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Caltech News

In This Issue

Social Entrepreneur

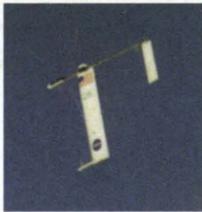
New York Actress

Balloons in Space

and

What Now, Voyager?





ON THE COVER

The Shape of Things to Come: The September dedication of the Broad Center for the Biological Sciences ushers in the latest chapter in Caltech's long and distinguished history of contributions to the life sciences (story on page 4).

3 From Smart Bombs to Reading Machines

Jim Fruchterman's Bookshare.org illuminates new uses for technology.

8 A Life in the Theater

Performer/playwright Noemí de la Puente has her act together in the Big Apple.

10 Up, Up, and Away

On a wing and a NASA grant, Alexey Pankine hopes to send balloons into space.

Also in this issue:

Actor Alan Alda speaks about his search for Richard Feynman; the Institute welcomes new administrators; alumni write in; and *Caltech News* goes looney over Voyager's 25th year (on the back-page poster).

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Up Front

TWENTY-FIVE YEARS INTO ITS AMAZING MISSION, VOYAGER HAS YET TO LEAVE THE BUILDING

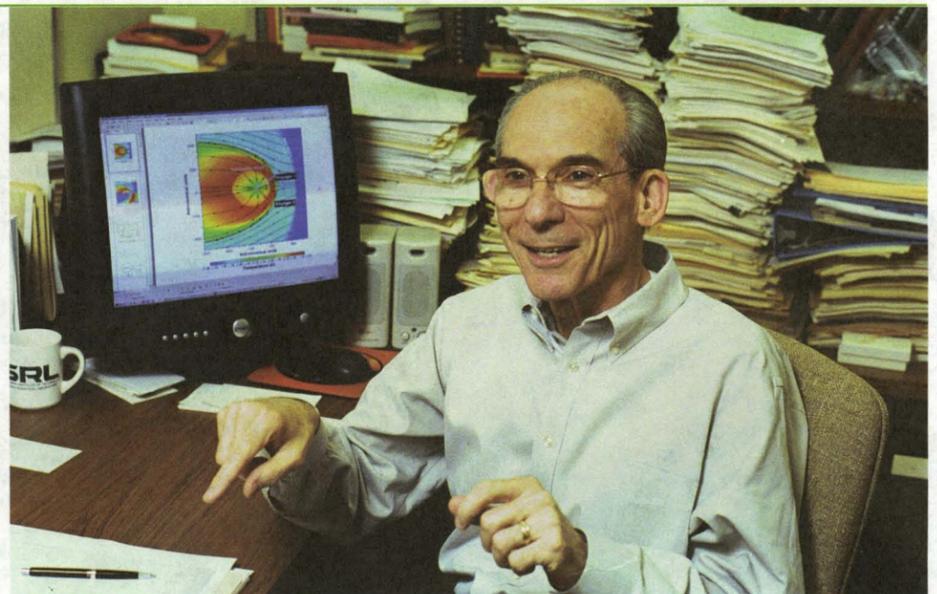
In 1977, Jimmy Carter became the 39th president of the United States, Elvis Presley died of a drug overdose, and NASA sent up two spacecraft, Voyagers 1 and 2. Twenty-five years later, they're all still going strong. Elvis's record sales are as hot as ever; Jimmy Carter is still trotting around the globe for world peace; and the Voyagers are streaking along, heading for interstellar space.

It may surprise some that the silver anniversary of the Voyager missions has generated nearly as much press as the anniversary of the King's death. But if Elvis turned a whole generation on to rock 'n roll, the Voyagers opened the same generation's eyes to some dazzling phenomena in our solar system.

"There will never be another mission like Voyager," said Ed Stone, Caltech's Morrisroe Professor of Physics, who, in November, will mark his 30th anniversary as the mission's project scientist. "It has discovered so many different worlds, and it's not over yet."

While it's been 13 years since Voyager 2 flew by Neptune—the last planet that either spacecraft visited—the scientific mission has continued. The Voyagers have been exploring the solar wind—a stream of electrically charged particles that, as they blow out from the sun, enclose it in a magnetized bubble of hot plasma known as the heliosphere. Scientists hope that the Voyagers will help them determine the size of the heliosphere, which is confined by the pressure from interstellar space and varies with the strength of the solar wind over the sun's 11-year cycle of activity.

Lately, the journey has taken on a new urgency as Voyager 1 may be two to three years away from a boundary called the termination shock, the point where the solar wind's velocity drops from supersonic to subsonic speeds. (Voyager 2, the slower of the two craft, is six years and 1.6 billion miles behind Voyager 1). Stone says that scientists must analyze the data carefully these days for signs that the boundary is approaching, since it will take the spacecraft only 10 minutes to pass through the termination shock.



After the termination shock, the spacecraft will spend 10 to 15 years in the slow solar wind before reaching the heliopause, the outer extent of the sun's magnetic field and solar wind. From there, it's on to interstellar exploration.

Time is of the essence. Scientists expect that the Voyagers' radioisotope thermo-electric generators will run out of power in about 20 years. After that, the craft will continue roaming through space, but they will no longer be able to communicate with mission controllers at JPL.

Stone was a 36-year-old associate professor of physics at Caltech, eight years past getting his PhD, when he was tapped as project scientist for the mission. At that

Fantastic Voyager. Surrounded by scientific papers that have poured forth from the Voyager missions, project scientist Ed Stone is now shepherding the spacecrafts' exploration of the heliosphere, whose bubblelike structure is modeled on the computer screen in his Caltech office.

Continued on page 12 . . .



From Smart Bombs to Reading Machines

BY RHONDA HILLBERY

Forget the idea of pushing a new technology to its limits and then trying to find a market for it. One-time rocket scientist Jim Fruchterman '80, MS '80, now turned socially minded entrepreneur, says he wants to use existing technology to help people live their lives a little better. In some cases, a lot better.

Case in point: Bookshare.org, which Fruchterman has set up to provide the largest electronic library of its kind on the Internet. The file-sharing service is modeled on Napster—a concept Fruchterman caught on to early, since he lived two doors down from an early Napster CEO in Palo Alto. But unlike the now-defunct music file-swapping service, Bookshare.org isn't battling a battalion of industry lawyers claiming copyright infringement. Instead, thanks to an exemption in copyright law for people with disabilities, Fruchterman's service is legal, and it is revolutionizing the distribution and delivery of books to the blind and disabled.

The nonprofit Web site has been online since February, operating a virtual bookstore for sight-impaired and learning-disabled readers in the United States. Fruchterman estimates that as many as 3 million people could benefit from the service. Users can access this cyber store through basic PCs, which Fruchterman likes to call "the Swiss army knife for people with disabilities."

Readers pay \$25 to sign up, then \$50 for annual subscriptions that entitle them to take unlimited advantage

of a large library of low-cost scanned books.

After supplying written proof of a disability that affects their reading, and receiving a password, members can select books to download in formats compatible with common Braille or synthetic-voice reading devices.

Fruchterman notes that evolving technology has made specialized formats easier to obtain and to utilize, as digital books can be downloaded over the Internet utilizing digital Braille or digital talking-book standards.

"A Bookshare.org subscribing member would go to the Web site as if it were Amazon.com for the blind, search for the book he or she wants, download it to their PC, decrypt the book with a password, then either listen to it with a synthetic voice or print it out in Braille. Within minutes of choosing a book, users can be reading it using the method of their choice."

To survey the titles, a screen reader literally reads the names of selections aloud in a "computer" voice.

Through the help of volunteers, Bookshare is able to offer new titles monthly, and its lending library now totals more than 10,000. Choices span a wide range, from *The Adventures of*

Right: Peter Scialli, a blind Bookshare.org user who provides technical support to the project, demonstrates how the service works at a desktop computer. Above and far right: Bookshare volunteers comb through a pallet of donated books, while others rip apart and scan the pages.

"We are not giving away technology as charity. We are trying to provide technology that maybe couldn't or wouldn't be provided by the for-profit sector."

Tom Sawyer to A Brief History of Time. Hot categories include recent bestsellers—*Stupid White Men* by Michael Moore and *The Corrections* by Jonathan Franzen, to name two—and religious titles.

What helps make the operation low-cost is Bookshare's reliance on volunteers like Carl Hoffmann, who discovered the service while Web-surfing through a Bay Area volunteer database. After being laid off from his job as an online-event producer, the 35-year-old was looking for an appealing way to stay busy. Since January he has worked five to 10 hours a week for Bookshare, evaluating and scanning contributions, keeping track of inventory, and obtaining additional scannable texts by trading titles with secondhand bookstores.

"It's fun because I am accomplishing something," says Hoffmann, who has since found paid work but hopes to continue helping Bookshare. "I am getting through a lot of books that will be read by people who otherwise wouldn't be able to read them."

One blind supporter donated 3,000 books that he had laboriously scanned

himself. "He'd been scanning a book a day for 10 years," Fruchterman says.

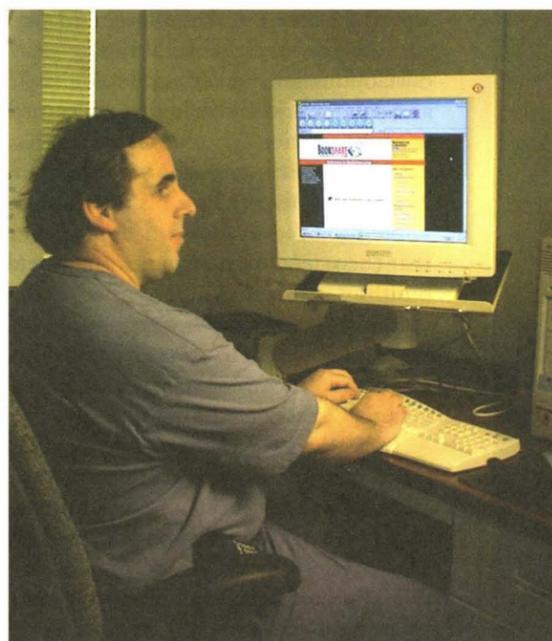
Upbeat testimonials appear on the service's Web site. One user describes the plight of slowly losing the ability to read large-print books, and credits Bookshare for restoring the freedom to "hunt, search, skim, and read."

Socially minded business models are nothing new to Fruchterman. Back in 1989, while still working in the for-profit world, he founded Bookshare's parent nonprofit, Benetech, an R&D company that develops products "designed to help disadvantaged people achieve equality." Eventually he quit his for-profit job altogether to pursue a hybrid of business and altruism.

In many ways, Fruchterman's quest started at Caltech while he was studying smart-bomb technology in an applied physics course. Warfare technology might seem an unlikely source of inspiration, but he saw the potential for turning it to a new use.

"At Caltech you spend a lot of time wondering how you will come up with a really good idea. I was learning about optical pattern recognition, and one of

Continued on page 12.





“Two of the great problems of biology—how cells work and how the brain works—may well be solved in the Broad Center in the next 20 years.”

Two views of the Broad Center. Left: The west side of the facility highlights the contrasting materials used to construct the building's exterior—embossed stainless steel on the left, travertine marble on the right. Right: A soaring atrium rises from the floor of the center's interior lobby.

A NEW BUILDING FOR THE BIOLOGICAL SCIENCES TAKES A BOW

With its Japanese stainless steel facade glimmering in the afternoon sun, Caltech's Broad Center for the Biological Sciences was dedicated on September 10. Local officials and members of the Caltech community, including faculty, trustees, students, and staff, were on hand to celebrate the opening of the architecturally engaging building with Eli Broad, Caltech trustee and chairman of AIG SunAmerica, and his wife, Edythe, who together provided the principal funding for the \$50 million edifice.

The Broad Center, the cornerstone of Caltech's \$111 million Biological Sciences Initiative (a fund-raising effort completed last year), now becomes the Institute's first new building of the 21st century. When fully staffed, it will

house 13 research groups from a wide spectrum of disciplines, including biology, chemistry, and engineering. But in the interdisciplinary tradition of the Institute, many of the groups will collaborate, bringing their diverse perspectives and range of technologies to bear on key questions in the biological sciences.

“Big challenges are in front of us,” declared President David Baltimore, one of several speakers at the day's event. “They are the challenges of ever-greater understanding of both the molecular underpinnings of living systems and the integration of individual events to make a functioning whole.” The science of the Broad Center, he said, “reflects these two directions. We have the structural chemists and biologists working at the molecular level and the neurobiologists, behavioral biologists, developmental and cellular biologists, and computational biologists concerned with integration.”

Added Baltimore, who won the Nobel Prize in 1975 for his work in virology, “We can confidently predict that the scientists working in the Broad building will make important advances that will increase our understanding of human life and help solve the daunting problems of neurologic, cellular, and genetic disease.”

Located on the northwest corner of Caltech's campus, the Broad Center is 120,000 square feet in size, with three floors above ground and two below. The interior features a modular design that allows for quick changes to accom-

modate research groups. The building will house Caltech's first magnetic resonance imaging machine that's big enough to look at the brains of humans, and will also contain electron microscopes and other equipment for studying a wide range of organisms. But there is clearly as much style as substance to the new facility.

Designed by renowned architect James Ingo Freed of Pei Cobb Freed & Partners, the Broad Center features a facade of stainless-steel panels and, on the south side, an exterior of enough travertine marble to encircle the campus, according to the building's general contractor. The travertine, which comes from a quarry in Italy, is also used throughout the interior lobby, which features columns, an atrium, and a grand staircase of the type one might expect to find in a five-star hotel.

A separate structure near the main building houses a New York-style delicatessen, an eatery that Baltimore—himself a native New Yorker—said he hoped would become a place where students, postdoctoral fellows, staff, faculty, and administrators would come to discuss “science, the affairs of the world, or the latest tennis match.”

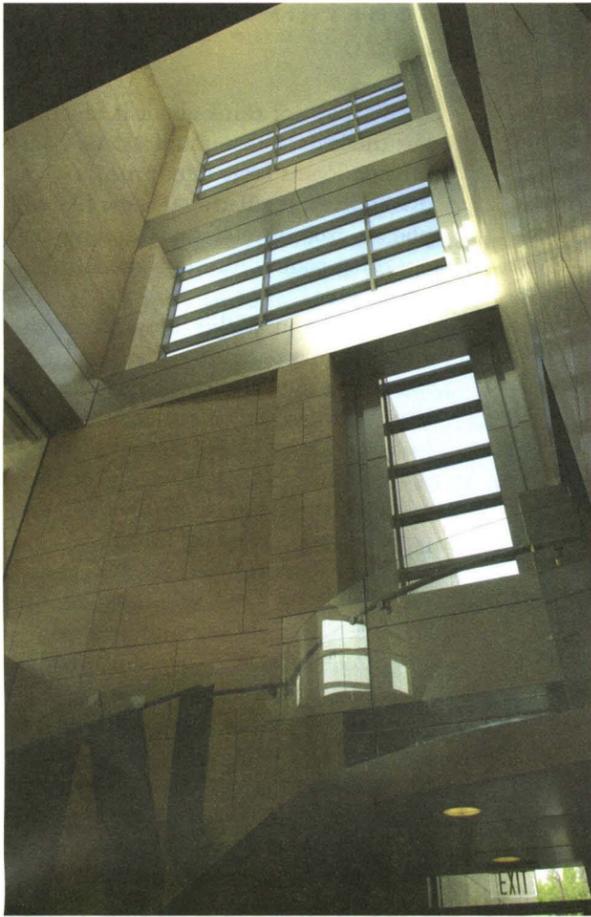
Most of the investigators who will be based in the Broad Center will be new faculty, according to Elliot Meyerowitz, chair of the Institute's biology division. Of the building's 13 research groups, eight have already been identified. “The faculty and students of the biology division are committed to solving the great problems of

biology, and two of these great problems—the problem of how cells work and the problem of how the brain works—may well be solved in the Broad Center in the next 20 years,” Meyerowitz predicted.

Each of the three above-ground floors of the building will house four research groups linked by shared research interests. The top floor will focus on structural biology. Investigators there include biology professor Pamela Bjorkman, who studies the structure and function of molecules involved in cell surface recognition, particularly those involved in the immune system; Assistant Professor of Biology David Chan, who is interested in understanding the mechanism through which HIV, the agent of the AIDS disease, enters human cells;



Above: Elliot Meyerowitz, chair of the biology division, addresses the crowd at the Broad dedication. Photo left: President David Baltimore and Trustee Eli Broad formally dedicate the facility, allowing visitors to get a look inside the new building.



science fiction movie. The basement will also house an X-ray room and two electron microscopes. And a new faculty member will eventually set up operations on that floor in a large space that is now being used to store library books.

In his remarks at the dedication, Broad said that he is certain that the new building will yield important new insights and will have a positive impact on the California and U.S. economies by fostering biotechnology start-ups. "Biotechnology has the ability to significantly improve the human condition in this century," he said. "Caltech has a culture and a tradition that pro-

duces breakthroughs."

Baltimore thanked the Broads for their "philanthropic leadership" in making the lead gift for the building. He also singled out other donors for their contributions, including Board Chairman Benjamin Rosen '54; Chairman Emeritus Gordon Moore, PhD '54, and his wife, Betty, for a gift made through the Moore Foundation, the first installment of their \$600 million pledge made last year; Senior Trustee Camilla Frost; Life Trustee Arthur Rock and his wife, Toni; Trustee Ronald Linde '62, PhD '64, and his wife, Maxine, for a gift that was matched by Caltech alumni; Warren Schlinger '44, PhD '49, and his wife, Katharine; the Ralph M. Parsons Foundation; and the estate of William Hacker '31.

chemistry professor Doug Rees, who uses X-ray diffraction methods to study structure-function relationships in macromolecules; and Grant Jensen, assistant professor of biology, who uses cryoelectron microscopy to study the interaction of proteins.

Behavioral biology reigns on the second floor, where two research groups have been placed so far. A group led by Associate Professor of Biology Erin Schuman studies how different types of molecular signals contribute to synaptic transmission and plasticity in the brain. Professor of Biology Kai Zinn, who heads the other research team, is interested in how synaptic connections form during neural development.

On the first floor, investigators will focus on computational biology, largely using computers to study biological systems. Niles Pierce, assistant professor of applied and computational mathematics, uses computational algorithms and experimental feedback to design novel molecular machines that function at the nanometer-length scale. Stephen Mayo, PhD '87, associate professor of biology and chemistry, uses computers to design proteins with novel structures and functions, and then goes into the lab to make them. The first floor also features a 100-seat auditorium with state-of-the-art Ethernet wiring.

The MRI facility will be housed in the basement. Three magnets will be located there, and one will be big enough to probe the brains of humans as they attempt to carry out various cognitive tasks. While this magnet won't be delivered for a few months, the elaborate structure built to contain it makes the room look like the set of a

MARGO MARSHAK IS NAMED CALTECH'S VICE PRESIDENT FOR STUDENT AFFAIRS

Margo Marshak has been appointed the Institute's new vice president for



University of Chicago administrator Margo Marshak has been named the Institute's new vice president for student affairs.

student affairs. Marshak, who takes up her campus post in October, has been the vice president and dean of students at the University of Chicago. She is also an attorney, and brings extensive experience in student affairs to the position.

Caltech's first female vice president, Marshak is also the first full-time vice president for student affairs—all her predecessors were Caltech faculty members.

"I am overjoyed that a person of Margo's qualifications has agreed to come to Caltech," said President David Baltimore. "I am sure that generations of Caltech students will benefit from her caring approach to student life and her deep knowledge of the needs of, and opportunities for, students. She will personally contribute to increasing the role of women at Caltech. She has long been deeply committed to increasing diversity in higher education and will bring a wealth of ideas to us."

Marshak served as vice president for student affairs for 10 years at New York University before moving to the University of Chicago. At NYU, she developed and implemented the large-scale renovation and construction of the student residence halls, and at Chicago, she set new directions for student affairs. A graduate of the University of Rochester, she holds an MA from the University of Michigan and a law degree from the California Western School of Law. She has also held vice and assistant deanships at the University of Pennsylvania Law School and the University of San Diego School of Law.

At Caltech, Marshak will be the senior Institute executive responsible for envisioning, leading, advocating for, and managing student welfare and interests. Among the responsibilities she will assume are leadership of the administration and budgeting for the 16 offices that make up the student affairs organization. This includes oversight of the supporting technological infrastructure, implementation of strategic planning and assessment, and working with undergraduate and graduate students to ensure that they have a good educational experience while at Caltech.

"I'm obviously thrilled to have the opportunity to come to such a great

institution. I look forward to getting to know the Caltech students and to working with them on issues that are of interest to them. I'm grateful to the Caltech family for welcoming my husband and me so warmly."

ERICA O'NEAL TO HEAD OFFICE OF MULTICULTURAL EDUCATION

Erica O'Neal has been named the new associate dean and director of the Institute's office for multicultural education and student affairs.

O'Neal, who joined the campus October 1, has come to Caltech from Stanford, where she was associate director of development in the School of Humanities and Sciences. At Stanford, she served previously as an assistant dean in the School of Engineering and worked closely with faculty and students to create and implement academic enrichment programs for underrepresented students.

"The knowledge and experience she brings to Caltech will contribute greatly to our efforts to increase the diversity of our undergraduate and graduate student populations and to enhance the educational experiences of all of our students," said Gary Lorden, acting vice president for student affairs.

O'Neal earned her BA at Harvard and holds an MS and PhD in higher education from the University of Pennsylvania. She has conducted research on the effectiveness of focused academic programs and has published articles on issues of diversity and academic preparation.

O'Neal's dissertation research at Penn focused on equity issues in undergraduate science and engineering education. As the assistant dean for engineering diversity programs at Stanford, she designed and implemented the Stanford Summer Engineering Academy, a bridge program for entering freshman women and students from underrepresented minority groups.

O'Neal also served as the resident fellow for Ujamaa, Stanford's African American-themed dorm for undergraduate students.

"I am enthusiastic about joining the Caltech family and making new contributions that serve to increase diversity and build community among the student body," O'Neal said.



Erica O'Neal will oversee Caltech's efforts in diversity-enhancement and multicultural education.

GARY DICOVITSKY APPOINTED TO HEAD DEVELOPMENT AND ALUMNI RELATIONS

Gary Dicovitsky has been named the Institute's new vice president for development and alumni relations, succeeding Jerry Nunnally, who stepped down earlier this year. In this position, he will be the senior executive responsible



Gary Dicovitsky will oversee Caltech's fund-raising and alumni programs.

for providing leadership for fund-raising and alumni activities. Dicovitsky, who previously served as vice president for development and secretary to the board of trustees at Pomona College, joins the campus in October.

"We are delighted that we have been able to find someone with Gary's qualifications, extensive experience, and history of accomplishment. With an ambitious campaign coming up, we will need his talents in the keystone slot in development," said President David Baltimore.

At Pomona, Dicovitsky's accomplishments have included leadership of a highly successful five-year comprehensive capital campaign that exceeded its goal by 37 percent.

Dicovitsky served as director of planned giving at Princeton for four years prior to joining Pomona in 1995. He also held senior positions at the University of Virginia and Dartmouth. In addition, he served as associate ath-

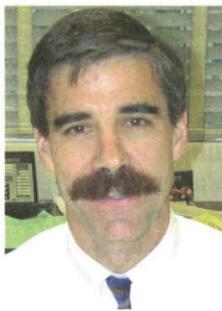
letic director and head coach of the men's varsity basketball team at Loyola College in Baltimore.

"Caltech's superior reputation as an institution with such depth and capacity in interdisciplinary projects and programs was fundamental to my interest," said Dicovitsky. "Its small size and formidable leadership added significantly to my belief that visionary aspirations and achievements, some unique to Caltech's resources, can be realized in the years ahead. I am honored to be offered the privilege to help build on the institution's past successes and to interact with such extraordinary faculty, staff, and alumni."

A native of New Jersey, Dicovitsky holds a BA from Dartmouth and a master's degree in education from Loyola College. He was formerly a certified financial planner.

At Dartmouth, he has served as president of the Alumni Council and of the class of 1972, as well as a member of the Alumni Council's nominating and alumni trustee search committee and the ad hoc committee to study Dartmouth College Alumni Council's structure and operation. His other volunteer work has included serving on the boards of directors of the International Foundation and the Princeton Area Planned Giving Council, as well as volunteering his services to the Claremont-area youth basketball program. He is a member of the National Committee on Planned Giving and the Council for the Advancement and Support of Education (CASE).

ANTONSSON NAMED JPL CHIEF TECHNOLOGIST



Erik Antonsson is moving up the hill from Caltech to become chief technologist at JPL.

Erik Antonsson, Caltech professor of mechanical engineering, has been named the chief technologist at JPL, a job he began in September. He has taken a two-year leave of absence from Caltech, but plans to continue during that time with his research programs on campus.

In a letter to the Caltech community announcing the appointment, JPL director Charles Elachi, PhD '71, said that Antonsson "was selected as the result of a national search led by Richard Murray, chair of the engineering and applied science division at Caltech. Murray and his committee interviewed a number of nationally recognized technology leaders and determined that Dr. Antonsson's expertise and experience are an outstanding match for the position."

At JPL, Antonsson will have responsibility for planning, implementing, and leading the lab's technology strategy. He will provide intellectual leadership in the strategic planning

of technology projects, manage technology and support personnel, and oversee technology research collaborations with universities, including Caltech.

Antonsson, who developed and runs the Engineering Design Research Laboratory on campus, joined the Institute faculty in 1984. He earned his BS from Cornell in 1976 and his PhD from MIT in 1982. He spent a year as assistant professor at the University of Utah, and subsequently served as technical director of the Pediatric Mobility and Gait Laboratory at the Massachusetts General Hospital while holding a joint appointment as assistant professor of orthopedics (bioengineering) at the Harvard University Medical School.

Antonsson's honors include an NSF Presidential Young Investigator Award, the Feynman Prize for Excellence in Teaching, and the TRW Distinguished Patent Award. He has contributed more than 100 scholarly papers to the engineering design research literature and holds five U.S. patents.

MICHAEL HOFFMANN APPOINTED DEAN OF GRADUATE STUDIES

Michael Hoffmann, the James Irvine Professor of Environmental Science at Caltech, has been named the Institute's dean of graduate studies, succeeding



Environmental scientist Michael Hoffmann has accepted an appointment to become dean of graduate studies.

Rod Kiewiet, who returned to full-time teaching and research in political science earlier this year.

Acting Vice President for Student Affairs Gary Lorden '62, who announced the appointment, said, "The job of

graduate dean requires great skill in collaborating with faculty, students, and others in the administration to help make our graduate programs as strong and effective as possible. In his long Caltech career, Mike has gained a wealth of experience in admissions, in working with graduate students as an option representative, and as the executive officer for environmental science and engineering."

Hoffmann has been on the Caltech faculty since 1980. An expert in environmental chemistry, he is a member of the editorial boards of the American Chemical Society's scientific journals *Environmental Science and Technology* and *Journal of Physical Chemistry*. He is also on the Scientific Advisory Board of the Max Planck Institute for Chemistry in Mainz, Germany.

The author of more than 200 research papers and the holder of several patents, Hoffmann was awarded the Alexander von Humboldt Prize in 1991 for his research and teaching in environmental chemistry.

In 2001, Hoffmann was presented with the American Chemical Society Award for Creative Advances in Environmental Science and Technology for "his fundamental and lasting contributions to the science of aquatic chemistry, to the development of aquatic remediation processes, and to understanding heterogeneous and multiphase processes in the atmospheric environment." This year he was honored as the Barnett F. Dodge Distinguished Lecturer in Chemical Engineering at Yale University.

Before coming to Caltech, Hoffmann was a member of the civil engineering faculty at the University of Minnesota. He holds a PhD from Brown and a BA from Northwestern. He was a post-doctoral scholar at the Institute from 1973 to 1976.

ECONOMIST SIMON WILKIE HAS SOMETHING TO TALK ABOUT

We may not think about it much, but the Federal Communications Commission looms large in our media-driven lives, regulating devices like cell phones, pagers, televisions, and numerous other communications modalities nationwide.

Now Simon Wilkie, senior research associate in economics at the Institute, has begun to help sort out the policy issues involved in various communications decisions. Wilkie has taken a sabbatical from Caltech to take on the job of chief economist for the FCC, a position he assumed on July 15.

Established in 1934, the FCC is responsible for regulating interstate and international communications by radio, television, wire, satellite, and cable. As chief economist, Wilkie will have the responsibility of providing independent, nonpartisan advice to the commissioners on various regulatory issues. Wilkie was selected for the position by Michael Powell, the FCC's chairman (and the son of secretary of defense Colin Powell).

As a regulatory body, Wilkie notes, the FCC makes policy decisions all the time. Accordingly, a good part of his job will be assessing proposed regulations and offering advice and recommendations from an economic perspective.

"We sort through what is oftentimes conflicting advice given to the FCC, then provide guidance to the commissioners and the chairman," he says.

He notes that Congress, for example, will mandate that the FCC should do certain things, like developing regulations for telephone network



Economist Simon Wilkie has taken a leave of absence from Caltech to serve as chief economist for the FCC in Washington, D.C.

access by new market entrants.

But, adds Wilkie, they don't spell out the specifics of how to do it. "Our job is to come up with the right formula that works, one that is fair to all concerned, and that is in the public's

best interests."

One of the first critical areas he will be involved with is developing a fair system for auctioning off high-speed bandwidth frequencies that are much desired for various kinds of wireless communications, from voice to video and the Internet. It is expected to be a highly lucrative market, and the bidding will likely be competitive. It will be Wilkie's job to develop an auction

Continued on page 13 . . .

FINDING YOUR MUSE, FEYNMAN-STYLE

ALAN ALDA ADDRESSES THE GRADUATING CLASS OF 2002

BY RHONDA HILLBERY

The actor and science buff who brought the enigma of Caltech's most famous physicist to the stage recently laid a little Feynmanesque wisdom on the Institute's graduating class of 2002. Plumb the origins of what brought you to Caltech in the first place—your love of science, urged Alan Alda, the first actor to be the speaker at a Caltech commencement.

On June 14, Alda, who hosts the PBS show *Scientific American Frontiers* but still evokes memories of his TV character Hawkeye Pierce, told the more than 500 graduates to follow their muse, using Feynman as their guide.

Alda's listeners included 140 candidates for the PhD degree, 126 for the MS, and 248 for the BS.

The audience seemed receptive to his message, free of Sound Employment Advice and deftly delivered with a trained actor's polish under a classically sunny June sky. At its core was what Alda called "a childish idea, something only an unschooled layperson would come up with." Take one thing you love about science, he said, and figure out how to make it understood by one million people. Make it a story, and a good one, filled with ups and downs and travails and uncertainties. It's especially important, he said, to include the rough patches in the scientific journey.

"Tell us frankly how you got there. If you got there by many twists and turns and blind alleys, don't leave that out. We love a detective story. If *you* enjoyed the adventure of getting there, so will we."

Fresh off a six-month Broadway run playing Feynman in *QED*, Alda recalled how his life became caught up in the story of the charismatic physicist, who found himself on the *front lines of so many big events of the 20th century*.

Alda said it all started during his 11 years playing Hawkeye Pierce in *M*A*S*H*. During off hours from tapings at Twentieth Century Fox studios, he often drove by the Caltech campus and wondered about the science that went on there.

Years later, he became intrigued with Feynman's larger-than-life character and exploits after reading up on his life, including the book *Tuva or Bust* by Feynman's longtime drumming partner, Ralph Leighton. He approached Gordon Davidson of the Mark Taper Forum in Los Angeles about developing a play based on Feynman's storied life. Intrigued, Davidson brought playwright Peter Parnell on board, and the three began collaborating on a treatment.

It was no easy task. "What part of him do you focus on? He helped create the atomic bomb; he helped figure out why the *Challenger* blew up; he understood the most puzzling questions in physics so deeply they gave him the Nobel Prize. Which facet of him do you let catch the most light? The one who was a revered teacher, a bongo player, an artist, a hilarious raconteur, or a safecracker? We wanted to make a play about Feynman, but *which* Feynman?"



Six years later they were done.

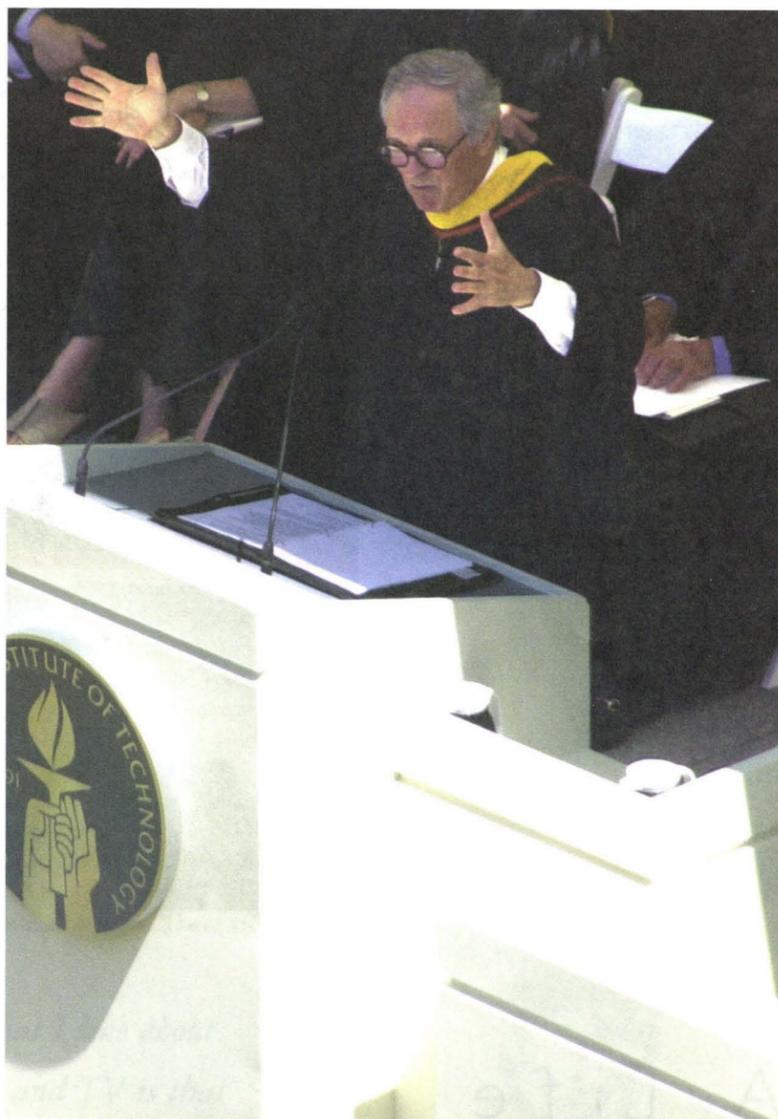
Since *QED* premiered at the Mark Taper last year, critics and audiences alike have praised Alda's performance for making Feynman understandable even to people who don't know subatomic particles from submarines. It was delivered on a simple set with a chalkboard containing the same scribbling that Feynman left behind on his office chalkboard when he died, including the phrase "What I cannot create, I do not understand."

Alda noted that exactly 28 years earlier, Feynman himself had delivered the 1974 commencement address. "This is the way the universe operates," he said. "First Richard Feynman gives the talk; then, 28 years later, an actor who played him on the stage gives it. This is what's called entropy."

One of the theoretical physicist's most captivating traits, Alda said, was his disarming, down-to-earth tendency to speak plainly. "And when he was talking to ordinary people with no training in physics, he never fell back on his authority as a great thinker. He felt that if he couldn't say it in everyday words, he probably didn't understand it himself. . . ."

"Like Dante in *his* time, he could say the most exquisitely subtle things in the language of the common people. He was an American genius, and like many American artists, he was direct and colloquial—not afraid to take a look at the ordinary, and not afraid to go deeply into it to reveal the extraordinary roots of ordinary things. And yet, he recoiled from oversimplification. He wasn't interested in dumbing down science—he was looking for *clarity*." Alda said he was especially impressed by Feynman's habit of working only on what truly interested him, even if that meant working on something with no practical application.

One of the best illustrations of this is the plate story, or how pure scientific curiosity helped pull Feynman out of a major funk after World War II. His first wife had recently died of tuberculosis. This loss, and the weight of comprehend-



Upper right: Fresh off his Broadway run playing Feynman in *QED*, Alan Alda advised grads to follow the physicist's example and find a way to share their love of science with the world.

Continued on page 13 . . .





A Life in the Theater

BY MICHAEL ROGERS

Excluding the occasional onstage cameo by Richard Feynman, Caltech hasn't exactly been famous for its thespians. So it may come as a surprise to learn that one graduating class has produced at least two stage performers. You may have already heard of one—Sandra Tsing Loh '83, the Los Angeles-based radio satirist, author, and performer. But performing on the opposite coast is Noemí de la Puente '83, a dedicated actress who is versatile enough to appear in children's theater, soap operas, and Shakespeare.

De la Puente has been a professional actor in New York for much of the past 12 years. Like the thousands of other actors in the Big Apple, she has spent countless hours in auditions and acting classes. While she's won a fair share of roles in musicals and dramatic productions, many of them have been on the road.

Unlike many of her peers, however, she has a steady acting gig as a member of the Society of the Educational Arts (SEA), a Hispanic/bilingual organization that includes an acting troupe that performs in SEA's theater on the Lower East Side of Manhattan and also in schools throughout the New York area. De la Puente also has a curriculum vita

that sets her apart from other actors. She's most likely the only actor in New York, or almost anywhere for that matter, with degrees from Caltech and Princeton. And not long ago, she had a career as an environmental engineer before throwing it away to tread the boards.

Growing up in Monterey Park, just east of Los Angeles and south of Pasadena, de la Puente excelled in science and math in high school, although she downplays her academic abilities. "I grew up during a time when a woman who was not afraid of math and science was considered gifted," she quips. It was also in high school that she first got interested in music and theater, singing and performing in several productions. Her father, a chemical engineer, encouraged her to apply to Caltech, even though she figured she would never be admitted. Even her guidance counselor told her not to waste her time applying.

"My dad told me to shoot for the stars, so I did," she says. She applied to Caltech and was accepted. But first she had to pass a summer program on campus, which she described as "a cram

course of calculus, physics, chemistry, and English" for students whom the Institute felt needed extra preparation to survive freshman year.

But even that didn't entirely prepare her for what she found. Like many Institute undergrads, de la Puente says that she went from being among the top students in her high school to near the bottom of her Caltech class. The memory of the academic pressure is still painful for her. "It took until halfway through my sophomore year for me to get my mental act together and realize that you don't have to be an overachiever to be a good person," she recalls.

To get some release from the pressures of school, she swam competitively, played volleyball, and performed in several Institute productions, including *Brigadoon*, a children's theater production of *Puss 'n Boots*, and a dance recital featuring music composed by Sandra Tsing Loh.

Noemí de la Puente, pictured top left with seismograph, in a 1980s Caltech brochure, made a seismic shift in her career, when she decided to leave science and engineering behind and pursue an acting career, including a recent appearance in a Shakespeare Festival production of *Twelfth Night*.



"I eventually dropped sports and took my meager amount of free time and spent it on theatrical activity," she recalls. Performing in shows "wasn't as important as meeting other people in the Caltech community who shared the same love of theater. It brought us out of the woodwork and I became good friends with people whom I wouldn't ordinarily have met. It was an important source of joy for me, because it broke up the pressure of school." For her degree, she chose engineering and applied science as her option, with the goal of becoming an environmental engineer.

After Caltech, de la Puente studied civil engineering in graduate school at Princeton, focusing on water resources. While she was there, she met her future husband, Ron Cohen, a graduate student in mechanical and aerospace engineering. She spent three years at Princeton, got a master's degree, and then left in 1986.

"I had done some soul searching, and was ready to leave," she says. "I wanted to get out and work." But her experience as an environmental engineer was disheartening. From 1986 to 1992, she worked in a series of mostly "unfulfilling" jobs, and recalls being particularly disillusioned with her experiences at a few environmental engi-

neering companies that turned out to be more interested in making money than in cleaning up the environment.

"After my fifth job, I realized I wasn't going to be happy doing this," she says. "With a company's backing, you could make a dent in a community, but you're not going to change attitudes or touch people through engineering. Your work may change things, but you're not going to fundamentally move people."

Throughout much of this time, she was still doing theater, performing with community groups on weekends and at night. And one day she asked herself, "If I knew I was going to die in one year, what would I change in my life? I'd want to be more involved in theater. I'd be able to move people in theater; get them to see things in a different light. I'd have the chance to tell them an interesting story that might change them."

So she quit her job in 1992 and started taking acting classes in New York and auditioning for roles. Although she soon started getting work in productions, she decided that she needed a stronger background in theater and enrolled in the University of Iowa's graduate theater program, graduating with a master's degree in 2000. Along the way, she also discovered that she could write plays.

For her master's thesis, she was required to play a lead role in a university production, but she says that none of the plays chosen by the faculty offered an interesting female role. So she decided to write, produce, and perform her own play—a drama about Dolores Ibárruri, a founder of the Spanish communist party. Also known as La Pasionaria, the political firebrand was exiled from Spain to the Soviet Union after the Spanish Civil War, but then returned to her homeland in the 1970s and was elected to parliament.

After leaving Iowa, de la Puente began auditioning again in New York. She performed last year at the Carolinian Shakespeare Festival in New Bern, North Carolina, and was hired back for this year's summer show, *Twelfth Night*, playing Maria, the devious chambermaid. She also performed last year on the soap opera *One Life to Live*. Such is the world of bit parts, de la Puente notes wryly, that she was cast in successive episodes of the same show as a banker, a flight attendant, and a nurse. "That last role got me my Screen Actors Guild card," she says.

She adds that working in television has helped her to develop skills beyond those honed on the stage. "On stage, you can't spend a lot of time with a character in thought," she says. In theater, actors are always talking or moving to advance the plot, and they have to learn how to project their voices. "In TV or film, thought is picked up," she says. Since there's so much attention to

close-ups, actors must find ways to convey emotions without speaking.

"What I like about film and TV is that you can do so little and it translates into so much. What I like about the stage is the immediate connection to the audience."

De la Puente says that her most satisfying role thus far has been on stage, when she performed in 1999 in a one-woman play called *The Last Lector* at the Cape May Stage in New Jersey. In the drama, she played a cigar-factory worker recalling the time when a man was hired to read novels to entertain the workers while they rolled tobacco. Through his readings, he educates them and encourages them to form a union.

"The show was well written and a beautiful story," she says. De la Puente was thrilled when, after one performance, the stage and screen actor Robert Prosky came backstage and told her he enjoyed her work. "It was nice getting feedback from someone whom I consider an exemplary member of the acting profession," she says.

Not all her theater experiences have been so positive. De la Puente recalls one vaudeville revue at a hotel in New York's Catskills that opened with 300 people in the audience and was down to 30 by the sixth skit. "The only people left were those who couldn't get up without assistance," she jokes.

Still, out of bad moments in the theater can often come a break. A woman who worked the lights for another wildly uneven show also ran a small theater company. She enjoyed de la Puente's performance and cast her in three productions. "There are jobs you slog through and others you really love," says de la Puente, but the idea is to keep working.

Her job with the SEA troupe began last year. She auditioned for the company on September 10. The next day, she was headed for a class in Greenwich Village, when the World Trade Center disaster occurred. It wasn't until October that she heard back from SEA and was offered a job.

"We recognized right away that Noemí was perfect for our company," says Richard Marino, the managing director of SEA. "She's very disciplined, very talented, and is also very funny."

"Working with SEA is the closest I've come to being part of an artistic community," says de la Puente, sitting in the lobby of the SEA theater, part of a complex of 14 other theater groups located in a former public school.

So far, with SEA, she has performed as the smart pig in *The Three Little Pigs* and the grandmother in *Little Red Riding Hood*. While it may not be Shakespeare, the work is challenging and pays well, she says. "I'm working with a good group and it's an important public service." It also allows her to exercise her improvisational skills.

For one performance of *The Three Little Pigs*, the backstage crew forgot to bring the soup pot. "So instead of cooking the wolf in the soup, I decided to barbecue him in the fireplace," she says.

While working for SEA, de la Puente continues to audition for other theater companies and also hopes to get roles in films. She has also finished writing her first full-length play, *Generic Hispanic*—a satirical drama about Latinos in advertising, whose title comes from a term that an agent once used to describe her. The plot revolves around the main character's efforts to get the ad agency she works for to stop stereotyping Hispanics.

"I see myself moving more into writing and producing," de la Puente says. "For women, after a certain age, there are not that many roles. I want to tell more women's stories. There are

"What I like about film and TV is that you can do so little and it translates into so much. What I like about the stage is the immediate connection to the audience."

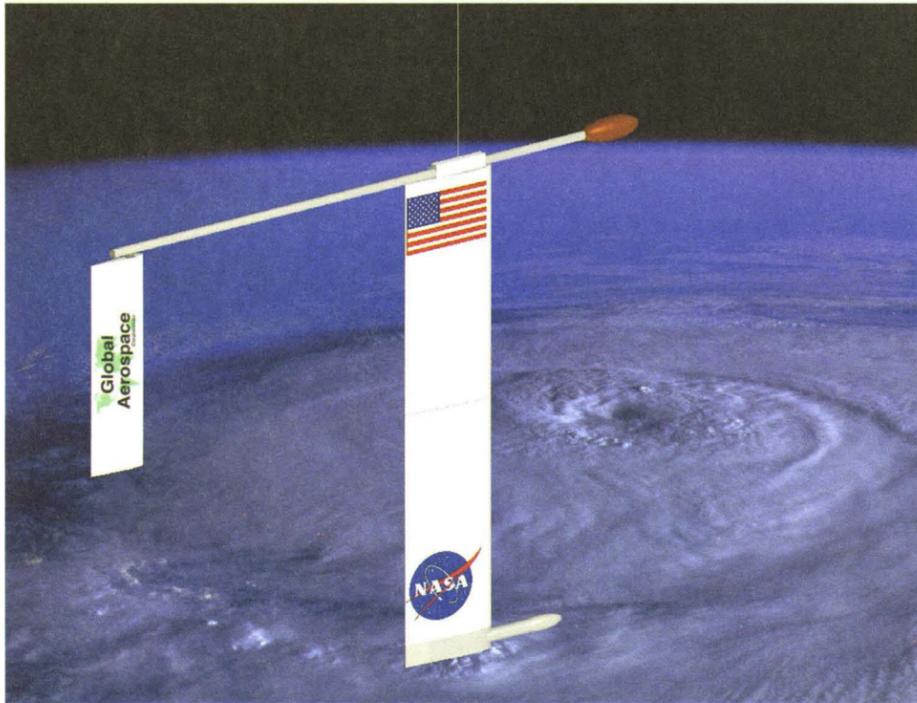


lots of things getting written about women, but not a lot of things getting produced.

"As an actor, you have to wait to be invited in" to a production, she says. "As a writer, you begin the process, and it doesn't exist without you. I want to show people I'm a willing collaborator, and sometimes the only way to do that is to create opportunities for yourself."

As far as her Caltech experience goes, de la Puente says that she will occasionally blurt out something about physics or chaos theory during a rehearsal, revealing her unique past.

"Going to Caltech taught me to work really hard," she says. "I learned about the learning process and how to ask intelligent questions. I learned how to think for myself. It's not like I use the scientific method when I approach a play. But sometimes you can't understand everything, and you have to accept a certain amount of mystery."



Up, Up, and Away

BY MICHAEL ROGERS

Ballooning forays by the likes of the Wizard of Oz and thrill-seeking moguls like Steve Fossett and Richard Branson notwithstanding, balloon flight has never exactly set the world on fire. But that's not stopping Alexey Pankine, PhD '01, from trying to set balloons on a course for outer space.

Pankine is project scientist for Global Aerospace Corporation, a start-up company with a name that's far more impressive than its headquarters: a handful of offices located on the dusty fringes of Altadena, just down the road from the Jet Propulsion Laboratory. With backing from NASA's Small Business Innovation Research program and NASA's Institute for Advanced Concepts—which provides funding for some of the most imaginative and innovative space projects—Global Aerospace has designed a system that can steer balloons, potentially overcoming the age-old problem that wind poses for balloon transportation.

Pankine's job is to develop computer models to aid in steering the balloons around the earth. He's also developing models of the atmospheres of different planets so that Global Aerospace can figure out how best to maneuver its balloons in wildly dissimilar planetary conditions. Pankine is also coming up with a list of things for the balloons to do if they ever get to another planet.

Pankine himself wouldn't have gotten to Global Aerospace if it hadn't been for Caltech. In fact, if not for the Institute, he says that he'd probably now be working somewhere in the struggling Russian space industry.

Growing up in Moscow, Pankine had the same interests as many Ameri-

can kids. He loved reading science fiction, dreamed of space exploration, and built his own telescopes to look into the heavens. Unlike many American kids, he didn't have a backyard, so he did his observing from the window of his family's flat on the sixth floor of a nine-story apartment building. Says Pankine, "My parents often complained because I was letting the cold air in during autumn and winter."

But they couldn't complain about his facility with numbers. By sixth grade, he was attending a special school for mathematics and physics. From there, he went to Moscow State University. In late 1993, he was at Russia's Institute for Space Research, putting the final touches on his undergraduate thesis on remote-sensing computer models, when Caltech's Arden Albee came through for a visit. Pankine's adviser introduced his student to the Caltech professor of geology and planetary science (and then dean of graduate studies), and Albee, who shared an interest in remote sensing, encouraged Pankine to apply to Caltech for graduate studies. The deadline was only a few weeks away, but Pankine took his advice.

"It seemed so difficult to go to a foreign country," recalls Pankine, 32. "But he said I should try to do this." His application got in under the wire, and by summer he was in Pasadena, ensconced in the Division of Geological and Planetary Sciences.

At Caltech, Pankine found a new mentor in Professor of Planetary Science Andrew Ingersoll, and worked with him studying atmospheric conditions around Jupiter, in preparation for

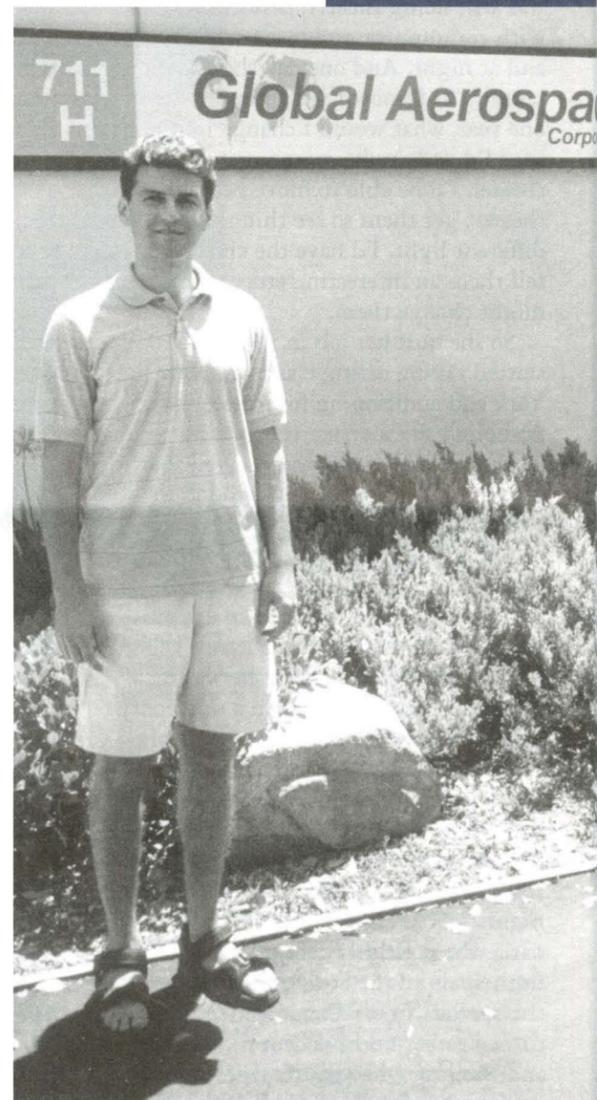
the arrival of the Galileo spacecraft, which reached the giant planet in December 1995. Pankine also investigated the unpredictable, two-month-long dust storms that occur on an irregular basis on Mars. For his thesis, he developed a computer model that tracks how changes in Mars's surface and atmospheric conditions are linked to the onset of dust storms.

"We developed a model that can simulate changes in the Martian atmosphere over 100 years," he says. "We were able to test different scenarios" showing how the dust storms develop, which may someday help researchers predict why the storms occur.

"I was very happy at Caltech," he says. "It's an awesome place. You meet very interesting people, get a first-class education, and I was able to work with experts in the field."

After Pankine graduated, Dmitri Kossakovski, PhD '00, a friend from Russia who had gone from Caltech to JPL, told him about Global Aerospace. Pankine already had a job offer in hand from an energy trading company, and was also slogging through the paperwork required for foreign nationals to apply for jobs at JPL. But Kossakovski's description of the research under way at Global Aerospace caught his attention.

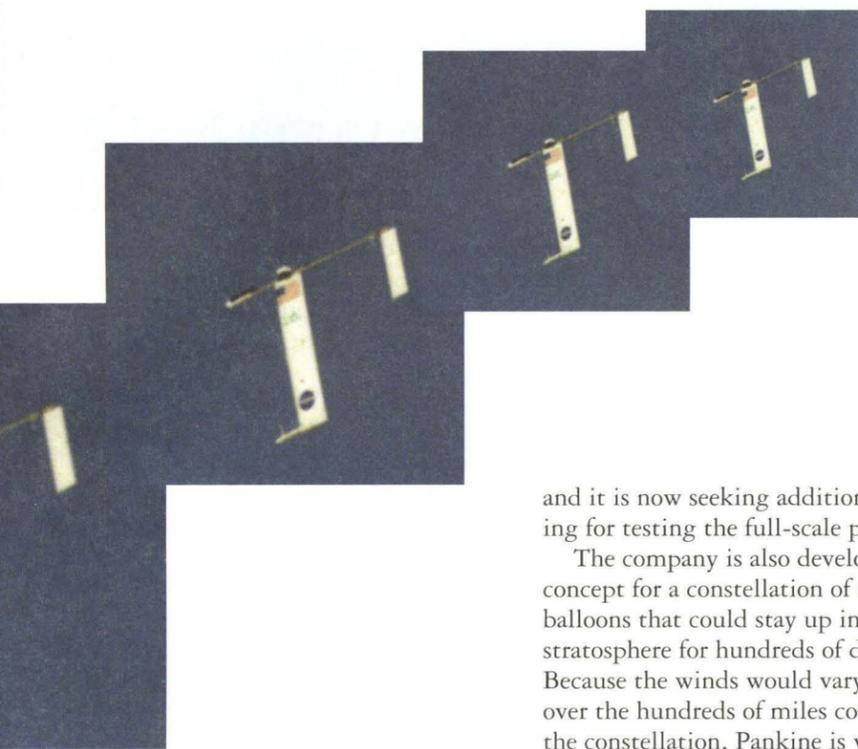
"It seemed like a good place to work," he says. "They were working on the problem of chaos in the atmosphere and that was relevant to what I did at



Caltech." He joined the company in April 2001.

Global Aerospace was founded in 1997 by two former JPL employees. Its president and chairman of the board is Kerry Nock, who worked at JPL on the design of several planetary missions, including Mariner 9 to Mars, Mariner 10 to Venus and Mercury, and the Voyager and Galileo missions. He and his colleagues figured that balloons had enormous promise to replace satellites, since instruments aboard balloons could also gather information on the weather, relay communications signals, conduct surveillance, and provide other functions. They also thought that they could be used in planetary exploration.

The company maintains that balloons would not only be 10 to 100 times cheaper than satellites, but could also fly much closer to the earth and other planets, providing up to 20 times higher resolution of surface images and



and it is now seeking additional funding for testing the full-scale prototype.

The company is also developing a concept for a constellation of dozens of balloons that could stay up in the stratosphere for hundreds of days. Because the winds would vary greatly over the hundreds of miles covered by the constellation, Pankine is working on a system that would keep the network formation in place. He is looking at the dynamics of atmospheric changes and even at biological systems to develop a computer model to keep the balloons in formation.

Biological systems? Pankine explains that in recent years, scientists working in control theory have developed mathematical models to mimic the behavior of biological systems that feature coordinated movements, such as flocks of birds. Global Aerospace worked with a group of scientists from Princeton University to adapt these models to distributed systems. After all, given the reputation of the average bird's intelligence, if pigeons can fly in formation, why can't balloons? "We're using a simple formula that calculates the force between objects and applies to every element of the constellation" or group, Pankine says. "It works like a spring. If two neighbors get too close, the spring pushes them apart, and

when they're too far apart, it pulls them together."

Pankine's role is to figure out what to do with the formula when you throw wind or weather vortices into the equation. "It's hard enough to keep one balloon flying over a general area," he says. "But it becomes enormously complex with hundreds of them." Having dozens of air-traffic controllers on the ground, each keeping several balloons on course, might be a great training ground for the FAA, but it wouldn't be very practical in a scientific investigation. So Pankine has to come up with a system in which the balloons with steering mechanisms act somewhat like a flock of geese being buffeted by wind.

Choreographing the movements of balloons is challenging, but Pankine seems most excited about the interplanetary uses for them. "Planetary science is my interest," he says. "By understanding other planets better, we can gain more knowledge about the earth." He looks forward to the day when scientists could gain a wealth of information about planets by sending up spaceships that would release into planetary atmospheres balloons equipped with small or inflatable versions of the StratoSail device. He envisions them dropping probes with instruments that could profile the

Pankine looks forward to the day when scientists could gain a wealth of information about planets by sending up spaceships that would release balloons into planetary atmospheres.

atmosphere and gather information from a wide swath of a planet's surface. Compare that, he says, to the Mars Pathfinder, which explored a small area of terrain and could see no farther than the hills about a kilometer from where it landed.

It could be a long wait, however, before balloons start sailing over Mars. Nock of Global Aerospace estimates that it will take approximately five years before the technology is ready for balloons to go to Mars or for a balloon constellation to soar into the earth's atmosphere. "Scientific and programmatic issues may delay that schedule," he says. Whatever the time frame, he hopes that any such effort would be part of a larger NASA project for a comprehensive sensor web to gather data from the earth. But in the meantime, the StratoSail system could steer and guide balloons that are currently used for scientific experiments.

In any case, none of this deters Pankine. Ambitious goals and investigations, he says, are worth the investment in time and energy.

"We are developing radically new approaches to observe the earth and the planets that can potentially revolutionize the way we do solar system exploration," he says. "We are working in a field that is just starting to develop, and the problems we are solving were never addressed before. This is like discovering a 'terra incognita.' Discoveries await around every corner. What could be more exciting?"

160,000 times higher signal-radar.

Despite their advantages, balloons are not without problems. The biggest roadblock is that no one has been able to build one strong enough to last more than a couple of weeks in flight. NASA is planning to launch an ultralong-duration balloon next year as part of a cosmic-ray experiment, but that is expected to fly for 100 days, still far below the amount of time aloft that balloons would need to compete with satellites.

Balloons, not to mention their proponents, also suffer from the Rodney Dangerfield syndrome—they don't get no respect. Global Aerospace would like to change that, but Nock recognizes the obstacles. "Balloons have always fought an uphill battle in that they're 'simple,'" he says. More to the point, they fly at the mercy of the wind, which can blow them far off course. So government agencies would rather spend money on the expensive hardware that goes into sturdy, dependable satellites than on something as elastic and unpredictable as balloons.

Global Aerospace figured that if it could tackle the wind problem, it might be able to convince the space industry to give balloons a chance. The company's main achievement so far has been to design and build a device called a StratoSail Trajectory Control System. Basically, it's an 18-foot-long wing with an eight-foot-long rudder controlled by radio telemetry. It hangs vertically by a tether below the balloon and is meant to keep it on course under most wind conditions. Global Aerospace successfully tested a scale model in the Mojave Desert in April 2001,



Opposite page, top photo: Global Aerospace's StratoSail flies over the earth in an artist's rendering. **Middle photo:** Alexey Pankine, PhD '01, stands in front of the Altadena headquarters of Global Aerospace, where he is project scientist. **Left:** a full-scale prototype of a StratoSail hangs sans balloon in Altadena.

Bookshare. . . from page 3

the applications for it is making a smart bomb. I was thinking of what, other than military targets, you could recognize with optical pattern recognition. The one idea I came up with was that you could make a reading machine for the blind using the same technology.

"I think that's part of the Caltech culture—how are you going to win your Nobel Prize when you grow up? Of course, that doesn't apply here. It's more of, what's the really important work you're going to do that helps humanity? And the idea of helping the disabled had such a great feeling about it!"

After completing a BS in engineering and an MS in applied physics at the Institute, Fruchterman headed to Stanford's PhD program in electrical engineering. After interrupting his studies to work on a rocket project, which blew up on the launch pad, he went on to launch his own businesses.

The first one failed. Then in 1982 he cofounded Calera Recognition Systems, a manufacturer that developed and marketed a line of reading machines. After serving in a number of executive positions there, he founded and served as chief financial officer for RAF Technology, which creates mail address-recognition systems used in business and government, as well as the software now used by the U.S. Postal Service.

Along the way, he became frustrated that some of the projects he wanted to do offering the greatest benefit to help people weren't profitable. To address the challenge, he founded Arkenstone, a not-for-profit supplier of reading machines for the visually impaired. When the opportunity came to sell the Arkenstone product line in 2000, proceeds of roughly \$5 million went to fund several new ventures, including Bookshare.org.

It's part of the bootstrap strategy of using one business to build another. Fruchterman has other projects under way, including Martus, which will offer technology tools to help human-rights organizations track information. Launch is planned for December. He is also working on a land-mine detection project, as well as on a handheld wireless device that is being codeveloped with Sun Microsystems and is intended to help disabled people navigate through the world of ATM machines, elevators, and other daily complexities.

"We are not giving away technology as charity," Fruchterman says. "We're trying to provide technology that maybe couldn't or wouldn't be provided by the for-profit sector. If we can offer it at a break-even level, it will enable us to launch other projects."

To supplement its revenues, Bookshare also routinely calls on corporations and foundations, including the Open Society Institute and eBay founder Jeff Skoll's foundation, for support. Silicon Valley companies such



Bookshare.org founder Jim Fruchterman has been named a Social Entrepreneur of the Year for 2003 by the Schwab Foundation for Social Entrepreneurship.

as IBM, Hewlett-Packard, Intel, and Fujitsu have chipped in with free and discounted computer equipment.

Sharing office space (and a foosball table) in Palo Alto with parent company Benetech, Bookshare.org attracts employees (Benetech has 18 employees and consultants, Bookshare.org has about five) who want to draw a steady paycheck *and* help people. It doesn't draw techies with visions of quick millions and lucrative stock options, the ones whose get-rich-quick lust was pummeled in the dotcom bust, but the people who work there don't take a vow of poverty either. According to Fruchterman, Bookshare.org's programmers earn salaries comparable to Silicon Valley norms.

Surveying the wreckage of the local dot.com binge, Fruchterman says that job and lifestyle expectations seem more grounded nowadays. Socially minded projects and proposals were a tougher sell during the boom times. Now he sees more job seekers reaching out for less glamorous but more lasting, less materialistic goals.

"There's a definite change, both in the engineering and business schools, as well as among mid-career professionals. The low point was two to three years ago during the dotcom craze, but the bust and 9/11 have really made people think. They ask, as they consider a new job, can it feed my soul as well as pay the mortgage?"

And if necessary he is more than willing to proselytize. "I feel strongly that I have a missionary role: to sell technologists on how much good technology can do in the world. We fail to give technologists a model between making scads of money on an idea or charity, and I think that technology can do so much for the people who can least afford it, as long as the cost is accessible."

Fruchterman sums up his quest as the search for common ground between what's possible and what's profitable. And as far as he is concerned, that interface is "just about the coolest place anybody could hope to work."

Voyager . . . from page 2

time, the Voyagers were intended to serve as a scaled-down version of a project called the "Grand Tour," in which NASA planned to send two spacecraft to Jupiter, Uranus, and Neptune, and another two to Jupiter, Saturn, and Pluto. The cost of developing the space shuttles and other projects forced NASA to cut back the "tour" to just two spacecraft and two planets, Jupiter and Saturn.

Voyager 2 was actually launched first, on August 20, 1977. Voyager 1 was launched 16 days later, but because it was traveling faster and was on a shorter trajectory, it beat Voyager 2 to Jupiter, making its nearest approach on March 5, 1979. Voyager 2's close encounter with the giant planet came four months later.

Stone says that Voyager 2 was originally planned as a backup to Voyager 1, in case the speedier craft failed. But when it succeeded in its mission to Jupiter and then to Saturn in November 1980, NASA decided to send Voyager 2 on to Uranus and Neptune after it too reached Saturn, in August 1981. While Voyager 1 was heading farther into space, Voyager 2 completed its encounter with Uranus in January 1986 and with Neptune in August 1989, taking its final picture in 1990.

The discoveries made by the spacecraft were numerous and astounding. One of the greatest surprises, says Stone, was the vigorous vulcanism on Jupiter's satellite Io, which was found to have 100 times more volcanic activity than Earth. Huge storms were found in Jupiter's atmosphere, and it was also discovered that Jupiter's moon Europa might have an ocean beneath its icy crust. Saturn's moon Titan was found to be smaller than expected, with a deep atmosphere of nitrogen and methane in which organic molecules are created and rain onto Titan's cold surface. Voyager 2 made the startling finding that the magnetic poles of Uranus were located near the planet's equator. Traveling on to Neptune, the spacecraft found that the giant gas planet had complete, not partial, rings surrounding it, and winds that traveled faster than those on any other planet. When Voyager 2 turned its sights on Neptune's largest moon, Triton, it saw active geyserlike eruptions sending nitrogen and dust particles several kilometers into space.

Beyond what the Voyagers saw, Stone says that it was an amazing engineering feat that they even traveled as far as they did. "Until we got to Uranus, nobody knew that the spacecraft would live that long," he said. In fact, just steering them away from Earth was a challenge. "These were the first fully autonomous spacecraft, with three computers, and software replacing the hard wiring that couldn't be changed in flight on earlier spacecraft. During those first six months, we learned to fly them, relying on computers that had just 8,000 words of memory—primitive by today's standards."

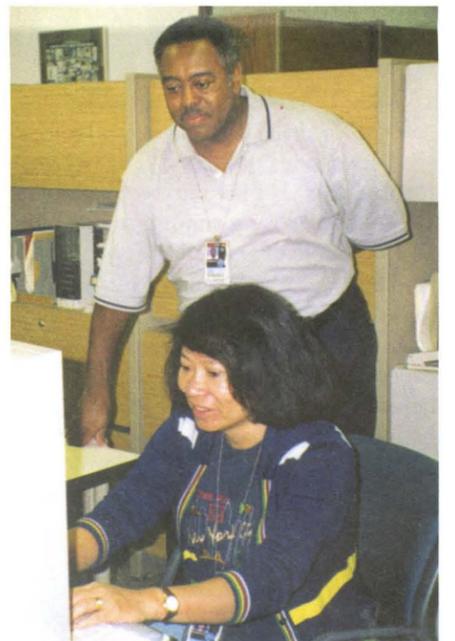
Although Stone has had many responsibilities during the time he has been Voyager project scientist—including the directorship of JPL from 1991 to 2001—he said that he never considered giving up Voyager to someone else. "This has been the voyage of a lifetime," he said. "The flood of discoveries has been unequalled."

Like dutiful children, the Voyagers still phone home once a day. It takes about 12 hours for JPL to receive a signal from them because of their distance. Voyager 1, the most distant human-made object, is now 8 billion miles from Earth. Voyager 2 is 6.3 billion miles from Earth.

Today JPL has 12 technical staff dedicated to the Voyager project. The team is led by Ed Massey, who serves as project manager, coordinating operations, science, administration, and public outreach. Massey is the mission's eighth project manager and, thanks to the Voyagers' durability, he is likely not the last. "It's surprising that all of the spacecrafts' systems have held up so well, from the computers to the attitude-control systems to the telemetry system," he says. "They put in lots of redundancies when they built these."

Once the Voyagers run out of power from their nuclear batteries and head deeper into space, it's anyone's guess what they will encounter. In about 40,000 years, Voyager 1 will come within 1.6 light-years of a star in the constellation of Camelopardalis. And in about 296,000 years, Voyager 2 will pass Sirius, the brightest star in our sky. In case something out there finds them, both Voyagers are equipped with a 12-inch gold-plated phonograph record containing a diverse collection of sounds from Earth, including selections from Bach, Beethoven, and Mozart, a Pygmy girls' initiation song from Zaire, and Chuck Berry's "Johnny B. Goode." Alas, no Elvis.

While the records come with a cartridge and a needle, the Voyagers are not transporting record players. But as Massey pointed out, if there are intelligent beings out in space, they're probably smart enough to build a turntable. "If some civilization finds it, they will know what Earth was like once upon a time," he said.



Billions of miles from home, the Voyagers continue to be directed and monitored by a dedicated JPL team that includes project manager Ed Massey and mission data manager Regina Wong.

MIKE ROGERS

Associates Activities

All events will be held at the Athenaeum unless otherwise noted. Individual invitations for each event will be sent monthly.

November 9, President's Circle Luncheon and Tour of Bowers Museum, Santa Ana—"Rediscovered Treasures: Masterpieces from the Nanjing Museum," with James Lee, professor of history, and Juliann Wolfgram, lecturer in art history



November 16, Northern California Dinner and Program at the home of Charles and Doris Pankow, San Francisco—Jess Adkins, assistant professor of geochemistry and global environmental science.

December 3, Associates Luncheon and Program—"White Diaspora: The Suburb and the 20th Century American Novel," with Catherine Jurca, associate professor of literature.

January 1, 2003, Tournament of Roses Parade Event.

January 27, Associates Board of Directors Meeting, Millikan Library Board Room—with Caltech president David Baltimore.



January 30, Associates Dinner and Program—"What Makes Us Different from Sea Cucumbers?"—Development of the Vertebrate Brain," with Marianne Bronner-Fraser, Ruddock Professor of Biology.

February 27, Associates New Member Dinner, with David Baltimore.



LOOKING IN ON THE CALTECH ASSOCIATES: Top, left: Associates Mark Sturza '77 and Rose Sturza check out an exhibit of Caltech student art on display at the president's residence. They were among approximately 200 guests who attended the President's Circle Garden Party reception and dinner at the home of David Baltimore and his wife, Alice Huang, in June. At right, fellow attendees Malcolm and Mary Ann Cloyd, Kimberly Ebner, and John Glanville chat in the garden of the president's residence. Above, left, an Associates trip to the Grand Canyon, led by geobiology professor Joe Kirschvink '75, MS '75, included a Colorado River voyage on a zodiac raft. Above, right, trip participants Evelyn Flam, Nancy Allen, Jack Irving '42, John Carney '56, MS '57, and Paul Allen '42, alight at the visitors' entrance of Zion National park in Utah. Associates membership is open to all alumni and interested friends of Caltech. For more information, please contact the Associates Office, 105-40, Pasadena, CA 91125; Phone: 626/395-3919; E-mail: jyoung@dar.caltech.edu

Wilkie . . . from page 6

system that is fair to all, including smaller companies, again while ensuring that the final results are in the public's best interests.

Wilkie brings to the FCC what he self-effacingly calls a "boring economic philosophy" that can best be described as studying the details.

"I believe that with each economic problem, the individual details of that problem are tremendously important," he says. "So in the traditional broad debate between market forces and government regulation, the wrong questions are often posed. By studying the specifics of each issue, we can avoid the most significant policy failures."

Wilkie is an internationally known scholar with extensive experience in the communications industry. Before joining Caltech, he was a member of the technical staff and a postdoctoral fellow at Bell Communications Research (BellCore). He also serves on the editorial board of the *Journal of Public Economic Theory* and he has published widely on spectrum auctions, game theory, and telecommunications regulation.

Wilkie has been a Caltech faculty member since 1995. He received his undergraduate degree at the University of New South Wales in 1982, and his PhD in 1990 in economics at the University of Rochester.

Alda . . . from page 7

ing the awful destructive power of the bomb he had helped create, left him reeling. He was teaching at Cornell, dispirited and at loose ends, when one day he observed a guy tossing a plate in the air in the school cafeteria. The plate had a university seal imprinted on its rim, and Feynman saw from staring at the insignia that the rotating plate's spin and wobble were not quite in sync.

Alda explained, "He gets fascinated, and he tries to figure out the relationship between the spin and the wobble. He spends months on this, and finally comes up with this complicated equation, which he shows to Hans Bethe.

"And Bethe says, 'That's interesting, Feynman, but what's the importance of it?'"

"And Feynman says, 'It has no importance, it's just fun!'"

The story underscores the absolute value Feynman placed on sheer enjoyment in the scientific process. "That playful inquiry, according to Feynman, eventually led in a circuitous way to the work that won him the Nobel Prize."

Alda added that Feynman's insistence on rejecting pat explanations of things, including standard textbook treatments of quantum mechanics, seems to hold particular relevance today. In an apparent allusion to fears of terrorism, Alda said that contemporary society craves certainty, maybe too much so.

"You're graduating today partly as Feynman's heirs in this gloriously courageous willingness to be unsure. And just as he was heir to Newton, who was heir to Galileo, I hope you'll think about devoting some time to helping the rest of us become *your* heirs."

Coverage of the 2002 commencement and related links, including a Webcast of Alda's speech, can be found on the Caltech Web site at <http://pr.caltech.edu/commencement/02/>.



Alda finally "meets" Feynman in a photo montage that President Baltimore presented to the actor at the post-commencement Speaker's Luncheon. Caltech News readers may recognize this graphic, which depicts the physicist giving Alda a characteristic once-over in his Caltech office—it originally appeared as an illustration in Caltech News #1, 2001.

REFLECTIONS ON THE CALTECH COMMUNITY

It's been a fair number of years since I first walked onto the Caltech campus and saw the "Welcome Co-Techs" sign that greeted Caltech's first class of undergraduate women. At the time, I wasn't sure how I felt about the sign, or where I would fit into this university I'd chosen. A lot was defined pretty quickly, though. The Caltech "House" system, both then and now, provides a strong framework for the community—perhaps in many ways the most important one for many undergraduates. Some of the most valuable lessons I learned were from my fellow students at 1 a.m. in those fabled "bull" sessions in Alley 45 of my house.

Working in various laboratories gave me another community, one with faculty, postdocs and graduate students, all of whom gladly took me into their research groups and taught me not only about science and life as a scientist, but also about life after being an undergraduate. Other professors were present in our lives—who can forget "Dirty Dave" (aka literature professor David Smith, then master of student houses) and his belly dancers on the Olive Walk, or Harry Gray and the "Nitty Gritty Group" (you had to score lower than a designated grade on the midterm to join that one), or Richard Feynman, who was known to show up at house parties to dance and play the bongo drums.

Like most young alumni, I lost contact with the Caltech community for several years after graduation. There was law school, career, kids, community activities, and maybe even a little Caltech burnout after a pretty intense experience. During the last several years, I have had the very rewarding and fun opportunity to once again become active in the Caltech community. Through the Seminar Day Committee, the Alumni Association Board, and recently as a member of the President's Task Force on Undergraduate Residential Life, I have spent a lot of time with alumni older than myself and with many of my old classmates, as well as with recently graduated alumni and current students. I never cease to be amazed at the ties Caltech alumni feel toward one another and toward current Caltech students, and how much they find they have in common—even when they are generations apart.

I am also constantly reminded of the intensity of their continuing interest in the House system, the honor system, and student self-governance. These attributes of Caltech life are under tremendous outside pressure these days, and while they

continue to be strong, they face increasing challenges. An honor system only works if essentially all of the members believe that it works and abide by it. Self-governance only works within the community if it earns the respect of those it affects.

Why do alumni long gone from the campus care so much about these issues, which really would seem relevant only to current and future students? I think that in many ways these aspects of Caltech life defined our community and made it different from the world outside. What I remember most about my experience in the student houses was the sense of acceptance, of being family, of people watching out for me. The trust that comes from a working honor system, the feeling of respect that enables a school to have nonproctored, take-them-when-you-want finals, was a heady experience. The uniqueness of that experience bound us as much as our love of science, our fascination with how things work, and our appreciation of the elegance of a proof or formula.

Students at Caltech today are exploring what these things mean to them, what they meant to those who have gone before, and how they fit into their world today. By the time you read this, many of you may have responded to a survey that examines these issues. It is being conducted by a couple of current undergraduates as part of the Summer Undergraduate Research Fellowships (SURF) program. I know that both current students and alumni will be interested in the results, and we'll pass them along when they are available.

Meanwhile, please join us in one or more of the Alumni Association activities, and enjoy meeting up with some other alumni and current students. If you haven't reconnected with Caltech in a while, you'll be surprised at how much fun it is!

Debbie Hall



New Association president Debbie Dison Hall '74 is joined by fellow members of the 2002–03 Association Board Executive Committee. Counterclockwise from front row, left, they are: Hall, Tom Tisch '61, vice president; Ted Jenkins '65, MS '66, past president; Stephanie Charles '73, treasurer; and Ponzy Lu '64, secretary.

Four members of the Caltech community who have contributed significantly to the quality of campus life for students were recognized for their contributions and elected honorary members of the Alumni Association in June. Pictured from left are Hall Daily, assistant vice president for government and community relations and adviser to the California Tech; Sharyn Slavin Miller, assistant vice president for Student Affairs; Delores Bing, director of Caltech's student chamber music program; and Bill Bing, director of the Caltech concert and jazz bands.



JOIN ASSOCIATION AT ROSE PARADE

Please join fellow Caltech alumni and friends as we welcome in the New Year with *Children's Dreams, Wishes and Imagination*, the theme of the 114th Tournament of Roses Parade! Your parade-morning package includes parking, reserved parade seating, and lunch at the Athenaeum, with an optional breakfast available at an additional cost. We will send confirmation of your reservations, along with a parking pass and additional information. Tickets will be held for pickup at the Athenaeum on the morning of January 1.

The cost is \$75 per person (\$70 for children under 12).

The optional breakfast is an additional \$10 per person.

Here is the day's schedule:

- 7 a.m.– 8:15 a.m.—Parade-ticket distribution and optional breakfast
- 9 a.m. (time approximate)—114th Tournament of Roses Parade (Association seating on Colorado Blvd., in front of the Pasadena City College Library.)
- 11:45 a.m.—Buffet lunch at the Athenaeum

You can now register online. Go to <http://www.its.caltech.edu/~alumni/> and click on Events. Or please fill out the registration form below.

2003 Tournament of Roses Parade Reservation Form

I will attend the 114th Tournament of Roses Parade and luncheon.
Enclosed is my payment for

Reservations at \$75 per person

Reservations for children under 12 at \$70 per person

I will attend the optional continental breakfast at the Athenaeum.
Enclosed is an additional \$10 per person for reservations.

My check is enclosed in the amount of \$ _____

I would like to pay with my credit card: Visa Mastercard

Card Number _____ Expiration _____

Name (as it appears on card) _____ Class _____

Address _____

City _____ State _____ Zip Code _____

Daytime Phone _____ Preferred E-mail _____

Please make check out to the Caltech Alumni Association. Mail payment with the form to Caltech Alumni Association, Mail Code 1-97, Pasadena, CA 91125

Alumni Activities

NOVEMBER 12

Washington, D.C., Reception with Caltech President David Baltimore, National Academy of Sciences, 5:30–7:30 p.m.

JANUARY 1, 2003

Tournament of Roses Parade Event, followed by lunch at the Athenaeum (see reservation coupon, facing page).

ON GALAPAGOS, ALUMNI FOLLOW IN DARWIN'S FOOT STEPS

This past summer, 36 alumni and friends of Caltech traveled to the equator to sail among Ecuador's Galapagos Islands, accompanied by two Caltech faculty members. During the 11-day voyage, developmental biologists Marianne Bronner-Fraser and Scott Fraser spoke on a wide variety of topics, covering Darwin's travels and theories, the workings of the evolutionary process, and current Caltech research in developmental biology. The group hiked the archipelago, cruised pristine lagoons in inflatable Zodiac boats, snorkeled with sea lions, penguins, and rays, and examined the islands' volcanic origins firsthand. There were even some very personal encounters with the rare and famous giant tortoise of the Galapagos.

"Everybody everywhere was so friendly and helpful," said participant Dave Wilson, PhD '58. "My wife, Marty, and I loved the ship—I hadn't been on a sailing ship since I was in high school. Things were very well organized—we had absolutely everything we needed and very little we didn't need. The reading list had Marty and me busy and fascinated for weeks before and after the trip. The trip far exceeded our expectations in all respects. The lectures were enjoyable, the guides superb, the destination spectacular."

In 2003 the Association plans to bring an alumni group to New Zealand, as well as offering a destination within North America. Check out the Association's Web page at <http://www.its.caltech.edu/~alumni> or contact Arlana Silver for more details (arlana@alumni.caltech.edu or 626/395-8363).



Above Photo: A view overlooking Sullivan Bay and James Island, where alumni travelers snorkeled with sea lions. The famous landmark known as Pinnacle Rock is visible at far right. Galapagos penguins, the second smallest penguins in the world and the only species found north of the equator, are often found at its base. **Center:** The giant Galapagos tortoise makes an appearance on Santa Cruz island. **Top:** Alumni cross a lava field on dramatic James Island.

T e c h

T a l k

THEN VERSUS NOW—ALUMNI WEIGH IN

Dear Editor:

The recent *Caltech News* has solicited comments from alumni to address the relative difficulties students have today versus those of other years. ["Are Caltech Students Overworked?" *Caltech News*, No. 2, 2002] For what it's worth, I've written a longish thumbnail of my personal history, which may have some points for comparison with the perspective of others.

I am a graduate in chemistry (with honors) from 1955, and I am not really able to decide about the degree of difficulty students experience today. I do not believe that the grade inflation of Harvard, Yale, and Princeton, which has been around since the college days

of George Bush and before, has ever come to Caltech, and it certainly wasn't there in 1951–1955. In 1951, by the way, Caltech switched from using its own entrance exam to the College Boards. Some years ago (while soliciting money), the Institute mentioned that the admission hurdles for my entering class were the lowest on record (they also accepted the largest proportion of applicants ever that year). So, presumably a good number of us were much less well-prepared for the tasks ahead than are today's students. Does that imply people had to work harder then to keep up? Maybe.

I was a Southern Californian; my background was not an affluent one; and I was the first in my family to go to college. Today Caltech says it can provide support for all who need it, but it was not in such a position in 1951. I could afford neither tuition (\$450!) nor to live on campus. Caltech made me a

loan for a couple of semesters, which came with the request that the recipient find a job. So I lived with relatives 40 miles from campus and found a job as a technician in Montebello. What was more stressful for all of us back in the era before ubiquitous air conditioning was the intense photochemical smog concentrated in San Gabriel—one could see the trees on San Pasqual disappear into the murk on the bad days—and which on the Pasadena and Hollywood freeways literally made you cry (Arie Haagen-Smit demonstrated that to us in class one day with an acetyl hyponitrite release). I was also a draft-eligible 1A for two years (Korea was still running), which had its own impact on the student environment.

There were few options in course load or composition for two years (I did take astronomy, which turned out to be a first course in quantum theory, and a class in geology). In my last two years,

I was hired by Jack Roberts in chemistry to do research, and so I worked nights in Gates, supervised by grad students and postdocs. That was exciting and truly educational—the real payment for that work!

The courses were different then (Linus Pauling personally taught us both general chemistry and public speaking—in different classes), but others will have to decide whether J. Kent Clark taught a more or less challenging English class than today's faculty (I had to be Lady Macbeth in his class!), and to make those judgments also about Jack Roberts, Norman Davidson, Ernest Swift, Carl Niemann, Don Yost, George Beadle, and the many others by whom we were instructed. I assume that course range and content today is much more demanding, although I wonder whether

Continued on page 16 . . .

Letters . . . from page 15

the number of extracurricular hours required to get it done is higher now than then.

What I do know is that, other than late night hamburger breaks at Bob's Big Boy, I could still find little disposable time at Caltech for much social life or extracurricular events.

Among the 600 or so undergrads, however, there were many who had lots of time on their hands for these activities, not to mention the few truly exceptional students who ran straight 4.0 averages or better without bothering to attend class or do homework. Others, however, did not get to graduation (including some faculty children) or struggled to get through academically.

So the answer is probably that today's students, like yesterday's, are distributed across a degree-of-difficulty spectrum that depends on personal circumstance and many other parameters. If they are all indeed more capable than my class was, perhaps that means they have to work less hard, or if they are more ambitious, perhaps they work harder and accomplish much more. With both content and opportunity more challenging now than in the '50s, the students of today are probably the ones who have the tougher time. And then there's the question of who complains more.

I enjoy the *Caltech News* and look forward to each issue.

-R. J. Piccolini '55

Regarding the question of whether Caltech and other schools have gotten harder since I was in school, I suspect not. In the 1960s and early 1970s, I attended MIT as an undergraduate and Caltech for graduate school. Both were very demanding, and I really don't see that there is much room for either school to have become more so over the years. It has long been the case that those applying to Caltech have expected a good workout and a good education to show for it.

-Robert Kline, PhD '74

I just finished reading the article "Are Caltech Students *Overworked?*" in the latest issue of *Caltech News*, I have no idea if things are tougher or easier than they were when I attended from '75 to '79. The academic environment

Caltech News welcomes letters from readers while reserving the right to edit and select them for publication. Please send correspondence to hja@caltech.edu or to Caltech News, Caltech 1-71, Pasadena, CA 91125

"So the answer is probably that today's students, like yesterday's, are distributed across a degree-of-difficulty spectrum that depends on personal circumstance and many other parameters."

was tough when I went, but I wouldn't have had it any other way. My experience and education at Caltech stand out as the best intellectual experience of my life. I regularly draw on those experiences and that education.

Before Caltech, I never worked hard at anything. School material could be mastered with a glance at the book. Homework was a joke. I received straight As in everything. But I knew it was too easy, and I wanted to attend a university with some serious academics. Caltech was it.

The first three semesters at Caltech, I had no idea how to apply myself. I came close to flunking out. I wasn't working. The low point was finals in my sophomore year. I wasn't prepared, and knew it. The stress was very painful; I couldn't face flunking out.

With a lot of hard work and coaching from my roommate (thanks, Mark!) I was able to learn enough to squeak by the exams. Never again, I thought; and resolved to never miss a class again, to write down all the notes during lectures, and to work every problem on every homework assignment until I understood it.

I learned that the professors knew what they were doing—by working in this new manner I was able to do a credible job on the exams. As the semesters went by, I didn't get any smarter, but my grades steadily improved. Much better than graduating, however, was the confidence that I could master any seemingly impossible problem. I don't much use the specific knowledge I learned at Caltech, but I do use the techniques I learned to solve problems, and that is the true value in the way Caltech teaches. The value was apparent in my first job after graduation when compared with what my colleagues from other universities received. The way Caltech teaches works, and works well. Don't change it.

My special gratitude goes to Professor of Physics Ricardo Gomez, who kindly tutored me in calculus in his spare time, and of course to all my friends in Page House who helped me conquer the homework problems.

—Walter Bright '79

Class Notes

1942

John McClain
JANDEMCC@aol.com

My choice of jobs today seems to be to write this column or balance my bankbook. Since writing this is a lot more enjoyable and has a lot more chance of success, I think I'll opt for that.

The 60th reunion of our class has come and gone. For those of you who attended, thanks for helping make it a success. For those of you who couldn't make it, including Paul and Nan Allen, and Al and Edie Albrecht, you were missed.

We started Thursday evening with a reunion-classes reception at the home of President Baltimore and his charming wife, Alice Huang. President Baltimore gave a very interesting chat on what is going on and what is planned for the future at Caltech. We then adjourned to the Athenaeum for dinner, where we were joined by several members of the class of '37. This was especially enjoyable for me because of the presence of **Munson Dowd '38**, MS '46, and his wife. Mun was the upperclass committeeman in Alley 2 [Frosh Alley] in Fleming when I entered in 1937.

Our speaker for the evening was Diana Kormos Buchwald, who is a professor of history and in charge of the Einstein Papers Project now in progress at Caltech. She gave a very interesting and infomative talk on Einstein.

Seventeen class members plus wives or friends wre present at the Half Century Luncheon on Friday. It is always an outstanding affair, especially since you run into people who were at Tech when you were but were not in your class. It was great to see **Yosh Nakada '40**, MS '41, and his wife and **Tway Andrews '44** and his wife, Joyce. Tway has a new retirement profession. He's a golf-swing analyst, so any of

you who can still swing a club and want to be analyzed, get in touch with Tway. The luncheon speaker was Provost Steve Koonin, who gave a great talk comparing the Tech of the '50s with today's Institute.

June was my high-school reunion from Punahou, in Honolulu, and I will never miss a chanch to go to the Islands. We had a wonderful eight days in Hawaii and returned in time to go to Palo Alto to see our oldest grandson get his master's degrees in ME and business. I'd write more about the rest of you if I had any input! I did have a note from **Fred Feldberg, MS '45**, who reported that he was still in reasonably good health, traveling, golfing, etc., but that his wife was in a rest home.

I did have an interesting phone call from Judy Capron in the Caltech bookstore requesting info on the "one design" class rings that we had in the '40s. It seems that there is now a movement to restore some of the "traditions" that have been lost over the years. There is no doubt that the rings that were produced by L. G. Balfour and T. V. Allen were quite distinctive, compared to those of the service academies and every other college in the country. If you have any input on the subject you can reach Capron at 626/395-2305.

Well that about does it for now, and besides it's 6 p.m.; the sun is over the yardarm; and it's time to splice the main brace. Hope y'all had a great summer.

1986

Scott Karlin
karlin@alumni.caltech.edu

Lisa (Cummings) Baxter writes that she is taking a break from her career to be home with her two boys, Colin, nine, and Liam, two. She just earned her Kenpo Karate black belt and is celebrating with Colin, who has earned his junior black belt.

CLASS NOTES CUTOUT COUPON

If you're a Caltech undergrad with a class agent, please take a moment to update us on what you've been doing, and we'll be sure to send that info on to your class agent. Return this coupon and any additional materials to Caltech Alumni Association, 1-97, Pasadena, CA 91125. If you would prefer to e-mail your news directly to your agent, you can find your agent's name and e-mail address on the Web at http://www.its.caltech.edu/~alumni/class_notes.htm. And if your class doesn't yet have an agent, please fill out and mail the Personals Coupon in the *Personals* section.

Name _____

Option and Degree Year _____ New address? _____

Address _____

Day Phone _____ E-mail _____

NEWS _____

Personals

1990

Ed Lee
edlee_@hotmail.com

Hello from Santa Barbara. Well, actually, I am writing this from Toronto, Canada, because I am visiting family here for a few days. Back in April and May 2002, I had cameo appearances, aka "background" or "extra" work, on *Ally McBeal* ("What I'll Never Do For Love Again") and on *The Shield* ("Two Days of Blood"). I stay in touch with the Santa Barbara City College theater group, and I made a few student films during the spring semester at SBCC.

Mike Masonjones writes, "MikeMasonjones (formerly Jones '90), wife Heather of twelve years, and the three kids (Sawyer, ten, Kellerin, nine, and Graelyn, six) braved the family minivan for five weeks on the ultimate 4x-cross-country driving trip from hell. We drove 11,200 miles—Florida to L.A. to Montana to Arizona and back to Florida. Sixteen national parks, six national monuments, nineteen states. Camped all but four days. Trip of a lifetime—mostly because I don't think I could convince anyone to do it again in my lifetime."

And this from Dean Oliver, "I'm obviously taking time off to write my book on basketball and staying at Dave Carta's. The book is coming along quite nicely. I'm about halfway through after four months, and my readers seem to like it a lot. I am still working for ENVIRON on a limited basis, working on the remediation of the MTBE plume in Santa Monica and other projects. I just met with the Seattle Supersonics today about some of the work I've done for them. They were really happy, which made me incredibly psyched. I visited Seattle for an economics conference, where I learned a lot and contributed probably only a little to the sports economics literature. All in all, I'm spread really thin, but doing a lot of things that are fun."

David Edwards sends word that he has been promoted to the rank of associate professor of mathematical sciences at the University of Delaware. His wife, Jacqueline Holmes '91, continues as a senior associate at the law firm of Jones, Day, Reavis & Pogue. They are adjusting to life with their new daughter, Hope, born 10/15/00 in Maslyanino, Russia, who arrived home in July. They live near Baltimore, Maryland.

1936

Peter Serrel, MS '39, and Alumni Association president 1963–64, writes that he and his wife, Kathleen, have been living in a retirement community, Terwilliger Plaza, in Portland, Oregon, since 1997, and that he is now finally retired. His last paid professional activity was with Tom Lang '48, BS '50; they worked on the propulsion and structure of SWATH (Small-Waterplane-Area Twin-Hull) ships up to the end of the '80s. Earlier, he had worked with Al Bodine, MS '59, at a San Diego subsidiary of Shell Oil, attempting to apply sonics to heavy industry, and prior to that he had worked at the Santa Monica office of Arthur D. Little, Inc. Whether self-employed or working for others, he writes, "I have specialized in the solution of unusual mechanical and structural design problems." He adds that "we are proudest of our four daughters, the third of whom we lost to a drunken driver in 1993." Their eldest, a CPA, retired after 12 years as Portland's city auditor, but she "lives nearby and gives us much appreciated support in our old age and precarious health." These days, he reports, "reading, writing, and volunteer editing and engineering keep us occupied, and our lay-led Unitarian Universalist Fellowship (Church) provides a loving community."

1939

Charles E. Pettingall reports that after graduating from Caltech he was employed briefly at Lockheed and the Federal Power Commission, then joined Douglas Aircraft, where for 20 years he worked in the field of flight testing. He later spent several years each at Hughes Aircraft Company, as a lunar and planetary engineer on the Surveyor program; at McDonnell Douglas West, with the Air Force's Manned Orbiting Laboratory (MOL) project; and at JPL, with the Voyager project as a planner in mission operations. He is now retired and living happily in the desert 10 miles southeast of Tucson.

1940

Keith "KA" Anderson has been inducted into the Idaho Engineering Hall of Fame by the Idaho Society of Professional Engineers, an affiliate of the National Society of Professional Engineers.

George R. Brown writes, "Well, the principal news around here is that I'm still here. Life presents no great problems other than my ability to communicate. When placing a business call, I am instructed by a recorded voice to press one or two of about seven selections to continue my call. When she is finished, I still don't know which is what I need. I wish Mert were still with us!"

1944

Cornelius Steelink, professor emeritus of chemistry at the University of Arizona, is the author of "Investigating Humic Acids in Soils," which is the cover story for the June 1, 2002, issue of *Analytical Chemistry*, a journal published by the American Chemical Society.

1946

James Evans reports that he has been retired for 21 years. He spends winters in the desert, with a golf game "now and then," and summers at Newport Beach. He takes an occasional trip to, as he puts it, break up the monotony.

1947

Edward B. Winters, of Santa Rosa, California, and a member of Caltech's football team in 1946 and 1947, reports that he is now retired and playing golf and poker, pulling weeds in his garden, participating in the Rotary Club, and traveling. He would like to contact and/or hear from classmates, especially those in the San Francisco Bay Area.

1948

John Wing Allingham, MS '54, writes that his only contact with Caltech has been through *Caltech News* and Stan Holditch '48. "He has been very good in keeping me informed about a few of my classmates. As for myself, I haven't been flying for a couple of years; the FAA doesn't like my medication. Also my wife felt that she would be more comfortable if I stopped flying. I hate to part with my beautiful sailplane, as it brought much pleasure exploring the valleys and ridges of Frederick County and beyond. I'll have to explore some of the trout streams in Maryland and West Virginia or the Bay as an alternative," which, he adds, is "nothing comparable, however, to Stan's trips to the waters of the Belize region."

1952

Theodore Y. Wu, PhD, professor of engineering science, emeritus, at Caltech, was elected a Foreign Member of the Chinese Academy of Sciences at its 11th annual meeting, which concluded on June 1. He was recognized for his contributions to fluid mechanics as well as his expertise and his international academic interaction and collaboration. A member of the National Academy of Engineering and of Academia Sinica, he is also a John Simon Guggenheim Fellow, a Fellow of the American Physical Society, an Australian Universities and CSIRO Fellow, a Fellow of Japan Society of Promotion of Science, and a recipient of the American Physical Society's 1993 Fluid Dynamics Prize.

1954

George Wallerstein, MS, PhD '58, now professor emeritus at the University of Washington, has been awarded the 2002 Henry Norris Russell Lectureship—the highest honor of the American Astronomical Society—for his career accomplishments in research in astronomy.

1955

Francesco Beuf, an associate clinical professor of pediatrics at the University of Colorado Medical School and a practicing pediatrician in Boulder, has been chosen Kaiser Permanente Outstanding Clinical Sciences Teacher of the Year (2002) in recognition of his "overall excellence as an educator." After receiving his BS from Caltech, he worked for General Electric's Missile and Space Division, graduating from GE's Advanced Management School and spending his last four years as manager of the division's international operations. In 1972 he took a leave of absence to attend Temple University's School of Medicine, graduating in 1976, and he bought his current practice in Boulder in 1991. Board certified in pediatrics, and with particular interests in the areas of asthma/allergy and neonatology, he is a fellow of the American Academy of Pediatrics, a member of the Colorado and Boulder County Medical Societies, and a recipient of the American Medical Association's Physician's Recognition Award with Commendation for Self-Directed Learning, and his articles have been published in national journals of medicine and interplanetary exploration and in sports-car magazines. He and his wife, the artist Penni Pearson, have three children, two stepchildren, and three grandchildren. His outside interests "include biking, skiing, racing my sports car, exploring Boulder and Denver restaurants with Penni, and trying to stay ahead of the deer and the weeds, which are competing for the garden."

1958

Lloyd R. Welch, PhD, professor emeritus of

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O b i t u a r i e s

electrical engineering at USC, has been selected to receive the 2003 Shannon Award of the Information Theory Society of the IEEE. The highest honor conferred by the Information Theory Society, it is named after the late Claude E. Shannon, who is considered the founder of information theory. "In addition to a certificate, a plaque, and a generous honorarium, the Shannon Awardee is also designated as the Shannon Lecturer, the keynote speaker at the annual weeklong International Symposium on Information Theory (ISIT)." Dr. Welch's selection was announced at the July conference banquet of ISIT-2002 in Lausanne, Switzerland, and he is scheduled to deliver the 2003 Shannon Lecture next July at ISIT-2003 in Yokohama, Japan."

1959

William L. Ko, MS, PhD '63, stayed on after receiving his doctorate from Caltech to do research regarding solid rocket motors, he and his professor developing the Blatz-Ko constitutive law for hyperelastic materials—known as Blatz-Ko materials—such as solid rocket motor grains. Currently, he is at NASA Dryden Flight Research Center, Edwards, California, conducting research on various thermostructural problems associated with future hypersonic flight vehicles. A member of the American Institute of Aeronautics and Astronautics, the American Society of Mechanical Engineers, the Society of Rheology, the Society of Sigma Xi, the International Solar Energy Society, and the Society of Engineering Science, Ko has published more than 100 internationally recognized scientific papers and has received a variety of scientific achievement awards, including NASA's Exceptional Service Medal. He at one time worked as a steam-locomotive engineer, and is preparing to publish a book entitled *Railroad Short Stories and Railroad Fine Art*, which will feature 32 of his own color paintings. His paintings have been published in *American Artist* and *Southwest Art*, and his *LBJ Ranch in Spring Time* is part of the permanent collection of the Lyndon Baines Johnson Library, in Austin, Texas. He is director of the Ko Watercolor Research Center, in Lancaster, California.

1960

Leroy Hood, PhD '68, president and director of the Institute for Systems Biology, and a visiting associate in biology at Caltech, "will receive the 2002 Kyoto Prize in 'Advanced Technology' for outstanding contributions to biotechnology and medical technologies," according to the Inamori Foundation. The prize, which will be awarded November 10 in Kyoto, Japan, comprises a diploma, a gold medal, and a cash gift of approximately \$400,000. Hood will also participate in the second annual Kyoto Laureate Symposium, at UC San Diego, March 5–7, 2003. He "has played a crucial role in advancing the life sciences, contributing particularly to the successful mapping of the human genome during the 1990s—a process originally predicted to require up to 100 years to complete. . . Hood's success in developing automated instruments for the synthesis and determination of protein and DNA sequences represents a milestone contribution to this field." He currently lives in Seattle.

1961

Jim Kallis, MS, of Los Angeles, married Beverly Ball, a dentist, this past July 14.

1971

Clifford Will, PhD, professor of physics at Washington University in St. Louis, has been elected a fellow of the American Academy of

Arts and Sciences. Founded in 1780, the academy honors distinguished scientists, scholars, and leaders in public affairs. In July, Will completed a 10-year stint as chair of Washington University's physics department and stepped down in order to return to full-time teaching and research.

1984

Norbert Arndt, MS, PhD '88, writes that, "after enjoying life in the Midlands of England for two years," he and his family have moved back to Berlin, where he has joined the management board of Rolls-Royce Deutschland as director of engineering.

1998

Ashwin Vasavada, PhD, writes, "I'm currently a Science Fellow in the U.S. House of Representatives. I work as a legislative aide to Rep. Vernon Ehlers (Michigan), and work with the House Science Committee on science policy issues." In fall 2002, he adds, he will return to UCLA as a faculty member in the department of earth and space sciences.

2001

Carrie Bunce has been appointed a project engineer by Kaikor Construction Associates, Inc., a general engineering contractor firm. She previously had been a project coordinator and research associate at the Next Generation Space Telescope Group on the island of Hawaii, and an engineering intern in Honeywell International's Space Systems Division.

John D. Scollard, who was a chemistry postdoc at Caltech 1998–2001, has accepted the position of director of research and development for Testmark Laboratories Ltd. He is living in Sudbury, Ontario.

MANY MOONS

Commemorating the Voyagers' 25th anniversary (see UpFront story, page 2), our back-page poster showcases some of the moons photographed by the two spacecraft. All images of the Uranus and Neptune satellites are from Voyager 2; Voyager 1 images of the moons of Jupiter and Saturn are indicated.

From the top, first row: Jupiter's moon Io, passing in front of the planet (Voyager 1); Io in full volcanic color (Voyager 1); mosaic crescent of the Jovian moon Europa; Saturn's moon Enceladus; Saturn's moon Iapetus. Second row: Europa (Voyager 1); Uranus's outermost moon, Oberon; false-color image of the haze layers across Saturn's moon Titan (Voyager 1); Saturnian moon Rhea (Voyager 1); false-color image of Jupiter's moon Callisto. Third Row: Saturn's dramatically cratered moon, Mimas (Voyager 1); color composite of Uranus's moon Titania; detail of Uranian moon Ariel, showing transecting valleys and impact craters on its surface; composite view showing Neptune on the horizon of its moon Triton, whose surface is computer-generated from a Voyager 2 image; the crescents of Neptune and Triton. Fourth Row: Neptune's moon Nereid; and color composite of Uranus's moon Miranda. O brave new worlds!

These images and many others can be viewed online at the JPL Planetary Photojournal at <http://photojournal.jpl.nasa.gov/>.

1923

Max B. Alcorn, of Pasadena, California, on January 22, 1998. He is survived by a daughter.

1931

Howard G. Smits, MS '33, of Santa Barbara, California, on June 18, 1998. He was president of Pacific Iron and Steel Company, in Los Angeles, and conducted business in Brazil, the Congo, and Southeast Asia. He later raised avocados in Poway, California. A past president of the Caltech Associates and the Pasadena Boys Club, he also had been involved with Pasadena Planned Parenthood. He was a member of the Gnome Club at Caltech. He is survived by Gwen, his wife of 63 years, and by three daughters, four grandsons, and three great-grandchildren.

1932

Charles W. Jones, of Laguna Niguel, California, on April 23, 2000. He is survived by his wife, Marijane; a son, Donald; a daughter, Donna Mathisen; and four grandchildren and six great-grandchildren.

1938

William E. Twiss, of Sunland, California, on August 30, 2000; he was 82. A metallurgist, he was president of Twiss Heat Treating Company, in Burbank, California, for over 60 years. He received numerous awards from Lions Clubs International, of which he was a member for more than 45 years. A member of the American Society for Metals and the Metal Treating Association, he served as president of local chapters for both organizations. In Burbank, he served as president of the Burbank Council of the Camp Fire Girls and as president of the PTA at Villa Cabrini Academy and Providence High School. He is survived by Evelyn, his wife of 48 years, and by four daughters and eight grandchildren.

1939

John Kaye, MS '48, of Charlottesville, Virginia, on May 25; he was 86. He worked for a time at Caltech and Hughes Aircraft, then joined George Washington University in 1950 as an assistant professor of mechanical engineering; he retired as professor emeritus of engineering and applied science in 1986. His memberships included the Society of Mechanical Engineers and the social fraternity Sigma Chi. He is survived by his wife, Isabelle, and by a daughter, Lynne Kaye Subler.

William G. Lawson, of Pomona, California, on July 2, 2000; he was 85. He served as a U.S. Navy ordnance officer during World War II, then returned to Pasadena and joined family friend P. S. Pomeroy in a small construction business that eventually became Pomeroy-Lawson, Inc. A member of the Tournament of Roses since 1949, he became a member of the executive committee in 1969, but two years short of becoming president resigned to assume the full-time responsibilities of executive secretary and manager, which position he held from January 1973 to January 1980. After a year's retirement he was asked to return for a six-month reorganization of the office management. Active in civic affairs, he was past president of the International Festivals Association and of the Pasadena Optimist Club, as well as past president and senior judge emeritus of the Cymbidium Society of America, and a member of the board of the Salvation Army. He enjoyed

retriever field trials, hunting and fishing, foreign travel, and the collecting and hybridizing of orchids. He is survived by his wife, Patty; a son, Key; two daughters, Carolyn Unruh and Virginia Bech; and seven grandchildren and one great-grandchild.

1940

Dwight H. Bennett, in La Jolla, California, on July 10; he was 84. A retired aerospace engineer and flight instructor whose career spanned more than 40 years, he began in 1939—a year before graduating from Caltech—working on B-24 Liberator bombers for Consolidated Aircraft, the forerunner of Convair, which is now a division of General Dynamics. He spent 23 years with San Diego-based Convair, designing and flight-testing aircraft including the Sea Dart supersonic seaplane and the F-102 and F-106 supersonic interceptors, before leaving in 1962 as assistant chief engineer for advanced design. He spent two years as vice president and assistant to the general manager at the Aero Commander division of Rockwell, in Bethany, Oklahoma, then went to work for McDonnell Aircraft Company in St. Louis. There, as a senior project engineer, he worked on the Breguet 941; the four-engine plane, produced in France, demonstrated that a large aircraft could be operated from short fields usually reserved for smaller and lighter planes. Later, as director of program engineering at McDonnell, he oversaw development of an advanced F-4 Phantom, and in 1980 he was promoted to manager of the F/A-18 Hornet project, based at Northrop in Los Angeles. After retiring in 1982, he worked as a full-time flight instructor in Long Beach, then returned to San Diego in 1989, settling in the Point Loma area. From 1940 to 1985 he logged 6,000 flying hours and achieved several pilot ratings, and while most of his flying time was in single- or twin-engine aircraft, he flew twice the speed of sound in 1958 while testing supersonic fighters for Convair. His honors included a 1972 Wright Brothers medal for best technical paper presented at a meeting of the Society of Automotive Engineers. He is survived by Katherine, his wife of 62 years; two daughters, Patricia Ladd and Barbara Aran; a son, Dwight Jr.; a brother, Louis; and three grandchildren and two great-grandchildren.

Carl A. Moore Jr., MS, of Huntington Beach, California, on June 27, 2000; he was 84. A former Caltech faculty member and a mechanical engineer for McDonnell Douglas, he is survived by his wife, Clare; three sons, James, Terry, and Thomas Gordy; and a daughter, Sally Gordy.

1942

Ching-U Ip, MS, of Los Angeles, on June 26, 2000; he was 80. He is survived by his wife, Rosaline, and by his children and grandchildren.

1943

Gerald Harrison, PhD, of Westport, Connecticut, on June 14, 2000; he was 83. During World War II he worked for the MIT Underwater Sound Laboratory. In 1947 he began teaching physics as an assistant professor at Queens College in New York City, and the following year he moved to Detroit, Michigan, to become associate professor of mathematics at Wayne University (now Wayne State University). In 1956, he went to work for Teleregister/Bunker Ramo Corporation, in Westport, as a systems designer and mathematical consultant. A crusader for human rights and world peace, he, along with his wife, protested the Vietnam

War with Saturday silent vigils in front of the Town Hall in Downtown Westport. He is survived by his wife, Cynthia; his children, Paul, Jonathan, Mary, and Carol; and three grandchildren and one great-grandchild.

1945

Richard G. Markham, of Prescott, Arizona, on March 31; he was 76. He served as an officer in the U.S. Navy during World War II, and he earned an MS in mechanical engineering from Stanford in 1947. After retiring as owner of Aquarium Pump Supply, he was led by his interests in engineering and research into a new business career as a patent holder and as vice president of Oxycal Labs of Prescott. Active in business and community service at both the local and state levels, he was one of the organizers of the Bank of Prescott, serving as a director and the first vice president. He also served in the Arizona Department of Economic Planning and Development and as a trustee of the Orme School and of Prescott College, among many other positions. In addition, he for a time published *The Paper*, a weekly newspaper serving the Prescott area. He is survived by Jonne, his wife of 51 years; two daughters, Janet Blackinger Markham and Marilyn Markham Petrich; three sons, Fred, Richard G. Jr., and Charlie; a brother, Charles; and nine grandchildren.

1947

Louis A. Giamboni, MS, PhD '50, of Laguna Woods, California, on July 26, 2000. He is survived by his wife, JoAnn, and by a sister, Natalie Silk.

Frederick Stevens, MS, of Long Beach, California, on June 16, 1998; he was 76. He served for 10 years on the Air Force Scientific Board and received the Air Force Meritorious Civilian Service Award, and he was involved with the first successful U.S. intercontinental-missile guidance systems. He spent 34 years with Northrop before retiring as a senior vice president. A fellow of the IEEE and an amateur radio operator, he also loved sailing and was a member of the Los Angeles and Long Beach Yacht Clubs, and a former rear commodore of the Cruising Club of America. He is survived by Barbara, his wife of 53 years; a son, Fred; a daughter, Claire; a brother, David; and three grandchildren.

1953

Luther William Eggman, PhD, of Groveport, Ohio, on February 28; he was 78. A former teacher at Ohio State University and former employee at the Battelle Institute, he had also owned the Plaza Cleaning Center. He is survived by his wife, Elsie; a daughter, Leslie; a stepdaughter, Helga; two sisters, Doris Lawson and Florence Wildman; two brothers, Richard and Kenneth; and two step-grandchildren and three step-great-grandchildren. He was predeceased by his first wife, Ruth, in 1968.

1966

Fergus J. Gaines, PhD, of Dublin, Ireland, on November 10, 2001; he was 62. He joined the mathematics department of University College Dublin (UCD) in 1967 and retired in 2000, but continued to teach as an emeritus lecturer. In addition to serving as assistant head of department, he was president of the Irish Mathematical Association, editor of the *IMA Bulletin*, and joint coordinator of the Irish team for the International Mathematical Olympiad. His linguistic interests led to fluency in German, Russian, and latterly Chinese; he served as president of

the Irish Chinese Cultural Society, and was instrumental in founding UCD's Centre for East Asian Studies. He is survived by Marie, his wife of 37 years; two daughters, Aine Lutes and Sarah Gaines; five sons, Sean, Brian, Kevin, Peter, and Eamonn; and a grandson, Cian.

1968

Richard A. Flammang, MS '76, PhD '82, of Manhattan Beach, California, on June 15; he was 56. In addition to his Caltech degrees, he had a master's in economics from Harvard. His 1982 PhD thesis "was a definitive theoretical study of the flow of optically thick gas into a black hole," and he continued his studies of black holes at the University of Texas, Austin. He worked as a scientist for 18 years at Hughes/Boeing, in El Segundo, California, on space and communications projects, on system engineering, and on mission analysis and design, specializing in launch vehicles, orbital mechanics, pointing control, communication payloads, thermal control, propulsion, space environment effects, contamination, and electro-optical sensor design. He was considered a key contributor to the Mars Observer and Mars Surveyor projects as well as Magellan, which radar-mapped Venus. He is survived by his mother, Gloria, and by two sisters, Janet and Barbara.

1974

Charles A. Langhoff, PhD, of Midland, Michigan, on May 22, 2000; he was 52. An expert in adhesion science and the optical performance of polymers and polymer interfaces, he served as a postdoctoral fellow with IBM in San Jose, California, and then as an assistant professor at the Illinois Institute of Technology. In 1981 he moved to the Dow Chemical Company in Midland, where he worked in a variety of scientific and administrative positions and held several patents. A former Little League and soccer coach, he enjoyed cooking, gardening, wood working, and golf, and he served as a judge with the National Association of Women's Gymnastics. He is survived by Joan, his wife of 26 years; two sons, Randall and Cory; a daughter, Leia; his mother, Lorraine; and a sister, Betty Adams.

1995

Charles Kincaid Witham, MS, PhD '00, on August 6; he was 33. Considered a key member of the JPL team working with direct-methanol fuel cells, he had joined JPL as a postdoctoral research associate, becoming a member of the engineering staff in January 2001; his work focused on the study of catalytic materials for the fuel cells and the attempt to find lower-cost alternatives to the precious-metal catalysts in use today. He was an avid environmentalist and cyclist, serving for years as a member of the Caltech Environmental Task Force and as a leading participant in efforts to create bikeways throughout the San Gabriel Valley. A bicycle commuter, he suffered fatal injuries when he collided with a deer while cycling home from JPL. He is survived by his mother, Linda; his father, Charles; his sister, Nita-Lyn Roth; and a grandmother, Anita Berzin.

JÜRIG WASER 1916-2002

Retired Caltech chemistry professor Jürg Waser, PhD '44, died of congestive heart failure at his home in La Jolla on August 16. He was 85.

For a generation of Caltech students, Waser was freshman chemistry. Former pupils speak of his memorable lecturing style, his habit of filling blackboards with great speed and agility, and his infamous pop quizzes. A dedicated teacher and supporter of undergraduate research, he was also known in the scientific community for his work in X-ray crystallography.

Born in 1916 in Zürich, Waser attended the University of Zürich and came to the United States in 1939 intending to spend a year on a graduate student exchange program at Caltech. The outbreak of World War II kept him in Pasadena, where he completed a doctorate with Linus Pauling in 1944. He remained at Caltech as a mathematics instructor, research fellow, senior research fellow, and A. A. Noyes Fellow until 1948, when he accepted an appointment at the University of Zürich and, later, at the Rice Institute (now Rice University) in Houston.

Waser returned to Caltech in 1958 as professor of chemistry, and for the next 12 years he taught Chem 1, the general chemistry course for freshmen. Before his retirement in 1975, he taught the basic course in physical chemistry as well as oral presentation, by then the only required course in the chemistry curriculum.

Upon his retirement from Caltech, he concentrated on writing texts on general and physical chemistry and continued to do research, including work in chemical thermodynamics. He also collaborated with colleague Hans Kuhn in developing a chemical scenario for the origin of life. He was a member of the Caltech Associates and traveled on Alumni Association excursions.

Waser loved logic and mathematics, music, and the outdoors, especially the landscapes of the American southwest. For most of his life he jumped at an opportunity to camp in the desert (preferably with a railroad in view).

He is survived by his wife, Irma; three children, Peter, Nickolas, and Katherine; a grandson, Andrew Waser; and a stepson, Ray Weiss '64.

DAVID MORRISROE, 1932-2002

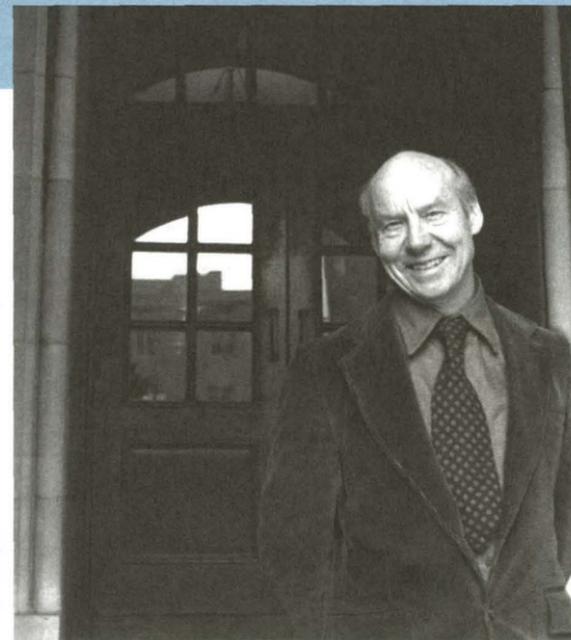
David Morrisroe, a former vice president at Caltech, died September 4 in Montecito, California. He was 70.

A native of New York City, he earned his bachelor's degree from Manhattan College in 1954, his master's degree from Columbia in 1956, and his MBA from Harvard in 1964. He also served in the U.S. Army as a lieutenant. Before coming to Caltech, Morrisroe served for years as a consultant, some of it overseas in Israel, Spain, and the UK. He also held positions at the Rand Corporation and General Electric.

He came to Caltech in 1969 as director of financial services, and was named vice president for financial affairs and treasurer in 1974. He was appointed vice president for business and finance and treasurer in 1978, and in 1995 became vice president and treasurer. He stepped down in 1995.

The Institute's David W. Morrisroe Astroscience Laboratory and the David Morrisroe Professorship of Physics, currently held by former JPL director Ed Stone, were named in his honor.

Morrisroe was a popular speaker and often lectured on topics such as managing not-for-profit corporations, administrative data processing, financial man-



agement of educational institutions, and planning. Beginning in 1971, he taught a business economics course at Caltech, and also founded the Caltech Student Investment Club.

He was a director of the Harvard Business School Association of Southern California, the Financial Executives Institute of Los Angeles, and was a former trustee of the University of San Diego. He was a member of the Academy of Management and the National Association of College and University Business Officers.

He is survived by his wife, Marie L. Morrisroe.

