

| | |
|--|----------------------------------|
| News Briefs 2 | The Challenges Ahead 3 |
| Special Events Calendar 2 | Reward & Recognition 4 |
| Senior research scientists appointed 2 | Classifieds 4 |

Efforts to contact Polar Lander wind down

NASA Administrator Daniel Goldin, right, addresses members of the Mars Polar Lander and Deep Space 2 flight teams in Building 264 mission control area.



Bob Brown/JPL Photo

mission planners for JPL's Mars Polar Lander are working to implement a plan to use Mars Global Surveyor to take pictures of the landing site for Polar Lander sometime this week in hopes of spotting the spacecraft or its parachute. However, while a recovery is still a possibility, the likelihood of hearing the lander is remote.

Repeated attempts to communicate with the lander since its expected touchdown Dec. 3 have been met with silence.

"The Mars Polar Lander flight team played its last ace," said Project Manager Richard Cook following an unsuccessful attempt in the early morning of Dec. 7 to get the lander to talk to Earth via the currently orbiting Mars Global Surveyor. Cook said the team will continue trying to communicate with the lander for another week or so.

Cook praised the flight team for its attempts to contact the spacecraft, even sleeping on the floors of their offices at times. "We're certainly

disappointed, but we're extremely determined to recover from this and go on."

Another communication attempt took place late afternoon Dec. 7, when a 46-meter (about 150-foot) antenna at Stanford University listened without success for a signal from the lander's UHF antenna. Engineers then commanded the spacecraft to use its medium-gain antenna on Dec. 8 to begin a scan of the entire sky. During the scan, the antenna was asked to bend and stretch in every possible direction, in essence "craning its neck" in an effort to be heard by mission controllers on Earth.

The Deep Space 2 microprobes that accom-

panied Mars Polar Lander have also been silent and their batteries by now are depleted. "Just getting the probes to the launch pad was a measure of success," said Project Manager Sarah Gavit.

Review boards will be set up within JPL and at NASA to study the cause of the apparent loss and explore ways to prevent a recurrence.

"What we're trying to do is very, very difficult," Cook said. "We hope people, and children in particular, will see from this experience that the mark of a great person, or group of people, is the ability to persevere in the face of adversity."

AIRS to breathe life aboard Earth-observing spacecraft

By Diane Ainsworth

Jim Kachmarsky of Lockheed Martin Infrared Imaging Systems, left, and Donna Markley of JPL's Quality Assurance Section 506 conduct a post-vibration test inspection of the Atmospheric Infrared Sounder's Earth shield and radiators at JPL last month.

NASA's new Atmospheric Infrared Sounder, known as AIRS, is about to take its first breath of life aboard the second of the agency's Earth Observing System spacecraft, Aqua.

Following successful performance, environmental and interface testing, the AIRS instrument and its ground support equipment have been delivered to spacecraft contractor partner TRW in Redondo Beach for integration and final testing. Physical integration of AIRS with TRW's heat rejection system and the spacecraft will begin in mid-December.

The 177-kilogram (389-pound) instrument is one of six major instruments to fly on the second of

three spacecraft in NASA's Earth Observing System series. AIRS will be carried into space in December 2000 to begin a six-year study of the planet's changing climate. Aqua will be preceded by the Terra spacecraft, set for launch Dec. 16, carrying JPL's Multi-Angle Imaging Spectroradiometer and Advanced Spaceborne Thermal Emission and Reflection Radiometer. (See accompanying article.) It will be followed by the EOS-Chemistry platform, carrying JPL's Microwave Limb Sounder and Tropospheric Emission Spectrometer, and is scheduled for launch in December 2002.

Continued on page 2



Bob Brown/JPL Photo

JPL Earth instruments ready for Vandenberg launch this week

Two NASA missions carrying JPL Earth science instruments are being readied for launch this week at California's Vandenberg Air Force Base.

The Terra spacecraft, which will include two JPL instruments as part of its five-instrument suite to study clouds, water vapor, aerosol particles, trace gases and other properties, is scheduled for launch Dec. 16 at 10:33 a.m. Pacific time. Set to launch three days later at 11:11 p.m. Pacific time is the Active Cavity Radiometer Irradiance Monitor Satellite (AcrimSat), which will monitor total solar irradiance, or the total energy received from the sun.

One JPL instrument onboard Terra is the Multi-Angle Imaging Spectroradiometer (MISR), which will image Earth simultaneously at nine different angles in each of four color bands to study aspects of Earth's climate system that scatter sunlight differently at different angles: clouds, the surface, and particles floating in the air (aerosols). Also onboard is JPL's Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), an imaging instrument that will be used to obtain detailed maps of land surface temperature, emissivity, reflectance and elevation.

AcrimSat will continue NASA's effort to measure the amount of sunlight entering Earth's atmospheric-oceanic system and determine whether an increase in solar luminosity is contributing to a rise in global temperature.

For more information about the JPL instruments, go online to <http://www-misr.jpl.nasa.gov>, <http://asterweb.jpl.nasa.gov> and <http://acrim.jpl.nasa.gov>.

Senior research scientists appointed



From left: JPL Director Dr. Edward Stone; new senior research scientists Drs. David Crisp, Joan Feynman, William McGrath and Dariush Divsalar; JPL Chief Scientist Dr. Moustafa Chahine.

JPL Director Dr. Edward Stone has promoted four JPL employees to the position of senior research scientist. Newly named to the position are DRS. DAVID CRISP of the Earth and Planetary Atmospheres Element 3233, DARIUSH DIVSALAR of the Communications Systems and Research Section 331, JOAN FEYNMAN of Space Physics, Earth Sun Connection Element 3239 and WILLIAM MCGRATH of the Microwave & Lidar Technology Section 386.

Crisp was named in recognition of his contributions to the development of advanced numerical methods for studying transport solar and thermal radiation in the atmospheres of Venus, Earth, and Mars. These methods are currently being used to refine our understanding of the temperature structures, compositions, and climates of the atmospheres of Venus, Earth, Mars, and Neptune.

Divsalar specializes in the development and application of error correcting codes and modulation systems for telecommunications. His inventions and innovation use of technology have made significant contributions to deep-

space telemetry and mobile data communications. His contributions to the development of channel codes, which perform close to the ultimate limits imposed by channel capacity, are extremely valuable for most future JPL/NASA missions.

Feynman's research specialty is space physics, with sustained achievement in solar, interplanetary and magnetospheric physics, emphasizing long-term variations and the Sun-Earth connection. She was the first to identify the physical significance of the interaction of plasmas from coronal mass ejections in space with Earth's magnetic field. She showed that geomagnetic storms carried the signature of solar plasmas, as opposed to just reacting to the plasmas. With this

insight, she then demonstrated that the southward versus northward pointing of the magnetic field of plasma clouds of solar origin is key to the occurrence of geomagnetic storms.

McGrath was named for his work in submillimeter-wave technology and applications, having contributed to research and development in this field for about 20 years. His research in the field of submillimeter-wave receiver technology has emphasized mixers for heterodyne instruments used in radio astronomy and atmospheric sensing applications, continually pushing toward ever-higher frequencies with low noise devices.

JPL's new technology reporting activities are paying off considerably. According to the Commercial Technology and Regional Development Program Office, an average of 20 to 25 new technology reports are submitted monthly by the Laboratory to NASA.

In recognition of the importance of this ongoing activity, NASA recently increased the monetary awards for new technology development reporting in two of three categories. The increases took effect for those reports sent to NASA on or after Oct. 1, 1999.

The awards to multiple authors for software reporting, previously \$250,

were raised to \$350. Awards to single authors for software reporting remain the same at \$500. All Tech Brief awards (software and hardware reporting), previously \$150, have been increased to \$350 per author.

If Caltech licenses the technology for royalties, employees can receive a percentage of the net licensing proceeds. This policy has earned several employees checks that were significantly larger than the NASA awards.

For more information about the program, including reporting forms, visit the JPL web site for reporting new technologies at <http://trac>.

New tech report awards increased

AIRS continued from page 1

Inaugurating a new generation of operational atmospheric sounders with modern technology, AIRS will provide improved weather prediction and better monitoring of changes in Earth's climate. Using new cutting-edge technologies, the instrument is a major innovation over existing weather satellite instruments and will significantly advance the science of weather prediction.

"AIRS will make highly accurate measurements of air temperature, humidity, clouds and surface temperature and give meteorologists new insights into Earth's changing climate," said Dr. Moustafa Chahine, AIRS science team leader and JPL chief scientist. "The instrument will read atmospheric temperature to within 1 Kelvin (1 degree C or 1.8 degrees F) per kilometer of altitude in the lower atmosphere. That degree of accuracy will allow weather forecasters to significantly improve and extend their weather predictions to seven-day forecasts."

The Aqua mission will make global measurements of atmospheric and surface temperatures to answer important questions of global change and global warming. Flying alongside AIRS are two other atmospheric monitors—the Advanced Microwave Sounder Unit and the Humidity Sounder for Brazil—as well as the Advanced Microwave Scanning Radiometer, the Clouds and Earth's Radiant Energy System, and the Moderate Resolution Imaging Spectroradiometer.

AIRS will help scientists piece together the wild weather puzzle that has punctuated the

closing decades of the 20th century. Continuously measuring more than 2,000 separate spectral channels, AIRS will carry out its passive remote sensing measurements using a high resolution spectrometer. The highly sensitive sensor will be able to precisely sample the atmosphere in the infrared spectral region from 3.74 to 15.4 microns (a micron or micrometer is equal to 1 millionth of a meter) for information from the ground up to as high as 50 km (30 miles).

With its atmospheric cousins, AIRS may be able to help scientists sort out meteorological mayhem. Weather flukes, such as hurricanes Floyd, Gert and Harvey and many more born during last summer's particularly severe hurricane season, and other horrific weather events, such as the torrential Midwestern floods of 1993 or the 1997-98 El Nino, one of the worst of the 20th century, will be measured much more accurately. Understanding these severe weather events will tell scientists more about how Earth's climate is evolving and changing.

AIRS follows in the footsteps of the National Oceanic and Atmospheric Administration's High Resolution Infrared Sounder and the Microwave Sounding Unit, which are the heart of the National Weather Service's current operational weather sounding system and have flown aboard NOAA's various polar orbiting satellites for nearly 20 years. In recent years, however, the National Weather Service established higher accuracy requirements to significantly improve its weather prediction capability. In addition to measuring lower atmospheric temperature at

an accuracy of 1 Kelvin in layers of 1 kilometer (0.62 mile) thick, AIRS will measure humidity to within 20 percent accuracy.

AIRS will obtain temperature and moisture profiles by observing the infrared spectral signatures of carbon dioxide and water vapor. Atmospheric gases such as carbon dioxide, water vapor, ozone, and methane strongly absorb around specific wavelengths of infrared energy, and this absorption increases as one looks deeper into the atmosphere from space. By observing at very high spectral resolution, or in very narrow bands, and at many wavelengths, scientists will be able to "see" different levels of the atmosphere. To determine the temperature or humidity at a specific altitude, AIRS will take the signals from many different bands and combine them to derive a vertical profile of the state of the atmosphere.

From these measurements, climate experts will be able to study Earth's water and energy cycles and how they vary. New information about cloud types, properties and the extent or amount of cloud cover will show them how these fleecy marvels of nature are affected by changes in temperature, evaporation, condensation rates and atmospheric circulation patterns. Their content will also shed more light on how greenhouse gases such as carbon dioxide, water vapor, industrial pollutants and aerosols are trapped in Earth's atmosphere.

For more information about the mission, go online to www-airs.jpl.nasa.gov.

Special Events Calendar

Ongoing

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—Will meet only once in December, on Friday, Dec. 10 at noon in Building 111-117. Call employee assistance counselor Cynthia Cooper at ext. 4-3680 or Randy Herrera at ext. 3-0664.

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

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

Tuesday, December 14

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

Wednesday, December 15

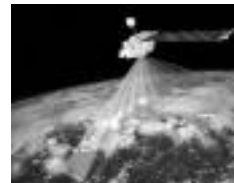
JPL Drama Club—Meeting at noon in Building 301-127.

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

Thursday, December 16

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

Von Kármán Lecture Series—Dr. David Diner, principal investigator of JPL's Multi-Angle Imaging Spectroradiometer (MISR) instrument, will



speak at 7 p.m. in von Kármán Auditorium. Open to the public.

Friday, December 17

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

Von Kármán Lecture Series—Dr. David Diner, principal investigator of JPL's Multi-Angle Imaging Spectroradiometer (MISR) instrument, will speak at 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

Wednesday, December 22

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

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

Wednesday, December 29

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

Tuesday, January 4

JPL Genealogy Club—Meeting at noon in Building 301-169.

Wednesday, January 5

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

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

Thursday, January 6

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

Friday, January 7

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

Sunday, January 9

Chamber Music—South American harpist Alfredo Rolando Ortiz will perform at 3:30 p.m. in Caltech's Dabney Lounge. Admission is free. For information, call (626) 395-4652.

View this and previous issues of Universe online

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



Bob Brown/JPL Photo

THE CHALLENGES AHEAD

Following the apparent loss of Mars Polar Lander and Deep Space 2, JPL Director Dr. Edward Stone addressed JPL staff in a Dec. 10 town hall meeting.

Remarks from Caltech President Dr. David Baltimore:

I really come here to salute the tenacity and the resiliency of the individuals and teams at the Lab. You are American explorers of the 20th and soon to be the 21st century. You are the Lewis and Clarks of our time. The determination that you and your predecessors have displayed in the face of half a century of unimaginable challenges is a testament to humankind's spirit of exploration. The poise and fortitude you have exhibited in the face of recent adversities is an inspiring example of the courage that has exemplified the early explorers of this country. The American public knows that you were given some of the toughest jobs we have. Doing the impossible is in fact sometimes impossible. Day in and day out, you're tackling unimaginable problems in planning, design and implementation. And that puts you in the forefront of change. So you have to adapt to the continually challenging new environment. You're repeatedly asked to do that: to do more with less.



Probably more often than not, you've made those Herculean tasks appear so easy that I think it masks the real risks that are involved, and raise sometimes unrealistic expectations. Building bridges to the cosmos is not a one-mission, one-generation and one-century undertaking. We're in the business of weaving contemporary dreams into future possibilities. There will always be rude awakenings, but proving your mettle in this adventure will feed your own curiosity and promote knowledge.

We've been asked to solve complex problems with minimal resources. We now have to find the right mix of resources and time, and it's a dynamic process finding that balance. The continuity of ambitious and able leadership at JPL will fuel the quest for a strategy that will give us more assurances of success in the future. And we will work hard to make sure that the past week of silence from another world does not make those on Earth deaf to the difficulties that caused it. Through it all, you should know there is one constant: Caltech faculty and administration stands behind you. You are part of us. In the laboratories and classrooms at Caltech, we know that this journey of discovery is often frustrating, even painful. You have the assurance of our own experience that the sweet taste of success will again be on all of our lips.

On behalf of Caltech, my message is that we are all honored to be in this together. Together, we are the number one university, and the number one laboratory of space exploration. And on a personal level, let me take this occasion to wish you and your loved ones a comforting and joyous holiday. Thank you.

Remarks from JPL Director Dr. Edward Stone:

Good morning. Last month when we gathered here in this room I spoke about "Yesterday, Today and Tomorrow." The focus then was landing on Mars. We redoubled our efforts to do everything we knew to have a successful mission. Unfortunately, that did not happen. This has been hard not only for the Mars team but for all of us. We share a great disappointment and a true personal sadness about the loss, one that is shared by our friends, our families, and people all over the world. But this morning we need to concentrate on "Tomorrow"—where the Lab is headed in the days to come, and the role each of us can play in getting there.

Fixing the Problem

It goes without saying that our missions to Mars attract tremendous public interest. The eyes of the world are always upon us when we go to the red planet. When we succeed, we enjoy considerable praise, even adulation. When we do not succeed, we experience the other side of the coin: scrutiny, criticism, even ridicule. The last week has been very difficult. And the attention is far from over.

But scrutiny and criticism can be good things. We are accustomed to this as an *internal* exercise. We excel at "finding the flaw, and then fixing the problem" because this activity helps ensure mission success. In the weeks to come the very same process that we are so good at internally will be applied externally. It may help you to keep this thought in mind in the days to come.

As part of the assessment activity JPL will form its own internal review board, which will share its findings with a specially appointed NASA panel. The NASA panel seeks to ask questions not only about Mars Polar Lander but a number of broader topics, including reviewing the Mars Architecture plan and management structural issues.

Congress will also be interested and will likely conduct hearings once the NASA panel has completed its report. The press, of course, will pay special attention to all these activities.

So, the days ahead will not be easy. At times we will be uncomfortable with some of what is said about us. But at the end of the day, we will learn from what has happened and JPL will be a better place for it all.

Support

And let us not forget all the support that has come our way this past week. It's when times are difficult that you find out who really supports the space program. And we are very fortunate in the encouragement that has come our way. I'm sure you have seen the statement of support e-mailed to you by Executive Committee of the Caltech Board of Trustees, and I am especially grateful that David Baltimore is here today as he was late last Friday and again early Tuesday to personally lend his support and share his thoughts with us.

The media coverage has been fair and, in many cases, empathetic. Listen to what a Wall Street Journal editorial had to say yesterday: "NASA setbacks on Mars shouldn't lead us to abandon space exploration. We should redouble our efforts instead."

NASA has been very supportive. Ed Weiler, NASA associate administrator for space science, was here to show his support for the Mars team, as was NASA Administrator Dan Goldin. The administrator came not only on Friday and stayed into the evening, but he changed his travel schedule so that he could come back Saturday night.

Leaders in Congress have gone on the record expressing their support. Representative David Dreier was here in the Mars mission control room on four separate occasions last week. And next week Chairman James Sensenbrenner of the House Science Committee and Representative James Rogan will be here at JPL to address the Lab.

On Wednesday the President also voiced his support, pointing out that landing on Mars is "rocket science" and voicing his opinion that we shouldn't stop now.

Finally, the American people, as evidenced in a recent poll, are strongly in favor of planetary science.

Now it's our job to act on all of these expressions of support.

Mars

Let me turn to Mars. To state the obvious, this has not been a good year for us at Mars. Not since our robotic missions to the moon in the early '60s have we experienced such a string of disappointments.

NASA has asked us to review the entire Mars Program. And that is what we are doing. They have *not*, as has been reported

"We can't turn back the clock to another era. . . .

the intelligent application of technology and process

is the key to breakthroughs in exploration."

in the press, requested us to review the entire planetary program.

That said, what does it mean 'to review' the entire Mars Program? Let me start by saying what it *doesn't* mean, based on NASA's guidelines for the review:

- The Mars Program is not being canceled.
- The Mars Program is not moving somewhere else.
- No money is being taken away from the Mars Program.
- And no money is going to be taken away from other JPL projects to support Mars.

What the JPL review *does* mean is that we are stepping back, undertaking an assessment of where we are, and asking where we need to be going. We have established an architectural redefinition team under Chris Jones that will broadly involve the Laboratory in the formulation of a revised architectural plan. That plan will be presented to NASA by Jan. 17 and will be subsequently reviewed by the NASA panel by the end of January. I suspect that those ideas will then be shared with Congress, which understandably wants to know what we will be doing in the future to ensure mission success.

Let me share with you some of the thinking already underway regarding Mars.

More than anything else, we want to assure that we have adequate resources to undertake the missions in the revised architecture—both here on the ground and at Mars. NASA has stressed that we, not the schedule, should determine what and when we are ready to launch. Just as the shuttle does not

launch until it is absolutely safe to do so, we are being urged that the same priority for mission safety hold true for our robotic missions: Do we have sufficient infrastructure to support our missions? Do we need a more robust system for navigation, surface reconnaissance, and communications? Are we moving at the right pace?

It's unlikely that the '01 Mars lander will be launched in '01, and that would likely affect other missions downstream. I realize this will be a disruption, but as we very well know, landing on Mars is the hardest thing we now do, and returning a sample will be harder yet. We have to do everything we possibly can to ensure success so that we can continue exploring Mars with the support of the American people. If that means going somewhat less often, then that is what we must do.

What does this mean for science? There has always been—and there should always be—an inherent tension between the needs of engineers and scientists when designing a spacecraft. There are always constraints and compromises to be made. Science will continue to be central, but mission success starts with safety—because we have to land safely before we can do the science.

Broader context

So that's what we are doing regarding Mars. Now I'd like to place the Mars Program in the broader context of the Laboratory's mission, beginning with a simple question: What is the motivation—the driving force—for what we are doing and *how* we are doing it?

We are engaged in nothing less than creating a new era of space exploration. Many of you have heard me speak to this before. The challenge of the first era at the beginning of the space age was simply to reach a destination. The second era was about trying to learn what was out there. We did that with large, expensive spacecraft that flew as infrequently as once a decade. These missions have given us, and will continue giving us, capability for global exploration.

The third era—where we are now—is radically different, because the future of the planetary program must shift from global to surface exploration. Our job now is land at a variety of other places, bring back samples of what is out there, and eventually establish permanent robotic outposts. Just as the first and second era were difficult for those who worked on them, the challenge in front of us is filled with difficulties. But that's our job: doing what no one has done before. That's the reason a place like JPL is needed.

To succeed in this new era—landing on the surface, bringing back samples and eventually establishing outposts—it is absolutely necessary that we go often. And to go often, we had to reduce the cost of our missions. And that's precisely what we have done.

Right now our focus is on Mars. But the strategy of landing, returning samples and establishing robotic outposts applies to many places in the solar system, whether planets, moons, asteroids or comets. That's our job in the early part of the 21st century.

We need to learn how to do this job, because this is our future. And we will learn how to do it, both from our success and our losses.

Right now we are pained by our losses at Mars. But step back for a moment and consider how far we've come since the loss of the Mars Observer in August 1993. The loss of that mission, which cost about a billion dollars, was a turning point in the direction of the Laboratory. We decided not to put all our eggs into a single basket.

And think about what we have accomplished since. We launched Mars Pathfinder, Mars Global Surveyor, Mars Climate Orbiter, Mars Polar Lander, Deep Space 1, Deep Space 2 and Stardust—all at a total cost roughly equivalent to that of Mars Observer. And think what all those missions represent. Mars Pathfinder was a spectacular success story with the public. Mars Global Surveyor is still orbiting Mars. Mars Climate Orbiter and Mars Polar Lander were losses, as was Deep Space 2. But even there we have invented new technologies and a new pathway that will certainly fly on future missions. Deep Space 1 represents a technological breakthrough in propulsion systems, and Stardust is now on its way to collecting and returning the first sample from beyond the Earth-moon system. That's what we have accomplished in just six years. Six missions—some successful, some not—that have helped prepare us for a new century of space exploration.

Faster, better cheaper

Let me now turn to the questions of whether we are moving too fast, doing too much with too few people, and trying to do take on more than we can afford. These are questions that are on everyone's mind at the Laboratory. Others are asking them as well. Let me add to the list.

- Do we have all the resources we need to succeed?
- Are we sharing resources effectively?

Continued on page 4

STONE *continued from page 3*

- Are we working together efficiently as a team?
- How do we ensure the success of other planetary missions?

We are going to ask all these questions. And we will find the answers and act upon them. That said, let me share my opinion.

We can't turn back the clock to another era. I am convinced that the intelligent application of technology and process is the key to breakthroughs in exploration. I am personally committed to reshaping the way we do things. We have to work as a team so that the enormous strengths and capabilities of this Laboratory can be brought to bear on the challenges we face as the world's leader in robotic exploration.

I suspect that the answer as to how we can best do our work has been captured in a recent USA Today editorial that urged that any review:

"... focus both on management issues within the agency and on the constraints Congress itself

imposes. Faster-better-cheaper isn't the sole problem, and it may be the only solution to modern realities. Truth is, NASA isn't going to return soon to the billion-dollar space probes of old. There isn't the money. And it makes sense to conduct multiple smaller missions. The losses are less damaging when they occur, as they always have, and as they surely will in the future. The question is how, within the constraints of politics and money, to go faster-better-cheaper more wisely."

Responsibilities

We all know about the sign Harry Truman had on his desk: "The buck stops here." Like Harry Truman, I believe the "buck stops at my desk." I accept that accountability. But I also believe that each of us must accept responsibility for mission success. And mission success is measured both in the knowledge gained and in the knowledge we share with the American people.

We have a number of launches in the six weeks ahead. We have instruments aboard the Earth-observing Terra satellite, and ACRIMSAT will study the Sun. And

in January our Shuttle Radar Topography Mapping mission is scheduled to fly. To say it again: we all share responsibility for mission success. Whatever job we hold, it's always our responsibility to do our best and to step forward if something is not right and make our concerns known.

It's also your responsibility to be a credit to the Laboratory in the sharing of knowledge. We will be—as we have always been—open to the media and their questions. But a word of caution: our words, just like our actions, have consequences. If you speak to the media, you speak as more than just an individual; you also take on the responsibility of speaking on behalf of the entire Lab. What you say, and *how* you say it, matters to everyone at the Laboratory. That's the reason it is the Laboratory's policy for you to always work in concert with our Media Relations Office when contacted by any member of the media, and I ask that you seek their assistance.

But before we communicate the knowledge we derive from our missions with the public, we have

to succeed with our missions. And to succeed we have to do our job, and our job in the 21st century is going to be challenging.

I was reminded of this earlier this week when the Homer Hickam, the author of *Rocket Boys*—some know this book by its movie title, *October Sky*—e-mailed me with words of support. He suggested I turn to Chapter 19 of his book, and that evening I did just that. The chapter, by the way, is called "Picking Up and Going On."

For those of you who don't know about Homer, he is a rocket engineer who helped build the Saturn rockets that took our astronauts to the moon. Homer grew up in a coal mining town in West Virginia, where his father was the company manager. In high school at the time of Sputnik, Homer was obsessed with building rockets. At one point he convinced an older worker who had worked his way out of the mines and into the machine shop to make some nozzles for his rockets. That was against company rules, and the man was sent back down into the mines. Sometime later there was an

accident, and the man died. Homer was devastated. "I felt," he wrote "as if somebody had reached up inside me and turned off a switch." Ridden with guilt, he decided to give up his dream of building rockets. And that would have been the end of it.

Then entered one of his teachers: Miss Riley. "Sonny," she told Homer, "a lot has happened to you, probably more than I know. But I'm telling you, if you stop working on your rockets now, you will regret it the rest of your life ... You've got to put all your hurt and anger aside so you can do your job ... Your job, Sonny, is to build your rockets ... You've got to give it everything you've got."

You are all Homer Hickams. A lot has happened to you, probably more than I know. But if you stop working on your rockets—on your projects—you too will regret it the rest of your life. You have to put all your hurt, your anger, aside, so you can do your job. Because your job is to build your rocket, because your rocket is going to open the doors to space exploration in the 21st century.

Thank you.

Next Universe

January 7, 2000

Due to JPL holidays coming up at year's end, this issue of Universe will be the last one published in 1999.

The deadline to submit classified ads for the Jan. 7 issue is Monday, Dec. 20 at 2 p.m.

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Notice to Advertisers

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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.

Correction: In the "Passings" section of the Nov. 12 Universe, the organization in which Roy Tyrrell worked was listed incorrectly. Tyrrell retired from Division 35.

Classifieds

For Sale

APPLIANCES: vacuum cleaner, canister, Regina, w/attach., fair cond., \$22; steam iron, GE Power Spray, vg cond., \$18; floor lamp, black base & pole, off-white shade, gd cond., \$15; table-top TV antenna, RCA, vg cond., \$10. 626/577-8107.

APPLIANCES: OAO/JPL Whirlpool 2-door refrig., side-by-side, icemaker & cold water; Whirlpool washer & dryer; basketball goal: all <1.5 yrs old, mint cond. microwave (2.5 yrs). 626/821-6592.

AQUARIUM, 10 gal., \$10. 362-3358.

BED HEADBOARD & frame, king, brass, exc., \$50/both; queen bedframe only, \$15; BLINDS, vertical, 2 pr., ivory, almost new, \$60; VENT HOOD (over stove), gd. cond., white, \$20. 626/794-6860.

BICYCLES, ladies Pugeot 10 sp., vg cond., \$100/obo; men's Raleigh 10 sp., lg. frame, gd. cond., \$60/obo; kid's Brit.-made 12" & 14" whl, w/training whls., \$20 ea. 626/355-4970, afternoons/eves.

BUNK BED w/lower futon couch/bed, matr. incl., black, exc. cond., \$100. 626/335-7179, eves. CEILING FIXTURES (chandelier), 1 ea. brass & glass, exc. cond., \$45/both; FIREWOOD, mixed, seasoned, \$150/cord, you pick up. 626/794-6860.

COFFEE TABLE, 24x60", walnut, exc. cond., \$100; SOFA BED, navy blue w/tan print, qn. sz., upgraded mattress, exc. cond., \$300. 626/793-7879.

COMPUTER, Dell 486, 15" VGA monitor, \$200. 362-3358.

COMPUTER, laptop, 486, 16MB RAM, 80M hard disk, floppy drive, internal fax/modem, B&W screen, carry case, battery & charger; runs MS Office applications; \$250, make offer. 730-7472.

COMPUTER, Mac PowerBook 145B, \$200; PRINTER, Mac LaserWriter 300, \$300. 626/793-3561.

COMPUTER, Pentium 166 w/math co-processor, 64MB EDO RAM, 2.5 GB disk, 28.8 modem, some software, \$575/obo. 626/795-1902, Seth.

COMPUTER DESK, wood, 5' long, pullout keybd tray, hutch shelves, monitor stand, lots of storage for tower, file drawers; was \$160, sell \$40. 626/441-8572.

COMPUTER MONITOR, Hyundai, 14" SVGA, 29 pitch, \$25. 626/398-4960.

CRIB, Bellini, beautiful, \$150. 626/572-0998.

CRIB, beaut. dark wood Vict.-looking. (Simmons), plus newer 15-yr. mattress; \$600 new, exc. cond., sell both \$150; SIT-IN BARN, like new, Little Tikes, perf. Xmas gift for older infant-toddler, \$25. 626/798-5143.

DESK, full-sz. metal w/glass top, \$50 (negotiable.) 626/799-2484.

DESKS, real wood, 1 reg.-style walnut, 1 "L" sec'y style oak; exc. cond., very low price. 805/649-3614.

DRESSER, white, 5-drawer, 29" w, 16"d, 42"h, on casters, \$50. 626/398-4960.

FUR COAT, silver fox, sz. 4, worn once, \$500. 951-8376.

FURNITURE, din. rm., Ethan Allen cherry wood server, Georgian Court Collection, 40"x21"x34", exc. cond., 1/2 retail price, \$785; mtchnng. wall-mounted shelf, \$40. 626/577-8107.

FURNITURE, sofa bed, off-white w/thin pastel stripes, queen-sz. mattress, gd. cond., 93"x34", \$250/obo.; coffee table, plain, walnut 52"x26", \$50/obo.; walnut wall units, unit 1: TV, VCR & knick-knack shelves, 2 drawers, 6'x36"x21", unit 2: stereo & lit knick knack shelves, 3 drawers, 6'x30"x16", both units \$300/obo. 626/355-2157, Steve.

FURNITURE, metal frame bunk bed, bottom folds from full-sz. futon bed to sofa, great for kids, \$400 new, sac. \$200; attractive burgundy sleeper sofa, \$150/obo. 626/355-4970, afternoons/eves.

GLASS INSERTS for coffee & end tables, leaded, 20"x24" with 14"x18" beveled glass, \$10/ea. 626/303-1927.

HOIST, portable, half-ton capacity, lightweight alum., gd. sz. for mounting in a truck bed, \$60. 626/303-1927.

MAGAZINES, National Geographic, 40+ yrs., + maps, indexes, over 500 issues, \$250/obo. 213/680-7805.

MATTRESS, full sz., exc. cond., must sell, \$150. 762-7294.

MEDICAL EQUIPMENT: Everst & Jennings wheel-chair, fair cond.; alum. walkers, new cond., misc. hardware. 626/446-4771, Bruce.

MIRROR, ~ 3x4 ft, beveled, no scratches, \$5. 790-3854.

MISC.: lg. Little Tykes climber w/slide, \$50 (reg. \$120); Fisher Price kitch. set w/2 chairs & food benches, \$10 (reg. \$40); girls' white imitation fur coat, beautiful, \$20; ladies' brown imitation fur coat, \$30; clothing, girls' sz. infant to teen, \$5-\$5; children's books, \$5-\$1. 626/355-1342.

MISC.: new Belkin 4 to 1 (or 1-4) peripheral sharing device, w/gold IEEE cable (\$49, orig \$99); new remote for all Sony big screen, satellite, DVD, VCR (\$19, orig \$60); satellite signal booster (\$9); new "All for One" univ. remote (\$7); new fast ATA66 IDE dual ribbon cable (\$12, orig \$22); 33.3 laptop modem card, w/o cable (\$10); deluxe ergonomic keyboard (\$10). 366-6134.

MISC.: AT&T cellphone w/case & adapter, \$40; various beautiful collectors' plates, from \$20; computer, 286, w/monitor, books & software, gd. starter, \$50; various a/v equip.; turntable, tapedecks, receivers, reel to reel (some working, some not), 3 color TVs, need work; Ronco electric food dehydrator, never used, \$30. 626/355-1342.

MOVING SALE: household furn., some new, Southwestern & Calif. styles; small appliances & electronics; sofas, leather recliner, chairs & tables, TV & stand; ice cream maker, etc. 626/446-4771, Bruce.

POOL TABLE, mini, wood-stained exterior, green felt table top, wooden cue sticks; approx. 3' by 1.75", exc. cond., orig. price approx. \$95; best offer. 626/795-1902, Seth.

RECEIVER, Sansui AV, 330W total pwr., w/ remote, vg cond.; Dolby Pro Logic amp/recorder, 100W total pwr., vg cond.; \$60/both. 626/798-4308.

REFRIGERATOR, Frigidaire, 20 cu. ft., side by side, water dispenser, icemaker, 1 yr. old, like new, \$500. 249-4646.

REFRIG./FREEZER, GE, 21 cu. ft., w/icemaker, exc. cond., \$300; TV, Zenith 25" color console w/remote, exc. cond., \$75/obo. 626/793-7879.

RING, .51 diamond w/gift box, purchased \$800, sell \$600/obo. 362-3358.

SEWING MACHINES, antique, foot-powered; both in gd. working cond.; Montgomery Ward \$225, Bartlett \$150; FIREPLACE, brass indoor (chimneyless), works on canned fuel, \$225 new, sell \$100/obo (fuel included). 730-7472.

SPA COVER & heater/filter syst., \$15. 790-3854.

STEREO SPEAKERS, 2 pair, JBL 15" and JBL 8" + tweeters, all in beautiful wood enclosures, mint cond., \$30/ea. pair, or \$50/both pair. 805/649-3614.

TELESCOPE, Celestron Ultima 8 w/PEC, 8-in. aperture, std. wedge, 1 1/4 star diagonal, 26mm Plossl eyepiece, electronic hand controller & focuser, 8x30 finderscope w/illuminated polar aiming device, cordless electronic drive syst., adjustable metal tripod w/rubber coated legs, delux foam-fitted carrying case, instruct. manual, \$900; Meade 2.0 in. star diagonal, \$80. 790-2123.

TV CART, on casters, accomm. up to 27" TV; place for VCR & storage; blond oak (light wood), \$35. 626/398-4960.

TYPEWRITER, IBM Selectric II, vg cond., \$125; COFFEE PERCOLATOR, Regal, 40 cup, vg cond., \$19. 626/793-1895, Albert.

VACATION PACKAGE, Las Vegas, for two, 2 days/1 nt., includes transportation, lodging, casino tours, games & prizes, \$50. 626/797-6644.

WARDROBE, Ikea Friodolin K, pine, \$100. 249-4096.

Vehicles / Accessories

'95 ACURA Legend LS coupe, 2D, black, auto, 104,000 mi., mint cond., leather, sunroof, heated seats, alloy wheels, CD changer, remote keyless entry, \$19,000/obo. 626/568-8298.

'86 AUDI 5000 S station wagon, gd. cond, 115K mi., new radiator, \$1,900/obo (blue book). aenzian@yahoo.com, 626/796-6759.

'65 CADILLAC Coupe de Ville, 50,272 orig. mi., runs perfectly, exc. throughout, newly painted gold exterior and ivory top; new tires, radiator and ps; all else original; ivory interior like new; full pwr. accessories & a/c.; \$10,000. 719/687-4432 or 626/446-4771, Bruce.

'94 CHEVY Astro LT minivan, pwr. everything, class 3 hitch, running boards, roof rack, 4 captains seats + 1 bench seat, CD player, super cond. inside/out, 89K mi.; \$14,500/obo. 952-

3113, Jeff.

'90 DODGE Ram van conversion, V8, 4 captain's chairs, rear bench seat, clean, extras, retail \$10K, sell \$7,500. 626/798-5835.

'89 DODGE Dakota LE, long bed, V6, 54K mi., auto, shell, bed liner, a/c, am/fm cass., retail \$6,500, sell \$4,500. 626/798-5835.

'81 FIAT Spider 2000, black/tan, fuel injection; body/engine/tires in great shape, smog checked, \$2,900/obo. 323/225-1732.

'92 FORD Taurus GL, 4 dr., white, new tires, am/fm/cass., a/c, gd. running cond., \$2,800/obo. 626/395-9593.

'92 GEO Metro 3-dr. hatchback, white, auto, 150K miles, a/c, gd. cond., \$550/obo. 626/355-7410.

'96 HONDA Civic CX, 5 spd., a/c, 71K mi., am/fm/stereo, lowered 5" muffler, green, exc. cond., salvage title, \$6,000/obo. 909/599-3230.

'95 HONDA XR650L, 4 stroke, 650cc, 5,800 mi., exc. cond., Pirelli tires, 90/10 (dirt/street), Supertrapp exhaust, dependable dual sport motorcycle, \$2,300. 909/374-2426.

'91 INFINITI G20, gd. cond., 107K miles, 4-dr. sedan, 5-sp. manual, moonroof, A/C, pwr. windows, leather seats, cruise cont., orig. owner, \$5,700/obo. 790-2558, eves.

'91 LEXUS LS 400, loaded, immac.: gold exterior pkg. includes auto climate cont., pwr. steering/windows/doors, telescoping wheel, cruise, Nakamichi prem. audio incl. CD audio changer, advanced traction cont., leather, moonroof, alloy whls.: 71k mi.; must sacrifice, \$17,950. 249-9437, eves.

'91 MERCEDES 300E, white, 4 dr., loaded, 73K orig. mi., mint cond., kept in gar., \$13,500/obo. 909/593-7177.

'95 PLYMOUTH Acclaim, 4-dr, silver gray, auto, a/c, PS/W/L, cruise, tilt whl, V6, 90K mi., am/fm/cass., very roomy 6-passngr., orig. owner, gd. cond., \$4,450. 790-0335.

'98 PONTIAC Sunfire convertible, white, loaded, 8,500 mi., exc. cond., \$16,000/obo. 790-2123.

ROOF RACK, Thule, 1/2 price; BARS, \$20; Y-MOUNTS, \$60; SKI HOLDER, \$30; LOCKS, \$10. 626/793-3561.

'95 TOYOTA Supra SE, pwr. windows/locks/antenna, CD, am/fm/stereo, black/black, 58K mi., exc. cond., salvage title, \$17,000/obo. 909/599-3230.

'94 TOYOTA Camry, vg cond., new tires, 79,000 fwy. miles, \$9,000. 310/372-0497.

'86 TOYOTA Supra, white, 5 sp., sunroof, CD player, 130,000 mi., real clean, runs great, \$3,300. 626/355-4049.

'85 VW Jetta, 4 dr., beige, auto, A/C, power brakes/steering, AM/FM radio, 62K mi., exc. cond., \$3,000. 626/794-2770.

'82 VW Westfalia camper, 21K on new motor, all records/receipts, exc. cond., \$4,500. 626/281-8954.

'84 YAMAHA IT490, 5 sp., great trail bike, front disc brake, fresh motor, many extras. 661/945-9984, Scott.

Wanted

BUNKBED set for grandchildren, white color preferred, reasonable. 248-3640.

COMPUTER, used laptop, DOS/Windows, rechargeable batt.; for ornithology field work, need not have huge HD or extensive RAM; hoping for less than \$400. 626/799-5349, Marilyn.

SOLID WOOD/METAL STAND, must be at least 4 ft x 1 ft and sturdy enough to hold a 60-gal. aquarium; wood is preferred. 542-3041, Scott.

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

WHEELCHAIR, lightweight, easy to transport. 626/572-0998.

Free

PUPPY, black Lab, approx. 5-6 mo. old, found abandoned; he needs a gd. home w/yard. 626/969-6938, Mary, eves./weekends.

For Rent

ALTADENA, non-smoking female preferred to share charming 2-bd., 1 ba. house nr. Christmas Tree Lane; very lg. yd., hardwood floors, sep. dining rm., big kitch., laundry hook-up, deck; a gardener's paradise; mature, quiet, personable professional preferred, must have exc. credit/ref. erences. \$500 + \$600 deposit, share gas, elect., gardener, housekeeper. 310/382-8189, Sally.

LA GRESCENTA house, priv. setting, 2 bd., 1 ba., pool, very quiet; \$1,400, includes gardener, pool service. 952-6007.

MONROVIA, 2 priv. rms. w/priv. ba. in 4-bd. house, 12 mi./JPL, full privileges, no smoking/pets, \$400/ea. 626/358-7728.

PASADENA apt. to share, furn., laundry, carport, a/c, 2 mi./PCC/Catech, \$425. 626/351-9641.

PASADENA, rm. in 3-bd. apt to share w/2 others, pool, parking, a/c, washer/dryer, \$460 + 1/3 util. 626/564-1078.

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

Real Estate

DUARTE condo, 2 bd., 1.5 ba., approx. 832 sq. ft., refinished cabinets, remodeled kitch. & bathrm, cent. air & heat, covered balcony, 1-level, end unit upstairs, move-in cond., \$101K. 626/447-6772.

PALM DESERT, designer furn. condo on dbl.-view fairway at Palm Valley CC; 2 bd., 3 ba., den, separate din/liv rms, 12" tile floors w/bordered carpeting, marble fireplace, Corian counters in kitch./baths, mirrored walls, custom built-in wall units/cabinets, auto awning on patio, nr. pool, many more upgrades; sale by owner, price negotiable. 888/659-3540.

PASADENA, 3-bd., 2.5-ba townhome built '98, nr Rose Bowl, 3.5 mi/JPL, gated, 1,440 sq ft, cent. heat/air, 2-car att. garage, prof. organized closets, tiled f/p, alarm, dbl glass windows, covered balcony off master, wood flrs every-where, Corian counters, lg. incl. backyd fully landscaped w/auto sprinklers, palm/fruit trees, fountain, community pool/Jazz, basketball court, \$246,000/obo. 626/568-8298.

TEHACHAPI area: new home; 3 bd., 2 ba., LR, DR, cent. a/c/heat, 2 1/2 acres fenced, 2-car gar., 2,800 sq. ft., Dutch barn (guesthouse), lots of oak trees; OWC. 626/794-5858.

Vacation Rentals

BIG BEAR cabin, quiet area nr. village, 2 bd., sleeps 8, completely furn., f/p, TV/VCR, \$75/nt. 249-8515.

BIG BEAR LAKE cabin, nr. ski area, lake, shops, village, forest, 2 bd., sleeps up to 6, f/p, TV, VCR, phone, microwave, BBQ & more, JPL disc. from \$65/night. 909/522-9874.

BIG BEAR LAKEFRONT, lux. townhome, indoor pool/spa, nr. skiing, beautiful master bd. suite, sleeps 6. 949/786-6548.

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

HAWAII, Maui condo, NW coast, on beach w/ocean vw., 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, microwave, dishwasher, pool, priv. lanai, slps. 4, 4/15-12/14 rate \$95/nite/2, 12/15-4/14 rate \$110/nite/2, \$10/nite add'l person. 949/348-8047.

LAKE TAHOE, west shore @ Homewood, close to northern ski areas: Squaw, Alpine Meadows, Homewood, etc.; 3 bd. + loft, 2 ba., slps. 8, linens provided, full kitch. & laundry, TV/VCR, wood stove, wood provided; 2 day min., JPL disc., \$75 cleaning fee. 626/585-0321, Bob or Nicole.

MAMMOTH condo, Dec. 25-28 (4 nights) La Vista Blanc, studio + loft, 2 ba., slps. 4, \$730. 790-4097.

MAMMOTH condo, studio + loft, 2 ba., f/p w/wood, Jacuzzi, sauna, game rm., color CB, TV/VCR, full kitch. w/microw., terrace, view, amen. 714/870-1872.