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Marjorie and Aden Meinel with a chart depecting the TAU mission.

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TAU's destination: 93 billion miles beyond the sun

by Winifred Veronda

Aden and Marjorie Meinel may be scientists at the Jet Propulsion Laboratory, but they feel a bit like the medieval architects who conceived the great Gothic cathedrals, knowing that future generations would complete them, and that they themselves would never live to see their works become a reality.

The Meinels are head of a team of scientists who are working on the TAU (Thousand Astronomical Units) mission — an effort that would last 50 years after its projected launch in 2010. During that time the spacecraft would travel 93 billion miles beyond the sun.

Initially TAU would provide intimate details of bodies within the solar system — of Pluto, for example, which has never been the focus of a flyby — and then of realms never before penetrated by an actual space probe.

Beyond the heliopause — the name given the boundary of the sun's magnetic field — the spacecraft's cameras would probe the inner Oort cloud (the hypothetical region where comets originate), and would investigate low-energy cosmic rays, low-frequency radio waves, interstellar gasses, gravity waves, and other deep-space phenomena.

But one of the spacecraft's most important contributions would be its capacity to provide far more accurate measurements of the distances between stars than those to which astronomers have previously had access. These measurements would help fine-tune calculations about the age of the universe, which in turn bears on the question of whether the universe will expand forever or ultimately collapse.

The most accurate earthbound system of measurement uses the diameter of Earth's orbit as the base of an imaginary triangle, with the target star as the third point. But because the baseline is so limited, this method can only be used to measure distances of less than 400 light years. By comparison, Earth is some 27,710 light years from the center of the galaxy.

The spacecraft would provide the ability to extend that baseline 500 times — giving astronomers the capability not only to measure stellar distances in the Milky Way but to stars in nearby galaxies as well. The accuracy of such a system of measurement would be far greater than the current system, which infers distances by what is called the cosmological distance ladder.

By contrast with present capacities, Meinel explains, 10 years into the TAU mission, scientists would be able to measure distances to the center of our own galaxy, and, after 15 years, they would be able to survey distances to any object in our galaxy.

Fifty years into the voyage, they would be measuring objects in nearby galaxies — all in absolute distance. "The volume of space that would become accessible to us would be immense compared to what is accessible now," Meinel says.

The Meinels came to JPL three years ago after retiring from the University of Arizona Optical Sciences Center. JPL director Lew Allen was interested in a project that would examine the prospects for sending a spacecraft to the nearest stars, and he asked the Meinels to explore the possibilities.

"We had worked with Dr. Allen when he was in the Air Force," says Meinel, "and he knew we were interested in projects that expressed the limits of human achievement.

"We didn't know whether a project such as he had in mind was possible. The whole objective was to look at it realistically, not from the standpoint of science fiction."

Working with the Meinels were seven SURF students — Caltech undergraduates on Summer Undergraduate Research Fellowships: Allen Gee (BS '87), Ara Kassabian (BS '86), Charles Neugebauer (BS '88), Dana Pillsbury (BS '88), Eugene Thomas (BS '88), Stephan Pietrusiak (BS '88), and Stephen Winters (BS '87). Another Caltech student involved in the work was Joel Sercel, a young JPL engineer who is now at Caltech, completing his doctorate on one of the advanced propulsion systems that he developed at the laboratory.

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FRIENDS

John Allman named Hixon Professor

John M. Allman, Caltech professor of biology, has been selected by the Board of Trustees to be the second Hixon Professor of Psychobiology. Allman, 45, has been on the Caltech faculty since 1974.

The genesis of the Hixon Professorship was a 1938 gift to Caltech from the estate of Frank P. Hixon (1862–1931), a prominent lumberman and banker who served in both branches of the Wisconsin legislature. Roger Sperry, now the Board of Trustees Professor of Psychobiology, Emeritus, served as the first Hixon Professor from 1954 to 1984.

John Allman earned his BA (1965) from the University of Virginia, and his AM (1968) and PhD (1971) from the University of Chicago. From 1968 to 1973 he did postdoctoral work at the University of Wisconsin. While he was there, he and a coworker discovered a series of maplike cortical areas responsible for processing visual information. These discoveries represented a major turning point in the study of visual perception.

After a year as research assistant professor at Vanderbilt University, Allman came to Caltech in 1974 as an assistant professor. He was professor from 1984 until his appointment as Hixon Professor.

At Caltech, Allman continued his study of cortical maps. Recently he discovered that the maps have a global organization such that information throughout the map registers at any one point within the map. This finding is a key to understanding the mechanisms of higher-order visual processing, such as the extraction of a figure from background.

A member of Phi Beta Kappa, Allman has been an honorary Woodrow Wilson Fellow, a National Science Foundation Graduate Fellow, and an Alfred Sloan Research Fellow, and he has won a United States Public Health Service Career Development Award.

New Associates officers: front row—Dorothy (Mrs. Charles) Pankow, secretary; Joanna (Mrs. Downie) Muir, president; back row—Kenneth Rhodes, vice president; Robert Banning, treasurer; and Arthur Adams, also vice president.

Associates tour GALCIT

The Associates were guests at a tour of the Graduate Aeronautical Laboratories (GALCIT) during March. GALCIT director Hans Hornung and faculty members explained current research projects that use the GALCIT 10-foot wind tunnel, the towing tank, the 17-inch shock tube, and the vertical shock tube. Also included on the tour were the hydrodynamics laboratory, the Iris workstation in computational fluid dynamics, and the combustion laboratory. Dinner at the Athenaeum followed by a talk by Professor Hornung completed the evening's program.

Michigan president chosen to speak at commencement

James Duderstadt (MS '65, PhD '68), president of the University of Michigan, has been selected as Caltech's commencement speaker. Duderstadt did his undergraduate work in electrical engineering. His MS and his PhD are in engineering science.

Duderstadt joined the University of Michigan faculty as assistant professor of nuclear engineering in 1969. He became a full professor in 1976, dean of the college of engineering in 1981, provost and vice president for academic affairs in 1986, acting president in 1987, and president in September of last year.

Duderstadt's research activities include nuclear reactor theory and design, radiation transport theory, kinetic theory and statistical mechanics, laser and particle beam interactions with plasmas, inertial confinement fusion, and computer simulation.

Contest announced for centennial theme

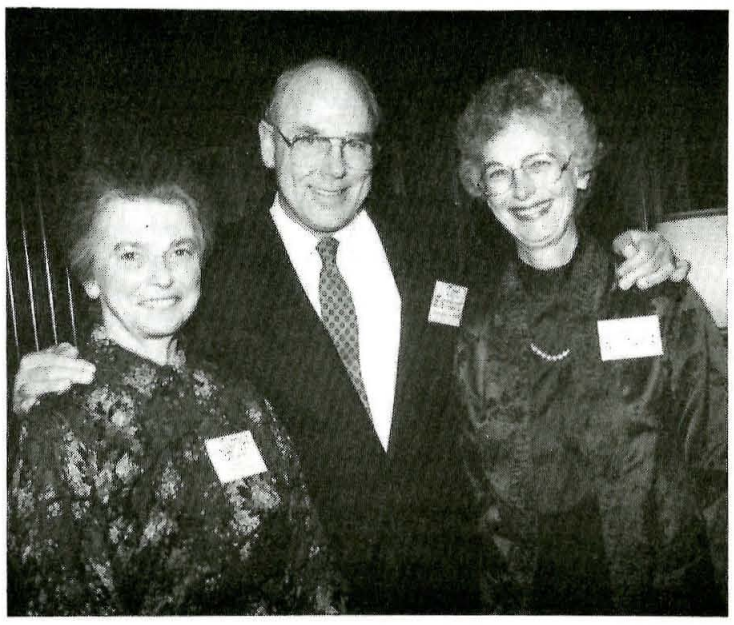
Caltech will celebrate its 100th anniversary in 1991. Planning for an exciting year of activities has begun, and all members of the Caltech community, including alumni, are invited to enter a contest for a centennial theme.

Said Sunney I. Chan, chairman of the centennial steering committee, "Caltech has had a distinguished past that we can all be proud of, and we possess the vision to chart a bold course for the future. As we celebrate our 100th anniversary, we want the world to share in our pride and benefit from our vision."

To help accomplish this goal, the steering committee has established this guideline for the contest: the theme should be a catchy, overarching "one liner" that can be used by various groups who are designing activities or materials in conjunction with the centennial. The deadline for the contest is April 28, 1989, and the prize will be a dinner for two at an elegant restaurant.

Entries should be submitted in writing to the Centennial Steering Committee, Mail Code 10-31, and should include the name, telephone number, and address of the entrant. The winning entry will be announced later.

Among guests at The Associates' new-member dinner were Betty Gould, Richard Craig, Downie Muir III, Larry Gould, and Carolyn Craig. The Craigs are new members who were sponsored by the Goulds.



Joanna (Mrs. Downie) Muir with Thomas and Doris Everhart. Dr. Everhart delivered the dinner address.

Rosen elected trustee vice chairman

Computer pioneer and venture capitalist Benjamin Rosen (BS '54) has been elected a vice chairman of the Caltech board of trustees, joining William F. Kieschnick in this role. Rosen became a Caltech trustee in 1986 and became a member of the board's executive committee a year later.

"Ben Rosen has a long history of association with Caltech, and his new position will further extend his role for the benefit of the Institute," said Caltech's board chairman Ruben F. Mettler, retired chairman and CEO of TRW Inc.

"One fair way to measure any university is to scrutinize the vitality and expertise of its trustees. As Ben Rosen continues to share his strong leadership qualities as a vice chairman of the board of trustees, Caltech administrators and faculty have an added reason to feel confident about the future," said President Thomas E. Everhart.

Rosen is chairman of Compaq Computer Corporation and Sevin Rosen Management Company, and he is a director of several other companies, including Borland International, Inc. He is also a former founding director of Lotus Development Corporation.

In addition to his Caltech degree, Rosen earned an MS from Stanford in 1955 and an MBA from Columbia in 1961. For a decade, beginning in 1973, he wrote the AIRosen Electronics Letter, which analyzed trends in personal computers and semiconductors. During the 1970s, Rosen was named Top Electronics Analyst by *Institutional Investor* six years in a row.

Hood receives $500,000 grant

Caltech biologist Leroy Hood has received an award of $500,000 from the National Institute of General Medical Sciences—a division of the National Institutes of Health (NIH)—to study the genetic basis of T-cell receptors, a crucial component of the human immune system. In addition to providing fresh insights into the fundamental nature of the immune response, a major aim of this project will be to develop improved techniques and instrumentation for mapping, sequencing, and analyzing DNA, the basic material of heredity.

Hood is the Ethel Wilson Bowles and Robert Bowles Professor of Biology at Caltech and a pioneer in the molecular biology of the immune system and the development of biochemical instrumentation. He was chairman of Caltech's Division of Biology from 1980 to 1988.

The project headed by Hood will concentrate on isolating and analyzing the genes that code for the development of receptors on immune-system cells known as T-cells. In all mammals, including man, the immense diversity of T-cell receptors plays a key role in enabling the body to recognize an almost limitless number of foreign invaders and to mobilize the immune system against such intruders.

The mass destruction of a class of T-cells is a fundamental characteristic of Acquired Immune Deficiency Syndrome, or AIDS, and scientists now believe that properly functioning T-cells play a significant role in protecting mammals from cancer. Hood and his group will also be examining the validity of the theory that T-cell receptors are involved in the onset of such disorders as multiple sclerosis, rheumatoid arthritis, and diabetes.

SURF program honors Liepmann

Life at Caltech can pose difficulties for unusually bright young people, Hans Liepmann, the Theodore von Kármán Professor of Aeronautics, Emeritus, acknowledged at the Summer Undergraduate Research Fellowships (SURF) kickoff dinner in the Athenaeum when he spoke on "Caltech Survival."

"Of course it is traumatic for the single leading light of a high school class to adjust to being surrounded by many leading lights among his classmates, and [to be] less shining than some. I never have forgotten the face of one undergraduate who complained to me about this very trauma, when I responded with the question of how he thought I should feel being on the same faculty with Dick Feynman!" Liepmann said.

Each year, the SURF program is dedicated to an emeritus faculty member, and this year, Liepmann is the person being honored. In his talk he stressed the importance of a comradeship at Caltech between students and faculty. "The survival of Caltech and survival at Caltech are closely related, and any weakening of one does impair the other," he said. "Both depend heavily on a comradeship of faculty and students of which SURF is obviously an important ingredient."

Liepmann expressed concern about a deterioration in faculty–student relations at the Institute, pointing out the difference in distribution of students in relation to the number of faculty over the divisions and options, and the increasing involvement of faculty in the red tape of research proposals and contracts.

Another factor in the separation, he said, is the "increasing number of problem sets for students. The former problem [that of red tape] is nationwide, and likely to get even worse. The latter could, I am convinced, be vastly improved, without impinging on the quality of instruction."

To foster more comradeship, Liepmann suggested more faculty–student social gatherings—for example, joint parties at the Athenaeum with faculty members and the members of a specific house. Strengthening SURF is another way to accomplish this goal, he said.

"But to me," he continued, "the single most important item is an active dedication to improved undergraduate education. I fully understand the intensity, the almost hypnotic attraction of working on a fascinating unsolved problem, and the overwhelming ecstasy of original discoveries in research. The immersion in creative research is one of the essentials of life at Caltech, and its experience is crucial for creative teaching.

"But the older you get, the more you realize that passing on ideas and style to the next generation is the most lasting and most gratifying final result and *raison d'etre* of universities. For this transfer, SURF provides a unique bridge between faculty and undergraduates, and I wish it all possible success for 1989 and beyond!"

Hugh Colvin, chairman of the SURF board, was master of ceremonies for the evening. President Thomas E. Everhart joined the program with remarks about the importance of SURF to Caltech. SURF student Dawn Sumner talked about her SURF project, and the importance of this work to her. Members of the faculty and the administration, donors to the SURF program, and members of last year's group of SURF students attended the dinner.

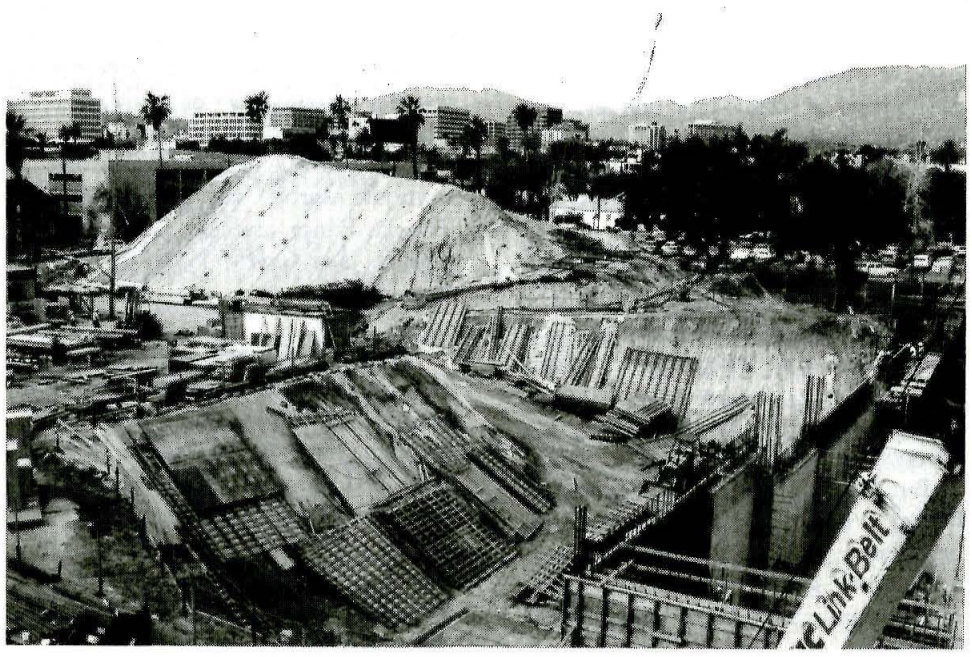
Previous SURF programs have been dedicated to Ray Owen, Robert Sharp, Lee DuBridge, and Ernest Swift.

Beckman Institute construction moves rapidly

Construction has been proceeding rapidly on the Beckman Institute, a center for research in the chemical and biological sciences. By the first of February the construction of subbasement- and basement-level floors and walls had been completed, along with 40 percent of the first-level floors. Plans were under way for a topping-out ceremony in June, marking the completion of the entire concrete shell. Dedication is scheduled for October 26. By that time, work on the interior will be nearing completion.

The Beckman Institute is being constructed with a $50 million gift from the Arnold and Mabel Beckman Foundation and $10 million in funds from other private sources.

Work undertaken at the Beckman Institute will focus on the invention of methods, instrumentation, and materials that hold the promise of opening new avenues for fundamental research in chemistry, biology, and related sciences. While providing technological support for these endeavors, the Beckman Institute also intends to furnish an environment that will promote the initiation and early development of research that may be deemed too innovative for conventional funding institutions. This research center will further Caltech's educational mission as well by involving students in its activities.



Construction site of the new Beckman Institute. The building is scheduled for dedication on October 26.

TAU reaches beyond the heliopause

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"We concluded that the technology available within the next two to three decades didn't appear able to support a mission to the nearest stars," Meinel continues, "but we found we could send a spacecraft well beyond the planets. The SURF students came up with some very thoughtful ideas that may be possible. They had imagination as well as a good sense of realism.

"Out of our work came a recommendation to Dr. Allen that we send a spacecraft 93 billion miles beyond the sun — or one thousand astronomical units — with the launch occurring as early as 2010."

This goal — deemed achievable and of substantial scientific merit — gave the project its name, TAU. There are no technological barriers to the project, say the Meinels, but there are a lot of engineering challenges. And money is becoming a severe problem because, as Meinel explains, "there are so many scientifically interesting challenges that the queue of projects today is substantially greater than can be funded by the money available to support them."

There is no lack of scientific demand for the TAU project, as the Meinels learned when they queried the scientific community about needs that the project would meet. "We found more potential science experiments for TAU than the spacecraft could carry," Meinel explains.

All the necessary technology is essentially ready to create a working TAU project except for one item — the nuclear power plant to run its ion propulsion system.

Space-based nuclear reactors are the subject of intense scrutiny as part of the Strategic Defense Initiative, otherwise known as Star Wars. In a recent report, the National Research Council recommended that NASA play a much larger role in SDI's SP-100 reactor program to help ensure that the reactor's future need for large amounts of energy in space will be met.

The ion propulsion system that the nuclear power plant would drive has been under investigation at JPL for several years, as has the powerful laser system that would relay data from the spacecraft back to Earth. "Ion engines have operated here for more than 15 years under JPL engineering programs," Meinel remarks.

Under the scenario that is envisioned, once TAU cleared Earth's atmosphere its reactor would begin supplying energy to a particle accelerator, which would emit streams of ions to provide the thrust. Acceleration would build gradually, and by the time the spacecraft was about 6 billion miles from Earth, it would be traveling at 225,000 miles an hour.

But long before this the spacecraft would have been transmitting valuable data. Of major interest would be a Pluto flyby — a project not a part of any current space mission.

Meinel explains, "Sometimes Pluto is called the double planet because an unusually large satellite called Charon is in such close proximity to it. Charon may be a wanderer from outside the solar system that Pluto captured. It is under intensive study right now, and a close look at it would be highly desirable."

Another project of high priority would provide detailed pictures of small objects in the rings of Saturn.

Particularly tantalizing is the prospect of finally getting a telescope beyond the heliopause. So far, no spacecraft has exceeded this limit. "The sun's magnetic field shields us from detecting quite a few phenomena that occur throughout the rest of the universe — low-energy cosmic rays, low-frequency radio waves, interstellar gasses, and gravity waves, for example," Meinel explains. "We have spacecraft that are slowly working their way toward this boundary, but the question is whether they will get that far before their power supply gives out."

In this region, the spacecraft's temperature would drop close to absolute zero as human technology literally penetrated what Meinel terms "the big icebox of space" for the first time.

As it ran out of propellant, the spacecraft would coast through space. "Ion propulsion," says Meinel, "is very gentle and builds up its velocity over a long time."

Meinel anticipates that the project would cost roughly the same amount as the Hubble Space Telescope, which is awaiting a June 1989 launch. The cost of this project is estimated at $1.2 billion.

The TAU craft would carry a 1.5-meter telescope for astronomy and a package of detectors to measure such phenomena as cosmic radiation and magnetic fields.

The Meinels are sanguine about the fact that, if TAU becomes a reality, they won't be around to absorb all of the information that it transmits. "We'd just be happy to be alive as it leaves the launching pad," he says. "It's often been true in the history of astronomy that the value of a research probe isn't known during the lives of the astronomers who conceived it."

But for the SURF students who helped to devise TAU, the story would be different. "All of this would occur during their scientific careers," says Meinel, "and they'd be in for some real excitement!"

CALTECH IN THE NEWS

●In a finding that may unsettle the nerves of millions of southern Californians, geologists have discovered two major faults deep below some of the most densely developed parts of the Los Angeles metropolitan area. . . .

Don Anderson

The discovery, along with the gradual realization among geologists that as many as half of all the faults in the Los Angeles area may lie deep underground and have yet to be discovered, presumably doubles the risk that a devastating earthquake will eventually occur in the metropolitan area, said Don Anderson, director of the seismology laboratory at the CALIFORNIA INSTITUTE OF TECHNOLOGY. But scientists do not know enough about these faults to calculate the actual risk. *The New York Times,* December 6.

●A team of researchers at CALTECH has discovered a new source of radiation near the center of our Milky Way galaxy, which they believe may be a black hole devouring matter from space. . . .

"It's been known for some time that there is a great deal of gamma-ray emission in the region of the galactic center, but we haven't been certain whether it was due to one object or many, or whether the emission was coming directly from the galactic nucleus or from just nearby," said team leader Thomas Prince, associate professor of physics. *San Gabriel Valley Tribune,* January 12.

●His academic resume would choke even the most most expensive photocopy machine, but University of Michigan President James J. Duderstadt [MS '65, PhD '68] ventured into the world of sports comedy Friday afternoon.

The one-time resident of Pasadena drew plenty of laughter during the 59th annual Kiwanis Rose Bowl Kickoff Luncheon at the Civic Center.

Duderstadt, who was named UM's 11th president September 1, entertained the crowd with some wry pregame comments. He poked fun at himself over the fact that a local graduate became the president of a Big Ten school.

"People refer to it as the ultimate CALTECH prank," Duderstadt cracked. Pasadena *Star-News,* December 31.

●Man has walked on the moon, and he can measure the distance to it within inches, but even with a trove of information available about the rocky body, experts still do not know where it came from.

But recent supercomputer models bolster a theory that the moon was formed when an object the size of the planet Mars collided with the earth.

The collision probably happened about 4.5 billion years ago . . . said David J. Stevenson, a planetary scientist at the CALIFORNIA INSTITUTE OF TECHNOLOGY in Pasadena. *The San Diego Union,* January 20.

●Physicists at CALTECH and MIT are preparing to test Einstein's prediction that measurable but very weak waves of gravity should exist. The existence of gravity waves might provide conclusive evidence that black holes do indeed exist.

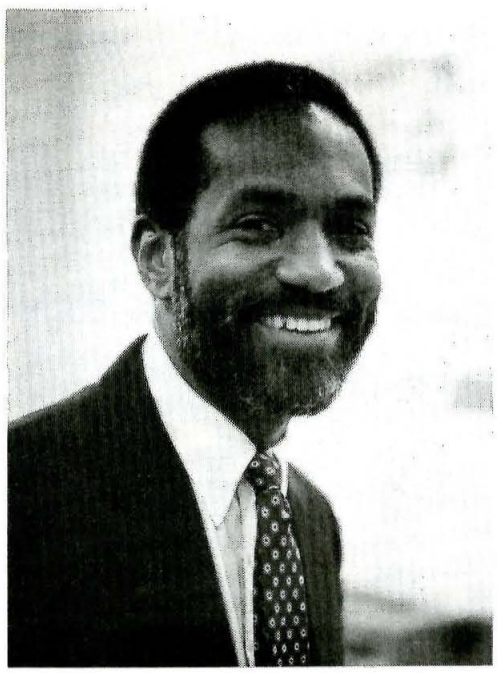
To detect the waves, the physicists plan to construct a pair of two-and-a-half-mile-long tunnels, one on each coast of the United States. Laser beams will flash through the tunnels and be reflected by mirrors at each end. If a gravity wave passes through the path of one of the beams, that beam would take a little longer to return to its starting point. *Science Digest,* March, 1989.

Conference on robotics scheduled

A conference on Autonomous Systems and Robotics has been scheduled by the Office for Industrial Associates, April 25-26 in Ramo Auditorium. Fred E. C. Culick, professor of mechanical engineering and jet propulsion, is the chairman.

Conference topics will include the theory, application, and VLSI implementation of neural networks; adaptive and learning control; parallel and concurrent computing for autonomous systems; telerobotics; redundant robot manipulators; multi-arms cooperative; robotic vision and sensing; and autonomous navigation.

Additional information is available from Linda McManus, events coordinator, 818/356-6599.



Says Paul Gibson, "We'll definitely be doing more work with underserved people in the community."

Helping students become involved

Paul Gibson, who became director of the Caltech Y last summer, was a premed student at Harvard when a surgeon from the AMA spoke on the psychological and social aspects of medicine. The surgeon told the students that 60 to 70 percent of hospital beds were filled with people being treated for sociologically and psychologically based problems, rather than ones that had a purely medical basis.

"I felt drawn to helping meet those concerns," says Gibson. "So I switched from doctoring the body to doctoring the soul."

Gibson's switch led him to earn a master's degree from Fuller Theological Seminary in Pasadena, and to spend 15 years as a campus minister for InterVarsity Christian Fellowship. His assignments took him to Columbia University, City College in New York, Hunter College, and—after a move back to the West Coast in 1976—to Cal State Los Angeles, PCC, and Occidental.

Then, in Pasadena, he worked for Citizens Concerned for the Quality of Life in Northwest Pasadena, a local branch of World Vision. In this role he was a resource for the Palm Street YMCA and the Fair Oaks Family Shelter, in programs concerned with disadvantaged youth, illiteracy, and homelessness. He also taught for a year with the Pasadena Unified School District.

From there he went to USC, where he directed the Upward Bound Program, a college-preparatory program for low-income students with no college access. And now he is with the Caltech Y, to which he brings a high level of energy, and where some of his goals are to help students explore their own values, and to become involved in their community.

The Y director notes that the Y has been called the "conscience of the campus," and this definition suits Gibson just fine. He outlines a variety of ways that the organization can help students explore their values and commitments, and come to terms with them.

Some of these involve traditional Y programs such as the Distinguished Speakers Series, which brings national and international figures to speak on campus, stimulating students to think about the arms race and other issues with ethical aspects. Among the speakers have been Norman Cousins and G. Jakes Gerwel, vice chancellor of the University of the Western Cape.

Point-counterpoint programs—a type of format that the students are enthusiastic about—bring the audience pro and con arguments on such issues as equal pay for equal work, women's roles, and environmental causes.

Community-involvement programs are expanding at the Y under Gibson. On Thanksgiving some 20 students went to Union Station to help feed the homeless. With typical Caltech enthusiasm, one student baked nine pies, starting with real pumpkins. The experience was a big success, and "they want to do more of this," says Gibson. "We'll definitely be doing more work with underserved people in the community."

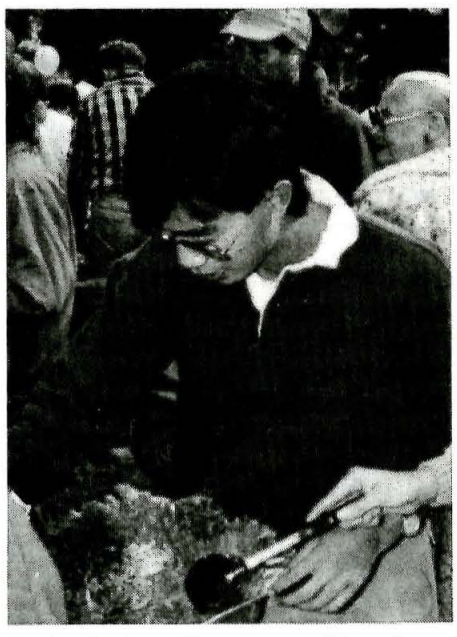
One example of such service is volunteer work at Five Acres, a local agency that serves emotionally disturbed young people. The students made their first trip to Five Acres on November 19. "As students get involved with the staff and counselors there, they end up asking themselves how, in their own lives, they face some of the emotional issues confronting them," says Gibson, "and this helps them to understand themselves better. Issues become clarified as students are able to have face-to-face conversations with the people involved at the agency. We may also explore issues of domestic violence and spouse abuse, through community service."

Some of the Y members are interested in tutoring underprivileged children—"one way to address the whole issue of illiteracy and academic impoverishment," says Gibson. "The tutoring may take the form of a one-to-one relationship, or it may involve visiting a public school and doing science demonstrations."

A major priority for Gibson is to encourage students to consider spiritual issues—to open doors for those who have never considered such matters, and to challenge adherents to evolve in their faith.

"Too many students here haven't taken a college-level look at spirituality," Gibson says. "Spiritually, they come here in high-school britches and they go on to graduate in the same britches that they were wearing when they came. We owe them the opportunity to explore spiritual values in a way equal in quality to the academic offerings here. We want to help students realize that they can be persons of faith, and still respect themselves academically."

Gibson recalls that such an opportunity came to him when George Wald, Nobel laureate in biology, taught his class in natural sciences at Harvard. "He said that in college we explore the theories of the origin of the universe, but don't deal with the fact that there could be a god behind it all," says Gibson. "For me, Wald stood out as a paragon of scientific integrity because he was willing to include explanations other than scientific ones for the world we know. He opened the door for me to resolve the issues in my mind, regarding spiritual development and the scientific endeavor."



Senior Andrew Hsu serves dinner to the hungry at a Y project.

In providing such opportunities for Caltech students, Gibson wants to work closely with the Hillel Foundation rabbi, the Newman Club priest, and other members of the Caltech community involved in religious issues, and to "explore ways we can stimulate the students to consider the interplay between science and spirituality."

Ways to help students develop their high-school-level faith and to grow in their spiritual perspectives might take the form of supporting the existing religious groups on campus, devising an inquirers' forum, or holding a seminar on world religions or on science and the transcendent, Gibson says.

One of the special benefits that the Y brings to students, Gibson feels, is the opportunity for contact with people of all ages, particularly through the Y board and the Friends of the Caltech Y, whom he describes as a "wonderful group of people. Interaction with them is very stimulating for the students."

Last fall, the Y worked with The Associates in a new program, signing up students for "Student Sunday," the first in a series of opportunities for Techers to have a meal in an Associate's home and become better acquainted. Sixty-four Caltech undergraduates enjoyed the hospitality of Associates families (there was a waiting list of 15 or 20 students), and the response was positive on the part of everyone. (Other Student Sundays are planned.)

Along with the new programs, traditional favorites like decompression, a ski trip at winter break, a tailgate brunch before a football game, and backpacking expeditions are continuing. So is the AMETEK Leadership Conference—a three-day program in the fall held in cooperation with the Industrial Relations Center and designed to meet the special needs of Caltech students for leadership training. A party for women at the conclusion of midterms drew 50 munchers. "Any program with food—especially on the weekends—is a real plus," Gibson remarks.

In planning programs, Gibson stresses that he works in close partnership with the Y board and the student executive committee. "I like to think that the Y is student driven and staff directed," he says. "My style of leadership could be described as participatory democrat, or player-coach, or a member of the team. I see myself being responsible for providing guidance, direction, and continuity to student-generated issues and concerns."

He also wants to work closely with the other offices on campus that support student life. "I see us as being part of a student services team," he says. "I want to strengthen the partnership that exists with the master's office, the dean of students, and student affairs."

When not involved on campus, Gibson is generally involved with his family—his wife, whom he met in Boston, and his four children, ages 16, 11, 4, and 3. He spends time walking,

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Y director Gibson

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hiking, and "rehabilitating his house." He's lived in Pasadena for 12 years.

What he enjoys most about his work is "seeing students learn from experience, and watching them develop leadership skills and planning strategies." And "it's great to hear reports that they've had a wonderful interaction with a member of one of our support groups, the board, or the Friends."

Gibson finds Caltech students inspiring because of their level of creativity, and their excellence as problem solvers. "This is the best scientific and technical institution in the country," he says. "Through working with the students as they deal with their concerns—moral, ethical, and cultural—through helping in rounding out their social educations, and seeing them develop a more comprehensive worldview, we have a wonderful opportunity. We're participating in the growth of some of the brightest young people in the country. And this is a very rewarding experience."

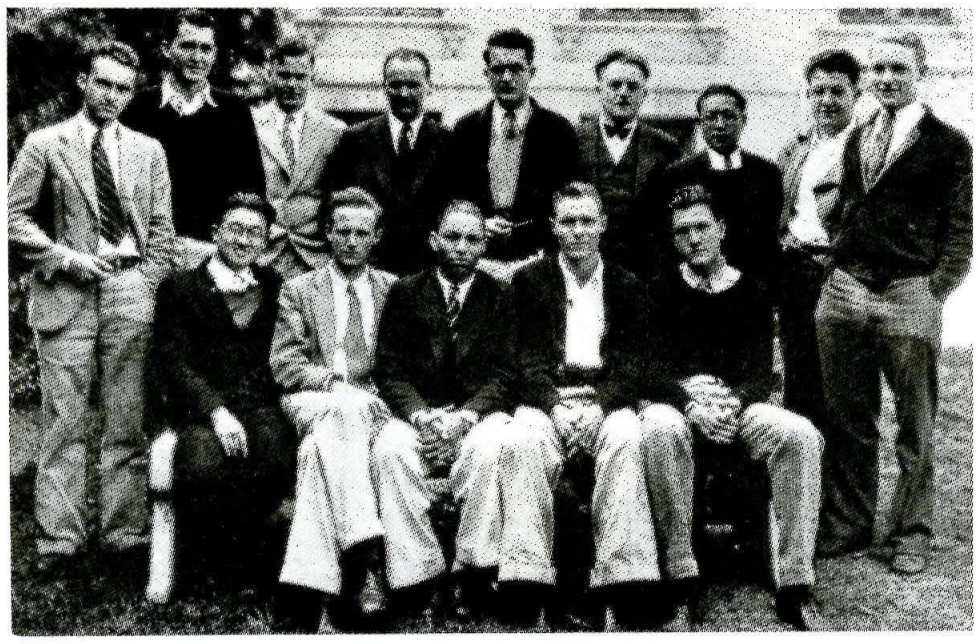
Davidson named interim biology head

Norman Davidson, the Norman Chandler Professor of Chemical Biology, Emeritus, has been appointed interim chairman of the Division of Biology until a permanent chairman can be named. Former chairman Leroy E. Hood, the Ethel Wilson Bowles and Robert Bowles Professor of Biology, stepped down from the chairmanship in January in order to devote full attention to Caltech's new Center for the Development of an Integrated Protein and Nucleic Acid Biotechnology, which he will direct.

Davidson came to Caltech in 1946 as an instructor in chemistry. During the 40 ensuing years he made transitions from inorganic and physical chemistry to biophysical chemistry, and then to molecular biology.

In his early years at Caltech he did pioneering research in the measurement of very fast reaction rates. As a biophysical chemist and molecular biologist, he has done fundamental work in the development of new methods of gene mapping and in the study of gene coding for ion channels and neurotransmitter receptors in the nervous system.

Davidson is a member of the National Academy of Sciences. He was named California Scientist of the Year in 1980.



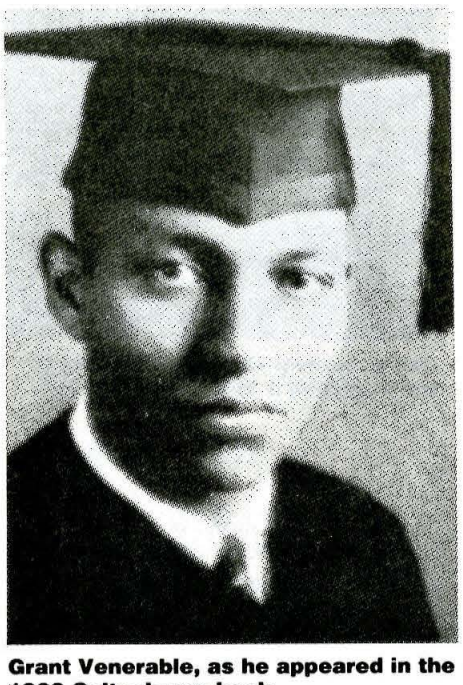
Grant Venerable is in the center of the front row in this photo of the Cosmopolitan Club from the 1932 yearbook. At his right is William H. Pickering.

Book fund honors first black student

The Caltech graduating class of 1932 contained some notable members. Among them were William Pickering, who went on to become director of JPL, and William Shockley, who earned a Nobel Prize for his invention of the transistor and who has also been outspoken on his views of racial differences.

Another member of that class was Grant Venerable (1904-1986), the first black American to graduate from Caltech. Now Venerable's family has endowed a memorial book fund in his honor.

A more than tenth-generation American, Venerable was of African, Cherokee, and Scottish descent. His father was born in Missouri during the latter days of slavery.



Grant Venerable, as he appeared in the 1932 Caltech yearbook.

Venerable came with his family from Kansas City to the San Bernardino area in 1919 and graduated from San Bernardino High School at the age of 16. He attended USC, UC Berkeley, and UCLA (then known as the Southern Branch). At UCLA, near the completion of his degree, he was expelled for dropping a course, required for the teaching candidacy in geometry, without permission of the department chairman.

"My father knew about Caltech but he probably wouldn't have tried for it if he hadn't felt pushed to the wall by the UCLA experience," said his son, Grant D. Venerable II. Venerable passed the entrance exams at Caltech and was admitted as a sophomore. "He particularly valued his Caltech experience because he felt he reached his emotional and intellectual maturity there," his son said.

At the Institute Venerable decided to become an engineer, rather than a doctor as his family had hoped he would be. Active on campus, he was president of the Cosmopolitan Club, a member of the track team for two years, and a member of the YMCA and the student chapter of the American Society of Civil Engineers.

Venerable made many close friends with whom he retained close ties over the years. His son attributes his success at Caltech to the fact that he often joined study groups of friends and thus strengthened his academic prowess.

At one point Venerable applied to live in one of the student residences, and Robert Millikan took to the Board of Trustees the issue of whether a "colored" student should be permitted to live there. Millikan later informed Venerable that he was welcome in the house, but the Caltech student had decided he couldn't afford the cost, and he continued to live in a small off-campus apartment. He supported himself by mowing lawns and doing odd jobs for faculty members, and working as a butler for a family in Beverly Hills.

After graduation, Venerable, like many of his colleagues in the depths of the Great Depression, was unable to find work in his field. He went to Montana to spend a year trying to put his aunt's gold mine on a profitable basis, and then returned to southern California, where he went to work for the Golden State Mutual Life Insurance Company, the only black-owned insurance company west of the Mississippi.

In 1940, Venerable met a friend and former Caltech classmate who lined him up with several mining engineering jobs and later invited him into the Hayward Spyglass Company, where he applied his knowledge of optics. More mining engineering assignments came after World War II, and then Venerable, wanting to be closer to his family in Los Angeles, bought a hotel, which he operated with his brother for several years. After this he bought an eraser-manufacturing company in Montebello, the George R. Healey Manufacturing Company, and managed it until his death.

Venerable was the father of three children, one of whom, Grant Venerable II, holds a PhD in chemistry.

The family has asked that the endowment be used to purchase books that "bear upon the human condition, especially of African-American and Native American cultures, and which bear upon the impact of modern technology on the human condition." The book fund is in memory of both Grant D. Venerable and his second wife, Naomi T. Venerable.

A member of the Usetoos 50-plus campus basketball squad, President Thomas Everhart aims for the hoop.

Fire damages TACIT house

A fire destroyed the upper floor of the Theater Arts of California Institute of Technology (TACIT) house on the morning of February 4, less than a year after TACIT moved into the Caltech-owned residence at 300 South Holliston Avenue.

The fire occurred less than two weeks before the opening of the annual musical, *Bye Bye Birdie,* on February 17. Fortunately, nothing for that production was damaged in the blaze.

Demolished or damaged in the fire, according to TACIT director Shirley Marneus, were the group's costumes, wigs and other hair supplies, drafting table and cabinets, a collection of theater posters, posters from TACIT's own shows, programs from previous productions, and lists of cast members in those shows.

TACIT, which moved into the house last summer, was planning an open house in the spring in connection with Seminar Day, and another open house during the summer to celebrate its first anniversary at the new location.

Marneus, who received a call about the fire at 9 a.m. on Saturday morning, called the 60-member cast of the musical, many of whom came to the scene on a cold, rainy day, to help with salvage operations. Equipped with flashlights, they emptied closets and other storage areas, and moved everything that could be saved out of the building. TACIT found a temporary headquarters back in the old campus barber shop in Winnett Center where it had been located before moving to 300 South Holliston. Some of the materials were stored. A search is under way for a new house for the theater program.

Marneus hopes former TACIT members will help her reconstruct the lost cast lists by sending their names, the shows they appeared in, and their current addresses to her. Meanwhile, the dominant image being tossed about by the current cast has been that of a phoenix rising from the ashes.

A message from the alumni president

Caltech alumni can look forward to an exciting year in 1991 as the Institute celebrates 100 years of outstanding achievement. A special Institute steering committee appointed by President Thomas E. Everhart and chaired by the faculty chairman, Dr. Sunney Chan, has begun considering all aspects of the Caltech community in planning the celebration. As part of that process, the Association has formed an Alumni Centennial Committee, which has begun meeting to consider appropriate alumni-related activities that could be scheduled during the year-long celebration. Ted Combs (BS '27), president of the Alumni Association in 1940 and an active alumnus, is a member of the Institute Steering Committee, and I have asked him to chair the Alumni Committee. In recognition of these activities, the Board has nominated him to serve a special three-year term as a director of the Association, to assist with centennial events. Other members of the Alumni Centennial Committee include Mike Boughton (BS '55), Joe Cheng (BS '85), Chuck Holland (BS '64), Le Val Lund (BS '47), Gary Stupian (BS '61), Vic Veysey (BS '36), and Bill Whitney (BS '51).

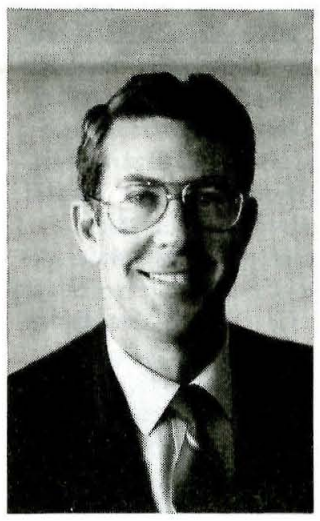
Program suggestions for 1991 include an exciting New Year's Day kickoff, special travel/study programs, an expanded Seminar "Day" weekend, an all-classes homecoming reunion centered around Seminar "Day" weekend, dynamic chapter programs throughout the country, and an all-chapter convocation via satellite hookup.

To achieve the best program, the committee needs your ideas now and your support as we approach 1991. Please send suggestions to me in care of the Alumni Office. Watch future issues of *Caltech News* for more information about centennial events and how you can participate.

Upcoming Alumni Association programs promise stimulating educational and social opportunities. The traditional wine-tasting program offered for southern California alumni will have a new focus this year when a tour of several wineries in Temecula will be offered on Saturday, June 10. The tour, organized by director Tway Andrews (BS '44), will be led by Yvonne Rich, a noted wine expert who has done extensive research into the wines of the Temecula region. The tour will include bus transportation from Caltech, lunch, tours of the wineries, and tastings. Flyers are being mailed to southern California alumni. If you live outside the area but would like to participate, please contact the Alumni Office.

Exciting travel/study opportunities with Caltech faculty hosts are being offered in San Francisco and the Mediterranean during the upcoming fall season. Look for more information about both of these trips in this issue of *Caltech News*.

Reunion activities are moving forward for the classes of 1939, 1944, 1949, 1964, 1979, and 1984, with exciting events scheduled this spring for each class. Preliminary planning is already under way for the spring 1990 reunions. The special 10th, 25th, and 50th anniversary classes (1980, 1965, and 1940) are moving forward with reunion committees. The possibility of an *all-classes* reunion during the 1991 centennial, however, raises some questions for other classes with a five-year multiple anniversary falling in 1990 (classes of 1935, 1945, 1950, 1955, 1960, 1970, and 1975). Would these classes prefer a separate reunion in 1990, or would they rather focus their efforts on the 1991 event with possibly larger attendance from alumni traveling from out of the area? Surveys have been mailed to alumni in those classes, and the results of each class's preference will be announced when the responses are tabulated.



Charles H. Holland, Jr.

Alumni Association chapters around the country continue to host a variety of programs for alumni in their areas. At a dinner on March 8, Washington, D.C., area alumni shared an evening with David Goodstein, Caltech professor of physics and applied physics and vice provost. John Andelin (BS '55, PhD '67) president of the Washington, D.C., chapter, arranged the event.

Portland-area alumni enjoyed the Caltech Women's Glee Club performance at Reed College on April 1 and the reception that followed for alumni and Glee Club members. In addition to planning the reception, Peter Serrell (BS '36, MS '39), president of the Portland chapter, and Fred Dorr (BS '64) of Beaverton, organized alumni in the Portland area to host the Women's Glee Club members during their stay.

After the enthusiastic reception for President and Mrs. Everhart in Orange County earlier this year, the organization of a new Orange County chapter is moving forward. All alumni in the area are being surveyed as to their preference for the chapter program.

We appreciate feedback from alumni concerning any Association issue. Please contact by mail or phone: Caltech Alumni Association, Mail Code 1-97, Pasadena, California 91125, 818/356-6592.

Earthquake risk assessment topic of conference

What are the probabilities of future California earthquakes? What are the lessons learned from the Whittier Narrows earthquake? These and other questions will be discussed at the Earthquake Research Affiliates (ERA) conference, "Earthquake Risk Assessment in Southern California," at Ramo Auditorium on May 24–25.

The recent earthquakes, both locally and in other parts of the world, have increased interest in assessing the risk of damaging earthquakes in southern California. This conference will feature research by Caltech faculty and staff on this important topic.

The conference is open to the public, and registration fees are waived for all ERA representatives, plus faculty, students, staff, and alumni of Caltech, and the faculty, students, and staff of other universities. There is a reduced fee of $200 Industrial Associates representatives.

More information is available from Linda McManus, events coordinator, Development, 105-40, Caltech, Pasadena, California, 91125, or by calling 818/356-6599.

ALUMNI

Alumni Activities

April 30–May 5—*Washington, D. C., travel/study program.*

May 5—*Reunion, class of 1979,* in the Athenaeum.

May 6—*Reunions, classes of 1944, 1949, and 1984,* in the Athenaeum.

May 19—*Reunion, class of 1964,* in the Athenaeum. *Reunion, class of 1954,* location to be decided.

May 20—*52nd annual Seminar Day,* on the campus.

June 2—*Dinner, class of 1939,* in the Athenaeum

June 3—*Half Century Club luncheon,* in the Athenaeum.

June 10—*Wine-tasting tour* in Temecula.

June 22—*Alumni Association annual meeting and honorary alumni dinner,* in the Athenaeum.

June 23–July 2—*Alaska travel/study program,* with Robert P. Sharp, the Sharp Professor of Geology, Emeritus, and Leon T. Silver, the W. M. Keck Foundation Professor for Resource Geology.

Sept. 17–22—*San Francisco travel/study program* with George Housner, Carl F Braun Professor of Engineering, Emeritus, and Fredric Raichlen, professor of civil engineering. See related article with sign-up information, in this issue.

Oct. 8—*"Phantom of the Opera,"* Ahmanson Theatre.

Oct. 12–24—*Adriatic/Aegean Odyssey travel/study program,* cosponsored by the Caltech and the University of Chicago Alumni Associations, and the Archaeological Institute of America. See related article in this issue.

For more information about any of these programs, please contact the Caltech Alumni Association, mail code 1-97, Pasadena, California, 91125, 818/356-6592.

Simon Ramo to be Seminar Day speaker

Simon Ramo, cofounder of and the "R" in TRW Inc., will be the general session speaker at Alumni Seminar Day on May 20. His topic is "Real World Engineering and Universities' Engineering Education—a Study in Contrast."

Speakers who will present research seminars include: David J. Anderson, assistant professor of biology; Tom M. Apostol, professor of mathematics; Lance E. Davis, Mary Stillman Harkness Professor of Social Science; William A. Goddard, Charles and Mary Ferkel Professor of Chemistry and Applied Physics; Kevin J. Hussey, technical group supervisor, JPL; James Z. Lee, associate professor of history; Nathan S. Lewis, associate professor of chemistry; Kenneth G. Libbrecht, assistant professor of astrophysics; Mario J. Molina, senior research scientist at JPL; Ronald F. Scott, Dotty and Dick Hayman Professor of Engineering; Leon T. Silver, W. M. Keck Foundation Professor for Resource Geology; John A. Sutherland, professor of literature; and Ewine van Dishoeck, assistant professor of cosmochemistry and planetary science.

Memorial fund honors son of alumnus

Tim McGarr, son of Arthur McGarr (BS '62, MS '63) died unexpectedly on January 31. McGarr, 16 years old, was a junior at Gunn High School, Palo Alto, California.

As a tribute to him, friends and former classmates of the McGarrs have established the Tim McGarr Memorial Fund at Caltech. Anyone wanting to contribute should send contributions to Caltech, Mail Code 105-40, Pasadena, California 91125. The McGarr family will be notified of all gifts received.

Alumni board nominates new members

The Board of Directors of the Alumni Association met as a nominating committee on January 26, in accordance with section 5.01 of the bylaws. Six vacancies on the board, including a chapter representative, in addition to the positions of president, vice president, secretary, and treasurer, are to be filled.

According to section 3.01 of the bylaws, the board can have a maximum of 22 members. In addition to filling the regular vacancies, the board has asked Theodore C. Combs (BS '27) to serve a special three-year term as director in conjunction with his work as chairman of the alumni centennial committee. The nominees for terms beginning at the close of the annual meeting in June 1989 are as follows:

Officers

President: *Rhonda L. MacDonald (BS '74)*

Vice president: *Edward M. Boughton (BS '55)*

Treasurer: *Gary W. Stupian (BS '61)*

Secretary: *Le Val Lund (BS '47)*

Directors

Theodore C. Combs (BS '27)—three years (alumni centennial committee)

Franklin D. Dryden (BS '54)—three years

Lisa Heinz (BS '78)—one year (chapter representative)

David Holtz (BS '64)—three years

Edward Lambert (BS '82)—three years

Leslie Paxton-Rousseau (BS '79)—three years

Victor V. Veysey (BS '36)—three years

Section 5.01 of the bylaws provides that members may make additional nominations for directors or officers by a petition signed by at least 50 regular members in good standing, providing the petition is received by the secretary no later than April 15. In accordance with section 5.02 of the bylaws, if no additional nominations are received by April 15, the secretary casts the unanimous vote of all regular members of the association for the elections of the candidates nominated by the board. Otherwise a letter ballot is required.

Below are the biographical summaries of those nominated for director.

Theodore C. Combs

Ted Combs is retired and lives in San Marino. He has served the Alumni Association for many years in several capacities: as president of the Alumni Association in 1940, as Seminar Day general chairman in 1965, as a member of the Board of Directors from 1965-67, and currently as the chairman of the alumni centennial committee. He is a member of The Caltech Associates and of the Gnome Club.

Franklin D. Dryden

A resident of Pasadena, Frank Dryden is self-employed as a consulting engineer. He is an active member of the Caltech Y Board of Directors and the Gnomes. Dryden has served on the Seminar Day Committee since 1984, and this year is general chairman of the committee for the 52nd annual Seminar Day.

Lisa Heinz

Lisa Heinz is a science policy analyst in the Office of Technology Assessment for the U.S. Congress. She has served as a district chair in the Washington area for the Undergraduate Admissions Support Committee for several years. In addition, she has participated in the Washington chapter of the Alumni Association.

David Holtz

David Holtz is president of Glatt-Holtz Incorporated and a resident of Van Nuys. He is currently serving the class of 1964 as reunion chair for both the Alumni Fund and the Alumni Association. He also was an area campaign chair for the Alumni Fund in 1988.

Edward Lambert

A resident of Pasadena, Ed Lambert works for McKinsey and Company in Los Angeles. He is a member of the Undergraduate Admissions Support Committee and of the Gnome Club.

Leslie Paxton-Rousseau

Leslie Paxton-Rousseau lives in Thousand Oaks, where she works for the Exxon Corporation. She has served the Alumni Fund as a reunion chair, a reunion chair for Washington, D.C., and the 1989 chair for the Young Alumni program of the Alumni Fund. Paxton-Rousseau is also a Gnome.

Victor V. Veysey

Vic Veysey lives in Pasadena and is the director emeritus of the Caltech Industrial Relations Center. He is a member of The Caltech Associates, and a Gnome. A member of the board since 1986, Veysey is currently chairman of the Chapter Affairs Committee and an ad hoc member of the Student/Faculty Relations Committee.

Mediterranean travel/study program planned

The success of the Antarctica cruise in February has prompted another travel/study program aboard the *Illiria*. For 12 days this fall, October 12–24, alumni are invited to explore the azure waters of the Mediterranean from Venice, mistress of the Aegean, to Istanbul, guardian of the Adriatic. October is the ideal time to sail this region. The days are sunny and warm, but the summer hordes of tourists have gone.

Participants in this adventure—co-sponsored by the Caltech Alumni Association, the University of Chicago, and the Archeological Institute of America—will also visit Dubrovnik, Yugoslavia, Europe's best preserved medieval city; and the Greek islands of Santorini, Lindos, and Rhodes.

Harold Zirin, Caltech professor of astrophysics and director of the Big Bear Solar Observatory, will accompany the group and lecture on astrophysics of the sun. Raymond Ciacci, a Greek historian from the University of Chicago, and James Wiseman, director of excavations at Stobi, and immediate past president of the Archeological Institute of America, will provide enrichment lectures on the trip.

Brochures announcing the trip were sent to members of the Alumni Association in late March. Prices for the program, not including airfare to Venice and return from Istanbul, start at $3,395. Anyone who did not receive a brochure and would like information should contact Kathy Harris, Caltech Alumni Association, Mail Code 1-97, Pasadena, California 91125, 818/356-6593.

Alumni to explore San Francisco

Cable cars, the Golden Gate Bridge, Sausalito, ferry rides across the bay—discover the romance and history of San Francisco while taking a scientific look as well. This Alumni Association travel/study program September 17–22 promises to be one not to be missed. Caltech faculty leaders will be George Housner, Carl F Braun Professor of Engineering, Emeritus, who specializes in earthquake engineering; and Fredric Raichlen, professor of civil engineering, who specializes in coastal engineering.

Highlights of the trip include:

- The Golden Gate suspension bridge—its design and construction, and information on the earthquake design of suspension bridges.
- The coastline from Half Moon Bay to San Francisco Bay—a tour of a beautiful part of the California coast. Emphasis will be on the effects of ocean waves on beaches, and the structures used to protect the coastline and harbors from waves caused by storms.
- The BART (Bay Area Rapid Transit) system—an analysis of the design of the tunnel that goes under the bay, between San Francisco and Oakland, with a focus on the earthquake engineering involved.
- A model of San Francisco Bay and Delta—a physical model used by engineers and planners for a better understanding of a wide range of problems. Among these are the intrusion of salt water into the delta region, currents induced by tides and river flows, and the fate of contaminants released at various locations in the bay and delta.
- The Earthquake Engineering Research Center—a world focal point for earthquake engineering research. The center is the home of the Earthquake Simulator Laboratory, which houses the country's largest shaking table.
- The Exploratorium—created by the late Caltech alumnus Frank Oppenheimer, a recipient of the Distinguished Alumni Award. The Exploratorium is a playful museum of science, art, and human perception.
- A day in the wine country of northern California. Learn how some of the best wines in the world are made, enjoy a picnic overlooking the Napa and Sonoma valleys, sip a glass of sparkling California wine, and end the day over a romantic dinner in a wine cellar.
- Golden Gate Park—an afternoon to explore the Natural History Museum, the Japanese Tea Garden, the M. H. de Young Memorial Museum, and the Steinhart Aquarium.

The San Francisco travel/study program offers a limited number of openings. The program will include five nights at the Hotel Juliana near Union Square, most meals, transportation after joining the group in San Francisco, selected educational materials, and special guided tours. For prices and more detailed information, fill out the coupon below and return it to the Caltech Alumni Association, Mail Code 1-97, Pasadena, California 91125, 818/356-6593.

Ahmed Zewail awarded King Faisal Prize

Ahmed Zewail, Caltech professor of chemical physics, has been awarded the 1989 King Faisal International Prize in Science, for "pioneering and excellent work on ultrafast laser chemistry." The prize, which consists of a gold medal and 350,000 Saudi riyals (approximately $100,000) is awarded each year by the King Faisal Foundation in Riyadh, Saudi Arabia, for outstanding scientific achievement.

The King Faisal Prize is considered one of the major international awards for creative achievement in the sciences. Zewail is the first Egyptian-born, U.S. scientist to be awarded it.

SAN FRANCISCO TRAVEL/STUDY PROGRAM
SEPTEMBER 17-22, 1989

Please send me more information about the trip. I am interested in _____ spaces.

Name _____ Class year _____

Address _____

_____

Phone _____

Return to: Caltech Alumni Association, Mail Code 1-97, Pasadena, CA 91125.

SPORTS

Basketball squad faces tough schedule

The Beavers faced a tougher-than-usual schedule in 1988–89. In order to keep Caltech's Division III membership, the baskeballl squad had to play 51 percent of its games against varsity teams, instead of playing against junior varsity teams, as it had done for the past three years. Next year Tech will field a varsity team in the SCIAC, and a junior varsity team as well.

The Beavers opened the season with a win over the alumni in overtime, 70-64. They improved steadily in play

throughout the year, winning 5 games out of 24 and losing some tough, hard-fought contests.

The team had three starters back from the previous season: sophomore center Bill Swanson, junior guard Jason Karceski, and team captain guard Brad Scott. The other players who saw the most action were senior forward Aram Kaloustian, senior forward Sean Hillyard, freshman forward George Papa, sophomore guard Larry Ahle, and junior guard Randy Ralph. Other squad members are sophomore center Dan Kollmorgen, freshman forward Lanny Boswell, and freshman guards Alex Duncan, Brian Duchovnay and Jon Philippakos.

In the SCIAC competition, Pomona-Pitzer led throughout the season, losing only one game. Occidental and Claremont finished second and third.

The Beavers will have a solid nucleus returning next year, and if the freshman class provides any new talent, the squad should represent Caltech very well at the varsity level.

Lindvall dies at age 85

Frederick C. Lindvall (PhD '28), professor of engineering, emeritus, died January 17 in Pasadena. He was 85.

Lindvall was born May 29, 1903, in Moline, Illinois, and earned his BS degree from the University of Illinois in 1924. He worked for the General Electric Company on various assignments from 1928 to 1930, and joined the Caltech faculty in 1930 as instructor in electrical engineering. He became assistant professor of electrical engineering in 1931, associate professor of electrical and mechanical engineering in 1937, and professor of electrical and mechanical engineering in 1942. From 1945 to 1969, Lindvall was chairman of Caltech's Division of Engineering and Applied Science. He retired as professor of engineering, emeritus, in 1970. From 1936 to 1953, he was a lieutenant in the U.S. Naval Reserve.

He was a Fellow of the Institute of Electrical and Electronic Engineers and of the American Society for Mechanical Engineers, national president of the American Society for Engineering Education and of Sigma Xi, and a member of the National Academy of Engineering, the Engineers' Council for Professional Development, and Tau Beta Pi. He received the Naval Ordnance Development Award and the Presidential Citation for Merit.

Lindvall served as a member of the board of directors of numerous firms and institutions, among them, the Bell & Howell Company, Stanford Research Institute, Royal Industries, and the Commission on Engineering Education. He was a trustee of Harvey Mudd College, and a member of the JPL Advisory Board and the Pasadena Hospital Association of the Huntington Memorial Hospital.

His research interests included vacuum switching glow discharge, weld testing and radiography, high-voltage phenomena, railway equipment, vibration and dynamics, and research management.

Paco Lagerstrom dies at 74

Paco Axel Lagerstrom, professor of applied mathematics, emeritus, died February 16 at Huntington Memorial Hospital a few days short of his 75th birthday.

A native of Oskarshamm, Sweden, he received his Filosofie Kandid in 1935 and his Filosofie Licenciat in 1939, both from the University of Stockholm. He earned his PhD in mathematics from Princeton in 1942.

The applied mathematician began his career at Princeton, where he was an instructor from 1941 to 1944. He came to Caltech in 1946 as a research associate in aeronautics. He was named professor of applied mathematics in 1967, and became an emeritus professor in 1981. In 1960–61 he was at the University of Paris, France, as visiting professor of mathematics.

In 1944–45 he was a research engineer with Bell Aircraft in Niagara Falls, and the following year he worked as a research aerodynamicist for Douglas Aircraft in Santa Monica. He was a consultant for TRW Inc. from 1966 to 1968.

Lagerstrom received a Guggenheim Fellowship in 1960. He was a member of the American Mathematical Society and the American Association of University Professors.

Active in the arts in southern California, he was a former president of the Coleman Chamber Music Association, of which he was a member for many years. He was a board member of the Southern California Chamber Music Society, and the Los Angeles Chamber Music Society. He had been a trustee of the Pasadena Art Museum. In 1972 he was named a Patron of the Arts by the Pasadena Art Council.

During his career, his research interests were the aerodynamics of supersonic airplanes and missiles; the theoretical studies of viscous fluids; the theory of singular perturbations with applications to fluid dynamics and particle dynamics; and applications of group theory to differential equations.

OBITUARIES

1923
HUBERT WOODS, of Chicago, Illinois, on November 11, 1986. After graduation he worked for the Riverside Cement Company as a research engineer and then as chief chemist. In 1949 he became the director of research for the research laboratories of the Portland Cement Association, and held that position until his retirement in 1964. Woods was a member of many technical societies including: the American Society for Testing and Materials, the American Concrete Institute (where he served as director from 1962 to 1964), the American Ceramic Society, and the Institute of Radio Engineers. He wrote many technical papers for journals such as *Rock Products, Journal of the American Concrete Institute,* and *Engineering News-Record*. He is survived by his wife, Catherine.

1928
RICHARD C. ARMSTRONG, of Seattle, Washington, on July 5, 1988, after a long illness. After serving as a flight surgeon in WWII, he was an opthalmologist in Pasadena.

1930
TRUMAN HOWARD KUHN, of Altamonte Springs, Florida. Born in Glendora, California, on October 31, 1908, he pursued his postgraduate studies at UC Berkeley, and received his PhD in geology from the University of Arizona. He worked in private industry for many years before joining the staff at the Colorado School of Mines. He was promoted to full professor in 1953, the same year he assumed the office of dean of the Graduate School. In 1956, Kuhn became vice president of the faculty, and then vice president of administrative affairs in 1968. In 1976 he retired to Florida. He is survived by his wife, Edith; two sons, David and Martin; a sister, Lois B. Songer; and five grandchildren.

1931
ERNEST A. BROOKS, MS, of Fort Collins, Colorado, on November 8, 1988.

1934
CHARLES L. SCHNEIDER, M.D., of Santa Barbara, California, on August 8, 1988, after an extended illness. After graduation he received a master's degree and PhD from Harvard and graduated from Stanford medical school. He was a retired professor from the University of Michigan medical school and was a researcher in the department of obstetrics and gynecology. He was recognized internationally for his research into the causes of hemorrhage during pregnancy and disseminated intravascular coagulation. He is survived by his wife, Ruby; a son, Charles, Jr.; two daughters, Maria and Anna; and four grandchildren.

H. ORVILLE COX, of Thousand Oaks, California. After an illness of nine years, he passed away on October 3, 1988, at the age of 75. He worked as an electrical engineer both in business and in the public sector for 42 years. He is survived by his wife, Opal; two sons, Ted and Richard; a daughter-in-law, Peggy; and two grandchildren, Casey and Jessica.

1938
RICHARD ROSENCRANZ, JR., of Houston, Texas. He is survived by his daughter, Marga Rose Hancock.

1940
HERBERT SARGENT, PhD '44, on March 2, 1988. He is survived by his daughter and son-in-law, Pamela and David Bergeson of Juneau, Alaska.

GEOFFREY L. KEIGHLEY MS, PhD '44, of Toronto, Ontario, on March 24, 1988. He is survived by his wife, May. He retired as a research associate in biology in 1970 after many years at Caltech. He carried out some of the definitive work characterizing the hormone erythropoietin, and for many years bore the primary responsibility for radiological safety in the Division.

1941
WILLIAM H. REMPEL, MS, of La Canada, California, of cancer, on December 7, 1988. He was a meteorology instructor from 1941 to 1946. During WWII, he taught his specialty, long-range weather forecasting, to pilots. After the war, he established the National Weather Institute and worked there for many years. He is survived by his son, Bill; his daughter, Susan; and two brothers, Carl and Evan.

1942
EVERETT P. TOMLINSON, PhD, of Chatham, Massachusetts, retired as professor emeritus of physics from Cape Cod Community College after a long academic career. He spent 20 years at Princeton University as instructor, lecturer, and researcher in beta-ray spectrometry and magnet measurements. He helped build the Princeton-Pennsylvania accelerator and studied the behavior of subatomic particles. He taught as a visiting professor in advanced physics at Bryn Mawr. Dr. Tomlinson was married to the late Nancy Kershaw Tomlinson, who died in June, 1977. He is survived by his daughters Cicely Richardson, Sally Tomlinson, and Kathleen Tomlinson. He is also survived by his wife Anna Lowell Putnam Tomlinson, and her children James Finnerty, Charles Finnerty, and Anna Lowell Macy.

1944
WARREN L. COWDEN, MS, of Bemidji, Minnesota, of leukemia, on June 28, 1988. After graduation he enlisted in the U.S. Navy and served as a lieutenant in the South Pacific theater until 1946. He returned to Bemidji in 1947 and opened a sporting goods store in partnership with Don Schei, which he operated until his retirement in 1978. He was named Knight of the Royal Arch, one of the highest honors given by the Grand Chapter of Royal Arch Masons. He is survived by his wife, Marie; and daughter, Judy.

1947
DUDLEY E. BENNETT, of Citrus Heights, California, after a long illness. He was 64. He worked for 37 years for Caltrans before retiring as chief of operations in 1983. He was the manager of the Camellia Symphony in the mid-1970s and was a patron of several local theater groups. He is survived by his wife of 37 years, Virginia, and children Kristin Bennett and Dudley Bennett.

1948
ALLEN T. PUDER, MS '49, of Los Altos, California, on September 18, 1988 of pulmonary fibrosis. He came to Caltech after serving with distinction as an Air Force pilot in the South Pacific. After graduation, he joined Westinghouse Electric Company for two years and then moved to Ruckstell Corporation where he became president. Later, he joined Hughes Electronics as vice president and pioneered the use of Xenon light sources in the motion picture industry. He continued his work with high-intensity light sources throughout his career. He is survived by his wife of 41 years, Dorothy, and their three children: Joyann, Janice, and Allen Brent.

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News _____

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PERSONALS

1932
CLIFFORD CAWLEY, MS '33, of Lake Oswego, Oregon has just had his ninth book—*CHAMRU—A World-State from the Nucleus of a CHina-AMerica-RUssian Federation* published.

1938
GEORGE R. MELLINGER, MS, of Lake San Marcos, California, has received the Double "D" award from his alma mater, Drake University. It is given to alumni, who earned a letter in athletics at Drake, who have excelled in their chosen fields. Mellinger earned the award for his work as manager of engineering flight tests for the P-51 Mustang, the F-86 Sabrejet, the F-100 Supersabre and the X-15.

1943
ANTHONY BRIGLIO, JR., MS '46, retired on January 31, after 42 years at JPL. After earning his BS, Briglio worked at Caltech from 1943 to 1946 on a study of chemical agents that might have been used during the war. He went on to receive his MS in chemical engineering, and landed a job at JPL working on rocket engines and their propellant systems. He worked on numerous projects including managing a subsystem of Surveyor I. He says "Surveyor I, the first soft lander on the moon and precursor to Apollo, was a highlight of my career because it was beset with difficulties. The project was tougher than expected, and I was extremely happy when it landed on the moon and carried out its experiments." Briglio and his wife, Cindy, will move to Cambria, California, where he will play tennis, golf, and snow ski.

1945
F. MILES DAY of Philadelphia, Pennsylvania, writes "After various activities in manufacturing and heat process development applications, I spent my last 30 years in the railroad industry, first with the Pennsylvania Railroad, then with its ill-fated successor, the Penn Central Transportation Company and finally with Conrail. My last few years were spent in engineering/marketing liaison functions including technical and economic analysis of various bulk materials facility interfaces between rail and water modes and other fast loading facilities at mines and electric utility plants."

1947
ERNEST PRITCHARD, MS, of Pacific Palisades, California, received an award for outstanding accomplishment from his employer, Aerospace Corporation, for his work with satellite launch vehicle integration with the space shuttle and Titan programs. He has been with Aerospace for 24 years.

1955
SALVATORE PHILIP SUTERA, chairman of the mechanical engineering department at Washington University, St. Louis, Missouri, has been named a Fellow of the American Society of Mechanical Engineers.

GEORGE EPSTEIN, moved from Indiana University, Bloomington, to the University of North Carolina, Charlotte, in 1985. His three youngsters are now in their twenties. He reports that he still enjoys self defense, poetry, chess and music, although he no longer practices piano late at night in Blacker Lounge.

1956
ROBERT C. KAUSEN, human relations consultant, has just published his first book, *Customer Satisfaction Guaranteed: A New Approach to Customer Service, Bedside Manner, and Relationship Ease.* In 1976, Kausen entered the human relations field full time and has conducted public programs on relationships and personal development attended by more than 14,000 people. He has also given programs in customer satisfaction and team building for more than 30 major corporations.

1959
SAMUEL M. BERMAN, PhD, has been named the first recipient of the Sadi Carnot Award in energy conservation given by the Department of Energy to recognize significant scientific and technological achivements in energy conservation and renewable energy. Berman was recognized for his pioneering work in improving the energy efficiency of window materials and lighting systems. In 1977 he worked to produce visibly transparent, heat-reflective, thin-film window coatings to reduce energy losses from buildings. He has made major contributions to the development of high-frequency, solid-state electronic ballasts for fluorescent lighting, which can provide a 30 percent increase in efficiency. He received a citation, a gold medal, and $10,000 in a ceremony at DOE headquarters in Washington D.C. Berman has worked at the University of California's Lawrence Berkeley Laboratory since 1977. Previously, he was a founding scientist of the Stanford Linear Accelerator Center, and was a professor there for ten years.

1960
EDWARD R.H. MCDOWELL, MS, PhD '64, of Pacific Palisades, California, began his year-long term as president of the American Institute of Chemical Engineers. McDowell retired after 27 years at Chevron Oil Field Research Company where his accomplishments included computer-simulated modeling of enhanced oil recovery processes. He has held other offices for the AIChE including a council director and chairman of the national program and the new technology committees.

The late mining engineer Louis Ricketts was posthumously elected to the Mining Hall of fame. Since Ricketts and his wife endowed the student residence named for them, Ricketts House was selected to receive the plaque. Professor Leon Silver, who was given the plaque on Ricketts' behalf, passes it on to the house president, Tom Tromey.

1961
GARY G. TIBBETTS, of Detroit, Michigan, has received the John M. Campbell Award from his employer, General Motors Corporation. He received the award for his development of methods for growth of carbon fibers from natural gas. Tibbetts obtained his master's and PhD degrees from the University of Illinois before joining the Research Laboratories in 1969 where he is a senior staff research scientist.

1967
GREGORY R. SHUPTRINE writes "I continue to work with Caltex in New South Wales, Australia, and have completed nearly six years in crude trading, supply, and shipping operations. I am just starting a new role in the manufacturing and supply division to provide a greater commercial focus to our refinery organization. My marriage of nearly 17 years came to an end in divorce, but in February I am marrying again."

1969
LEWIS WHEELER, PhD, has been named a Fellow of the American Society of Mechanical Engineers. He is a professor in the department of mechanical engineering at the University of Houston, Texas.

1971
DAVID N. SCHRAMM, PhD, gave a lecture on the large-scale structure of the universe at the University of Tennessee on November 18, 1988. He is the Louis Block Professor of Physical Science at the University of Chicago, and is a consultant to the Lawrence Livermore National Laboratory in California and to Fermilab, outside of Chicago.

FRANCOIS WILDENBERG, MS, is head of Constructions Mecaniques Des Vosges—Marioni, of Lamarche, France, which has won three awards: Concours Initiative et Qualite, Grand Prix de la Productique, and Grand Prix de la Qualite Totale.

1972
YORKMAN LOWE, of Hayward, California, writes "I recently joined Mensa. In October I made a 2-week trip through the South that included my 15-year reunion at Georgia Tech."

ROBERT C. DULLIEN, of Boulder, Colorado, is CEO of Dullien Associates, Inc., a management consulting company that handles complex technical, organizational and marketing issues. His primary interest is in the applications of computer and optoelectronic technologies; others in the company work on biotechnology and pharmaceutical research.

1974
ALEX J. WILSON has moved his family to Overland Park, Kansas; he is manager of information systems for the Rural Systems Division of Butler Manufacturing. He has two children: Nathan 12, and Lindsey, 7.

1977
JOHN W. HICKS, MS, was recently appointed NASA Chief Engineer for flight research on the hypersonic National Aerospace Plane (the X-30) at the Dryden Flight Research Facility at Edwards. He is also responsible for the lead on all other hypersonic-related flight research at Dryden. He recently completed the X-29 program and is moving into new research frontiers.

1981
ROB BONNEY, MS, has received a PhD in electrical engineering from the University of Maryland. He is working on optical signal processing.

1984
DANIEL C. DAVIS has received a MD degree from the University of Iowa School of Medicine. He entered the US Navy to fulfill a health professions scholarship obligation and is interning at the Naval Hospital in Portsmouth, Virginia.

1950
KENNETH J. HAMMOND, of a metastatic malignant melanoma, on November 17, 1988. He worked as a senior engineer at Interstate Electronics in Anaheim, California, for the past ten years. He is survived by his daughter, Kimberly, of Fort Collins, Colorado; his son Patrick, of Monrovia, California; and his sister, Donna Christian, of San Francisco, California.

1955
OSCAR SEIDMAN, Eng, of Chevy Chase, Maryland, on November 28, 1988. He is survived by his wife, Louise.

1983
JAMES A. ANDERSON, on December 31, 1988, in a bicycle accident. He is survived by his parents, the Roger K. Andersons.

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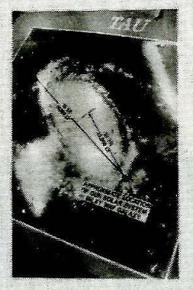

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