technical staff in Section 660, died of cancer Aug. 8 at his home in Pasadena.

Martens joined JPL in 1942 and retired in 1987. He is survived by his wife, Virginia; daughter Daphne and son Harlan; and three grandchildren.

Services were held Aug. 11 at Forest Lawn Memorial Park in Glendale.

JAMES BLUE, 65, a retired member of the technical staff in the former Section 222, died of cancer Aug. 20.

Blue worked at the Lab from 1969-93. He is survived by his wife, Karen, three children and 10 grandchildren.

Services were private.

Classifieds

For Sale

AIRLINE TICKET, 1 round trip on Delta anywhere in 48 states, Canada or Bahamas, must book before 10/31/00, but can fly up to 1 yr. beyond booking date, \$325. 626/333-3212.

APPLIANCES: washing machine, lg. cap., \$50; dryer, elec., \$50; stove/oven, gas, \$60. 951-5952.

BABY ACCESSORIES: 3 car seats, basinett, clothing, etc.; TREADMILL, NordicTrack, (manual), FURNITURE: pictures, stools, curtains, rugs, vases, bedding, pillows, clothing. 626/398-1988.

BEDROOM SET, girls, twin w/matt., dresser/mirror/desk/hutch/chair, 2 yrs. old, pd. \$2,400, sell \$1,000. 909/861-8998.

BEDS: 2 qn. sz. headboard, full mirror & reading light, white w/gold trim, bed & matt. in great cond., drawer set also avail.; child's twin box w/Disney animated sheets, ideal child's dream bed, great cond., prices negotiable. 383-7383, Pattyl.

BED, king sz., used about 2 yrs., matt., box spring & frame, \$150; TV CABINET/ARMOIRE, lg., reddish-maple, holds 32" TV, front drs., 3 drawers, shelves for stereo/VCR/videos, etc., pd. \$1,200, sell \$250. 626/791-9202.

BICYCLES, 10 spd., men's, 27" whls. & girl's 24" whls., \$25/ea. 952-8803, Don, 5 min./JPL.

BLOCKS, Duplo, several sets incl. motorized train set, appx. 200 pcs., \$60. 352-2036.

BOOKCASE, 7' x 3' x 1', \$30. 790-0697.

BOOTS, snowboarding, Burton, size 7, like-new cond., worn 2 or 3 times by teen who outgrew them first season, \$40/obo. 249-3633.

CHINA CLOSET, glass front, 37" w, 23" deep, 74" H, \$50/obo. 790-7019.

CLARINET, wooden, B-flat, #7823, A. Fontaine, Couesnon, Paris, \$285. 310/318-9574.

CLAY POTS, round, large (2' & 3' dia.), \$50 ea. 2/obo, \$60 ea. 3/obo. 626/398-3480.

COFFEE TABLE, oval, Chinese motif, black, w/6 sectional tables; has 5 handcrafted mother-of-pearl lady figurines around a hand-painted Chinese pagoda; glass cover to protect figurines; exc. cond., photo at <http://www.homeboutique.com/homeboutique/ovcoftabw6.html>, pd. \$480, sell \$180. 626/683-0706.

COMPUTER, 586 IBM compatible, 100MH full tower, Win98, Ofc97, printer, keyboard, 15" color mon., \$300/obo. 957-4770.

DRILL PRESS, lg. 22", 2HP Craftsman w/ 3/4" chuck, full sz. adj. T-slot table, new cond., apx. 1 yr. old, barely used, pd. \$600 new, sell \$295. 326-5233.

DRYER, Whirlpool, full sz., 18 mo. old, \$100; FRIDGE, oldish but works fine, \$30/obo. 626/792-7820.

FURNITURE, oak: desk, computer, 2-pc., L-shape w/butcher block top, keyboard drawer, 5 drawers (2 for files, 1 w/lock); file cabinet, vertical, 4 drawers (1 w/lock); shelf unit, 8 shelves 50w x 60h x 12d, all in VG cond., \$500/obo. 626/791-6101.

LUGGAGE: hard-sided, women's American Tourister, red, vg cond., 27", \$40; 24", \$30; Bel-Aire, lt. brown, vg cond., 22", \$20; men's Samsonite, drk. brown, fair cond., 27", \$10; 21", \$5. 626/577-8107.

MATTRESS, qn. size, exc. cond., \$175; FOOD PROCESSOR, CuisinArt, gd. cond., with blades, \$65. 626/798-8071.

MISC.: monitor, Sony Triniton, 15", color, \$119; gift certificate, \$100, Circuit City, \$85; batteries: Nokia, for 5100 or 6100 series cell phone, pd. \$60, sell \$19, Sony camcorder, \$10, Sony Mavica infolithium, \$20; auto-switch, new 4:1, Belkin, orig. \$100, sell \$35; remote, new Sony Commander deluxe, for Sony TV, DVD & stereo, \$19. 366-6134.

MOVING SALE: oven, Hotpoint, warr. thru Nov. '01, \$300; washing mach., Kenmore, heavy duty, super cap., \$300; dryer, Kenmore, heavy duty, super cap., \$300; sofa, black/white/gray pattern, \$300; coffee table, lt. wood w/mirror top, \$60; ent. ctr., black w/glass door, \$60; TV/VCR stands, 2, black, \$30/ea. 626/398-7090, Karen.

OSCILLOSCOPE, Tektronix T935 dual channel 35MHz, gd. cond., incl. 2-10x probes, \$250. 626/791-9202.

REFRIGERATOR, GE, 18.2 cu. ft., 5 yrs. old, exc. cond., frost free, \$200. 352-5638.

REFRIGERATOR, Kitchen Aid, exc. cond., 20.7 cu. ft., auto-defrost, tempered glass shelves, meat locker, ice maker, more, \$400; MICROWAVE, Panasonic, 1,000W, many features, \$100; FAX/PHONE, Panasonic, plain paper, digital ans. sys., \$100; FUTON sofa bed, brown wood frame, queen matt., \$150; CRIB, wooden frame, wheels, matt., \$100. 626/795-1610.

SCOOTER: fashionable girl's model painted rare light pink w/pink whls. & handle grips, new in box w/instructions; Just Go brand (just like Razor), \$100/obo. 626/379-8222, Diana.

SPEAKERS, 2, Sony, lg., for component sys., exc. cond., \$50. 626/445-2616.

STEAM CLEANER, Bissell canister, model #1655, \$60. 352-2036.

TABLE, dinette, square, glass top, 5'x5' w/metal feet & 4 matching chairs, \$800/obo; BAR STOOLS, 4 matching, metal frame, all exc. cond., \$400/obo. 626/398-3480.

TV, Panasonic 25" diag., wood cabinet, remote, 8 yrs old., \$150/obo. 626/398-3480.

TV, Quasar, 7", color, & 11" VCR/remote, exc. quality, \$175/obo. 909/593-4046, viidavies@starquest.net.

TV, 13", color, \$25; FLOOR SPEAKERS, Sony, \$25/pr.; BIKES: men's 10-spd., \$40, women's 10-spd., \$25; PRINTER, Apple 2400, color, \$25. 957-1409, Allen Farrington, eves.

TYPEWRITER, IBM III Selectric w/stand on wheels & cover, \$150 firm. 626/284-9664.

Vehicles / Accessories

'86 ACURA Integra LS, silver w/black int., 5-spd., moonroof, cc, VG mech. cond., well maint. inside & out, 109K mi., orig. owner, \$3,400. 626/398-0921, Shari.

'00 BMW 328i, auto, leather, CD player, sunroof, loaded, 9K mi., silver/black, \$34,995. 909/599-3230.

'84 CHEVY Caprice, V8, auto, a/c, am/fm, 121K, white, just smogged, new tags, \$2,800/obo. 626/797-1310.

'95 FORD Escort wagon, silver, auto, a/c, gd. cond., low mi., \$6,500/obo. 951-3185, lv. msg.

'94 FORD Thunderbird, V-8, full pwr., leather, showroom cond., \$8,495/obo. 952-3854.

'88 FORD Ranger, ext. cab, gd. cond., \$3,200. 626/355-1646.

'70 FORD F250 camper special truck, p/s/disc brakes, a/c, rebuilt eng., reliable, runs great, all new running gear/motor/trans., no rust, needs minor body work, \$5,500/obo. 626/285-5722.

'67 FORD Mustang, 8 cyl., 289, eng. VG cond., needs paint, orig. owner, \$6,000/obo. 626/797-5768.

'92 LINCOLN Continental, dreamboat, white w/blue simulated convert. top, loaded, blue lthr., new head gaskets, tires, well maint., rides/runs great, 115Kmi., \$5,750/obo. 249-6786.

'95 MERCEDES BENZ E320, auto, 91K mi., am/fm/cass., a/c, alarm, alloy whls., anti-lock brakes, cc, dual airbags, heated pwr. mirrors, lthr. seats/steering whl., pwr. brakes/dr. locks/drivers & pass. seats/steer./sunroof/wins., telescopic steering whl., tinted glass, cell phone, trunk CD changer, metallic paint, premium sound, Blue Book \$25,765, sell \$24,750. 626/744-9412.

MISC.: '79 Fifth Wheel, 28' triple axle closed trailer, exc. cond., great for racing, \$6,500/obo; '87 LANCE camper shell, LS9000, 11' 3", self-contained, exc. cond., 12V swamp cooler, see to appreciate, \$5,700/obo. 626/285-5722.

'88 MITSUBISHI Mighty-Max pickup, gd. shape, a/c, pipe rack, \$1,800/obo. 790-7019.

'81 PACE ARROW motor home, 31', full kitch & ba., rear bd. rm., 1,800 mi. on motor & tires, must sell. 626/285-5133.

'91 PLYMOUTH Acclaim LE, gd. cond., gray, 3L V6, 93K mi., auto, air, am/fm/cass., pwr. w/dr. locks, driver seat air bag, Blue Book \$5,000, sell \$4,000/obo. 790-6283, Bob, after 5 p.m.

'98 TOYOTA Tacoma, reg. cab, 2WD, 4-cyl., 2.4L eng., exc. cond., 49K mi., black ext., beige int., am/fm/cass., alarm, bed liner, a/c, dual airbags, 5-spd. manual, 1 owner, \$10,500/obo. 626/403-7786, jspl00@gte.net, Audrey.

'94 YAMAHA Banshee, must sell, FMF silencer & pipes, paddle & regular tires, exc. cond., runs great, \$3,750/obo. 626/796-8982.

Wanted

CAR to purchase, luxury, '98/'99, low mi., Acura RL, Lexus GS-300 or Lexus LS-400, will pay finder's fee. 236-4869, Harold Minuskin.

CARPOOL, full or p/t, meet at Diamond Bar Park & Ride, hours M-F, 7:30-4:15. 4-8583, Ferne Griffin; 4-7456, Emma Ramos.

CARPOOL, Huntington Beach/JPL M-F 8:30-5:00, negotiable. 626/675-4483, Nicole.

HONDA Z50 or CT70 Mini-Trail, '69 or later. 310/832-7942.

JACKET, JPL, lt. nylon, Dunbrooke "Pla-Jac", L/XL. 848-7072.

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

VOLLEYBALL PLAYERS, coed, all levels of play, Tues. nts., 8-10, Eagle Rock H.S., \$3/nt. 956-1744, Barbara.

Lost

WATCH, small, brown band, on 8/29 between Bldgs. 306 & 302. Exd. 4-2662.

Free

FRONT DOOR: double, solid wood w/frosted glass win., 36"x80" ea. dr., use singly or as pr. 790-3217.

MOVIE CAMERA & projector, 8mm, near-new cond., tube-type oscilloscope, tube tester, works fine. 790-7019.

SCOPE, Tektronix 545. 790-0697.

For Rent

ALTADENA, share charming 2-bd. house in quiet neighborhd., Altadena Estate area, nr. New York Dr./Allen, huge yd, patio, off-st. pkg., gar., storage, all privileges, avail. 9/15, \$625, all util. pd. 626/797-3354, bpeteron@huntington.org.

ALTADENA, lg. furn. rm., cable, priv. ba., priv. off-st. pkg., share 3-bd. 3-ba. quiet hilltop house, view (incl. JPL), pool, patios, c/a/h, all amen., kitch., d/w, laundry, 11 min. JPL, smoke OK, owner smokes; \$480, incl. all util. + dep. 626/794-1050 after 5 p.m., Harry.

EAGLE ROCK, 7 mi./JPL, rm./ba. in charming, comfortable home; quiet & safe area; use of gar., kitch. washer/dryer & pool; occas. cleaning; util. incl., no smoke/drugs; \$415. 323/256-0535, Lucia, or Lucia@bluemolly.com.

GLENDALE condo, nr. Montrose, 1 bd., gated area, view, lovely pool, covered car space w/storage, \$750. 661/259-6390.

LA CANADA-FLINTRIDGE, room, private ba., kitchen privileges, pool, BBQ. 790-1280.

LA CRESCENTA duplex, front unit, yd, 2 bd., 1 ba., water/gardener/trash pd., a/c, heat, 6 mi./JPL, no smoke/pets, \$850 + util. 248-8103, Mike.

PASADENA, 1 bd., 3/4 ba. in charming 1907 bungalow; share house w/JPL engr., laundry, cent. a/c, quiet neighborhd., off-st. pkg., all privileges, 10 min./JPL. 626/792-2056, lv. msg.

PASADENA, spacious rm. in 2-bd. residence, priv. ba., share kitch. & l/r, quiet area, free parking, \$485 +1/2 util., sec. dep. 626/792-9365, Jean-Paul.

SOUTH PASADENA, fully furn. studio apt, nice area at 1718 Huntington Dr., betw. Marengo & Milan Sts., car space, laundry facilities on premises, util. pd., no smoker/pets, \$565. 626/792-9053, Marilyn.

SOUTH PASADENA house, spacious 4 bd., 2 1/2 ba., 2-car gar. exc. schools, 8 min./JPL; MT. WASHINGTON house/rms., lg. custom 3 bd., 2 1/2 ba., 2-car gar., exc. elem. schools, 12 min./JPL, view, quiet neighborhd., both avail. end of September. 323/255-1474.

Real Estate

LA CANADA-FLINTRIDGE, view home, 4 bd, 2.5 ba, c/a, 2,778 sq. ft., 2-car gar., lg. driveway, 15' swim spa, LC schools, very quiet street & neighborhd., \$3,954 sq. ft. on 2 lots, oak forest & creek, 2.5 mi./JPL, see www.realtor.com, "La Canada", "Ca", MLS ID=G202353, \$849,500. 952-9654.

PASADENA, delightful 4 bd., 3 ba., Spanish style home in Caltech/So. Lake area, over 2,600 sq. ft., lg. rms., lots of light, f/p, newer kitch., best price in area, offered by former JPL/Caltech emp., sec. 336, 10+ yrs., 615 S. Mentor, Pas., \$475,000. 626/229-0909, Lowell Hamburg, DBL Realtors.

PASADENA, ideal 980 sq. ft. starter home, new roof/bath/copper pipes, 2 bd. 1 ba. on beaut. landscaped 8,750 sq. ft. lot. room to grow, great mtn. views, 7 min./JPL, \$210,000. 626/798-5613.

SIERRA MADRE house, 3 bd., 1 3/4 ba., 2-car gar., \$370,000. 626/355-1646.

SOUTH LAKE TAHOE, Seasons timeshare at Heavenly Valley, 1 bd. suite in 5-star hotel, pd., \$10,000, sell \$2,000, high seas. 661/269-8002, or 661/204-5349, cell.

Vacation Rentals

BIG BEAR cabin, quiet area near town, good walking, hiking, 2 bd., sleeps 8, completely furn., \$75/nt. 249-8515.

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

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

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

HAWAII, Kona, on 166 ft. of ocean front on Keauhou Bay, priv. house & guest house comfortably sleep 6, 3 bd., 2 ba., rustic, relaxing & beaut., swim/snorkel/fish, spectacular views, near restaurants/golf/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, mcrow., d/w, pool, priv. lanai, slps. 4, 4/15-12/14, \$100/nt./2, 12/15-4/14, \$115/nt./2, \$10/nt. add'l. person. 949/348-8047.

LAKE ARROWHEAD house, 4 bd., 2 1/2 ba., sleeps 10, quiet, secluded, relaxing, woody area of Cedar Glen, close to the best burgers/malts on mtn., JPLers receive free days, week-end or week rates. 323/255-1474.

LAKE TAHOE, North shore, 2 bd., 2.5 ba., sleeps 6, private beach, pool, great location, all amenities, hiking, golfing, fishing, 2 miles to casinos, Sept. 10 thru Nov. 8 - \$85/day or \$500/week + cleaning fee, 3-day min. 626/355-3886, Rosemary or Ed.

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

MAMMOTH, Snowcreek, 2 bd., 2 ba., + loft, slps 6-8, fully equip. kitch. incl. mcrow., d/w, cable TV, VCR, phone, balcony mtn. view, Jacz., sauna, streams, fishponds, close to Mamm. Creek, JPL disc. 626/798-9222, 626/794-0455.

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

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

SOUTH LAKE TAHOE, Seasons timeshare at Heavenly Valley, 1 bd. suite in 5-star hotel. 661/269-8002, or 661/204-5349, cell.

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