

CALTECH NEWS

Mead appointed the Moore Professor of Computer Science

Carver A. Mead, BS '56, MS '57, PhD '60, professor of computer science and electrical engineering at Caltech, has been named the Gordon and Betty Moore Professor of Computer Science. The professorship honors Gordon E. Moore and his wife, Betty, who endowed it. Moore is the chairman and chief executive officer of the Intel Corporation of Santa Clara, California. The Moores are members of The Caltech Associates.

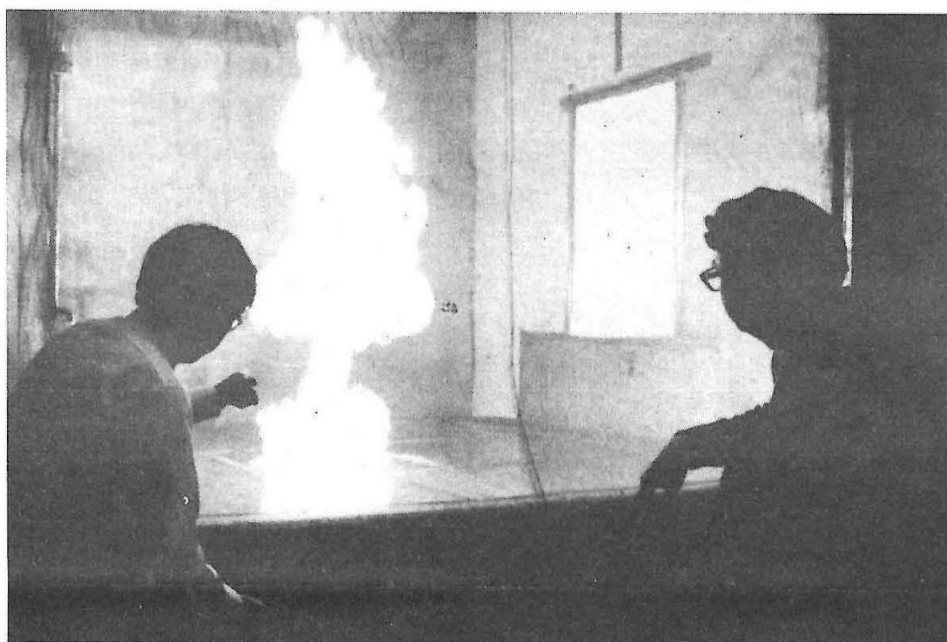
"We're grateful to Dr. and Mrs. Moore for their support," said President Marvin L. Goldberger. "Their gift is highly important in enabling Caltech to remain a world leader in computer technology. And we're doubly fortunate in having an individual of Dr. Mead's stature to fill the chair."

Moore, PhD '54, is a pioneer and leader in the semiconductor industry—the technology that has made it possible to place tens of thousands of interconnected transistors on a chip of silicon smaller than the head of a thumbtack.

Moore is the co-founder of the Intel Corporation and of the Fairchild Semiconductor Corporation, which became the Semiconductor Division of the Fairchild Camera and Instrument Corporation—the leading innovator in its field during the 1960s. As director of research and development for Fairchild he supervised much of the work on which today's semiconductor industry is based, and at Intel he led in creating many of the semiconductor products that are now in general use. He is a recipient of Caltech's Distinguished Alumni Award, the highest honor that the

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Studying fire in the laboratory



How do fires spread in buildings? Edward E. Zukoski (professor of jet propulsion and mechanical engineering, right) and Toshi Kubota (professor of aeronautics) are seeking better answers to this question. Here, in a Caltech laboratory, they study the behavior of a buoyant plume above a large diffusion flame.

New light on the cause of the Tunguska explosion

An atomic explosion? A collision with a black hole or a mass of anti-matter? A UFO crash? All of these exotic explanations (plus the more prosaic and more generally accepted one of a comet exploding in the atmosphere) have been suggested as the cause of the gigantic explosion in 1908 that reverberated around the world from Tunguska in central Siberia.

Two geophysicists at Caltech are offering an alternate hypothesis for the explosion that was heard 800 miles away—and one that explains the absence of a crater that collision with a conventional comet would produce. The scientists, Professor of Geophysics Thomas J. Ahrens and Visiting Associate John D. O'Keefe of TRW Inc., believe the explosion could well have been the result of

the collision of earth and a comet with the density of a "dusty snowball."

In their investigations, Ahrens and O'Keefe carried out computer calculations of the effects of cometary impacts on planetary surfaces. They found that such a "dusty snowball" collision could explain the absence of a crater after the explosion, despite an energy release comparable to the detonation of about 10 megatons of TNT.

According to their calculations, the low-density comet would have flashed into steam upon impact in Tunguska, causing the explosion that leveled 2,000 square kilometers of forest and created either a slight, broad depression in the earth or none at all. (Soviet expeditions have reported no evidence of cratering.)

Their theory also agrees with recent Soviet reports that tiny silicate and magnetite spherules (of the type that would be generated by a collision) have been discovered at the site. The scientists reported on their work at the 11th Lunar and

Planetary Science Conference at the Johnson Space Center in Houston.

The Tunguska explosion, which occurred on June 30, 1908, has been the subject of considerable speculation because the absence of a crater or meteorite fragments seemed to rule out a conventional explanation. The most widely accepted hypothesis has been that a large natural object, possibly a comet, exploded in the atmosphere, but the problem with this theory has been how and why a comet would explode so violently before striking the earth.

The calculations carried out by O'Keefe and Ahrens show that a large low-density comet colliding with the earth could explain the air blast, heard 800 miles away, and the extensive destruction of trees, and still not produce an observable crater.

Previously, seismologists studied the seismographic ground motion records produced by the event, as well as barographic records. By calibrating these data using signals from atmospheric nuclear explosions, they calculated that the energy of the Tunguska blast was equivalent to about 10 megatons of TNT.

Comets are conglomerations primarily composed of water, and possibly other ices including ammonia, and silicate dust, that form outside the solar system. Scientists believe they have a "dusty snowball" structure because of observations of their tails—long, luminous trails that provide spectacular displays as the comets' orbits bring them close to the sun. A comet's tail forms as the comet's ices begin to boil away under the sun's heat.

Many comets approach the sun in parabolic orbits that again carry them far out into space. But others orbit the sun and eventually may collide with the earth or other planets at speeds ranging from about

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5 to 72 kilometers per second (about 11,000 to 160,000 miles per hour).

When a stony or iron meteorite impacts a planet, it leaves a deep crater, often surrounded by shattered and melted rock and meteorite fragments. According to Ahrens and O'Keefe's calculations, the crash of a comet with a nucleus of solid ice would produce a similar crater.

But a low-density comet with a mean density between one-tenth and one-hundredth that of solid ice would completely vaporize on impact. A comet with a one-tenth-of-ice density would produce a shallow crater, while one with a one-hundredth density would produce a broad, barely discernible flat-floor depression. This is the type of comet that Ahrens and O'Keefe believe struck at Tunguska.

Collision with the same type of comet may be responsible for certain features detected on other bodies in the solar system — for example, in Mercury's Caloris Basin, on the backside of the moon, and on the ice-covered Jovian moon, Callisto. Here planetary scientists have found circular rings or a central peak within a depression.

Ahrens and O'Keefe's calculations show that impact with a "dusty snowball" comet could produce the circular rings or a central peak. The rings may be the result of what is known as Rayleigh-Taylor instability (the production of ripples at the interface between two substances such as porous ice and a silicate planetary surface, caused by attempts of the lighter material to accelerate into the denser material). A central peak in a depression may occur when the planetary surface rebounds elastically from the impact.

The Caltech scientists came to their conclusions about the Tunguska explosion in the course of studies of the effects of varied planetary material properties (such as viscosity and strength) to see how they affect the growth rate and wavelength of Rayleigh-Taylor instabilities that may control crater ring structures.

"Leading edge" campaign ends successfully

Caltech's five-year, \$130-million fund-raising campaign "At the Leading Edge . . ." has been concluded successfully. President Marvin L. Goldberger has announced that, as of December 1979, gifts and pledges to Caltech amounted to \$132,018,000.

"We are especially indebted to R. Stanton Avery, chairman of the Board of Trustees, and his colleagues on the Board for their leadership in the campaign and for their untiring efforts to keep Caltech's programs at the leading edge of education and research," said Goldberger in announcing the conclusion of the campaign, which began in 1974.

According to Goldberger, approximately half the funds came from private donors, about one-fifth from corporations, and one-fourth from private foundations.

"We are, of course, deeply thankful to our loyal and enthusiastic alumni," he said. "In the five years of the campaign, annual alumni giving has more than doubled, and for the last three years, the Caltech Alumni Fund has been awarded first place for sustained excellence in the competition sponsored by the Council for the Advancement and Support of Education.

"Our success was also aided greatly by such valued friends as The Caltech Associates. Their rapidly growing organization has shown an unflagging concern for the quality of the Institute. Our appreciation also goes to members of the Regional Advisory Councils and all the other individuals who were important in the success of the campaign.

"Caltech's steadily growing Industrial Associates organization has also greatly benefited the Institute, as well as, we hope, those corporations that have participated in our programs of information and research."

According to Goldberger, support from corporate and foundation sources enabled Caltech to strengthen existing programs and embark on extremely promising research in such diverse areas as immunology and cell biology, computer design, and the study of the environment. "Such projects epitomize Caltech's outstanding ability to launch research projects that are both scientifically excellent and beneficial in the knowledge they yield for the future," he said.

"One excellent example of foundation support is the Sherman

Fairchild Distinguished Scholars Program. Through the Fairchild Foundation's generous support, scores of intellectual leaders have been able to make extended visits to campus to share their expertise."

Goldberger said that the campaign's success was marked by substantial increases in endowment and building funds. Caltech's endowment was increased by \$27.9 million to \$156.7 million, and building funds totaled \$27 million. Thirteen new endowed professorships were established during the campaign, and substantial campus improvements, including two new buildings, were initiated.

Work was begun last fall on both the \$12-million Braun Laboratories of Cell Biology and Chemistry, and the \$6-million Thomas J. Watson, Sr., Laboratories of Applied Physics. Both of the buildings will be completed in 1982.

The \$132 million also included \$17.4 million in unrestricted funds, \$43.8 million in restricted funds, and \$15.9 million in income trusts and annuities.

"We have been enormously encouraged by the success of the 'At the Leading Edge . . .' campaign," said Goldberger, "for we believe that it represents a strong endorsement of Caltech's efforts in research and education. At the same time, we must not allow our success to make us complacent. We are being challenged by the crippling rate of inflation, rapidly rising energy costs, and a continuing need for sophisticated new instrumentation and the rehabilitation of existing facilities.

"Thus, we will be even more vitally dependent on voluntary support from all private sources—individuals, corporations, and foundations—to preserve Caltech's role as an independent world center of academic and scientific excellence."

Caltech adds five to NAE roster

The National Academy of Engineering has announced the election of five persons associated with Caltech: a faculty member (who is an alumnus), a member of the Board of Trustees, and three other alumni.

The new members are William H. Corcoran, BS '41, MS '42, PhD '48, the Institute Professor of Chemical Engineering, for his contributions to rocketry, biomedical engineering, applied chemical kinetics, transport phenomena, engineering education, and the chemical engineering profession;

Fred L. Hartley, chairman and president of the Union Oil Company of California and a member of the Caltech Board of Trustees, for pioneering work in oil shale and the development of geothermal energy resources; Stanley Corrsin, MS '42, Eng '42, PhD '47, professor of fluid mechanics, the department of chemical engineering, The Johns Hopkins University, for contributions and discoveries concerning turbulent flows of fluids, and leadership in engineering education;

Galen B. Schubauer, MS '30, retired, for discovery of self-excited oscillations in laminar boundary layers; and Glenn A. Schurman, MS '47, PhD '50, managing director of Chevron Petroleum (U.K.) Ltd., London, for leadership in major offshore engineering achievement that has advanced deepwater oil production technology.

Mead appointed the Moore Professor

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Institute confers on a graduate.

Mead has been a member of the Caltech faculty since 1958. His book, *Introduction to VLSI Systems*, which he wrote with Lynn Conway of Xerox PARC, has had a major impact on industry and university teaching in its field.

An exponent of the view that computer scientists should build machines that are oriented to humans rather than forcing humans to orient themselves to computers, Mead has played a leading role as an innovator in education. He created undergraduate courses in solid state electronics and digital electronics and introduced a graduate course in the design of integrated circuits—all aimed at training computer scientists who will develop machines to make people more efficient and powerful in their work but still in control of the processes for which they are responsible.

Mead has conducted research in solid state devices, metal-semiconductor interfaces and surface physics, optical measurements of semiconductor and surface properties, and electronic processes in insulators, and more recently in VLSI, computer architecture, and physics of computation.

A gala birthday party for the Athenaeum

by Phyllis Brewster

The grand birthday cake was crowned with 50 lighted candles—making a splendid blaze as it was swept through the darkened Athenaeum dining room by maitre d'hôtel Albert Lopez and assistant manager Abel Ramirez in tails. And if that weren't enough, 36 individual cakes followed in procession, each with five lighted candles and each carried in style by a red-coated waiter.

Not one, but two distinguished carvers—Marvin Goldberger and Lee DuBridge—held the knife that cut the first serving. Then it was cake and champagne for all, and the toasts began for the Athenaeum, whose 50th anniversary was being celebrated.

Among the capacity crowd of 360 members who gathered for the dinner in honor of the 50-year-old elegant Italian Renaissance-style club were 34 of the founding members, each introduced by Caltech President Marvin L. Goldberger.*

Goldberger also welcomed Michael Millikan and George Ellery Hale, grandsons of two of Caltech's three founders (Robert A. Millikan, George Ellery Hale, and Arthur Amos Noyes) who conceived the idea of establishing a "modern Athenaeum" on campus that would serve the "social, cultural, and intellectual interests" of the scholars and friends of Caltech and associated institutions.

Then, Hannah Bradley, 1980 president of The Associates, paid tribute to the building on behalf of this group of friends of Caltech who have been a part of the Athenaeum since the beginning.

Caltech President Emeritus Lee A. DuBridge recalled the building's early days, mentioning some of the famous who ate, slept, lectured and listened there, among them Albert Einstein, J. Robert Oppenheimer, Walter Lippmann, Guglielmo Marconi, Princess Margaret and Lord Snowden, Field Marshal Montgomery, Anthony Eden, Charles Beard, Niels Bohr, Herbert Hoover, and Hugh Walpole.

Among the stories DuBridge culled from the archives was a description of the thrones built for Allan and Janet Balch, donors of the stock that made the building possible. The Balches were seated on the thrones at a dinner party in their honor November 6, 1930, just a few months after completion of work on the structure.



Wishing for another glorious 50 years of Athenaeum history, as they blow out the candles on its birthday cake, are maitre d'hôtel Albert Lopez, Caltech President Emeritus Lee A. DuBridge, Caltech President Marvin L. Goldberger, and the Athenaeum's assistant manager, Abel Ramirez. Lopez and Ramirez led a procession of waiters bearing lighted birthday cakes through the Athenaeum dining room.

Actually the Athenaeum's existence is also due to the Caltech financial adviser who fortuitously converted the Balches' stock into \$500,000 cash just before the market crash of 1929. That half-million dollars paid for not only the building and furnishings, but also the landscaping, three tennis courts, and a badminton court.

DuBridge also reported on a letter, circa 1930, from Professor Earnest Watson (on campus) to Professor Horace Gilbert (in Europe for the summer), complaining that the Athenaeum was being taken over by women—faculty members' and Associates' wives. The letter began "Help! Succor!"

Other glimpses into the history of the Athenaeum, the Institute, and the times in general during the past five decades, were provided by programs, correspondence, and monthly bulletins of the club, blown up to poster size and displayed in the lounge.

During the first year of operation, Athenaeum dues were "\$1 per month—not exceeding \$10 a year." Tea was served at 4 p.m. on Sundays and Wednesdays at no extra charge. Nineteen years later, in 1949, dues had risen to \$4 a month and in that same year the Christmas dinner of turkey and sirloin steak cost \$1.90. By 1954 a deficit in the Athenaeum's financial situation compelled the house committee to announce that it would be forced to hike the price of lunch by five cents and the price of dinner by fifteen cents.

In 1953 a social milestone was marked when the requirement that

members wear coats and ties to lunch was deleted. Another significant social change came in 1968 with the acquisition of a liquor license.

Over the years, speakers and programs, lectures and discussions, have dealt with most of the major scientific, political, and cultural issues of the times. Other Athenaeum affairs reflected the pursuit of pleasure: holiday parties and dances, wedding receptions and banquets—and grand occasions like a 50th anniversary.

*Founding members at the dinner included Dr. and Mrs. Carl D. Anderson, Dr. and Mrs. Robert F. Bacher, Mrs. John E. Barber, Dr. and Mrs. Arnold O. Beckman, Mrs. Charles F. Briscoe, Mrs. John Buwalda, Professor Frederick J. Converse, Mrs. Robert L. Daugherty, Mrs. Godfrey Davis, Mrs. Jesse DuMond, Mrs. Paul Epstein, Mr. and Mrs. Philip S. Fogg, Dr. and Mrs. Horace Gilbert, Mrs. William Houston, Dr. and Mrs. Arthur L. Klein, Dr. and Mrs. Frederick C. Lindvall, Mrs. Aristotle D. Michal, Dr. and Mrs. H. Victor Neher, Dr. and Mrs. William R. Smythe, Mrs. J. H. Sturdivant, Dr. and Mrs. Ernest H. Swift, Dr. and Mrs. Ray Untereiner, and Dr. Harry V. Warren.

Duwez receives APS prize

Pol Duwez, professor of applied physics and materials science, emeritus, at Caltech, is recipient of the 1980 American Physical Society International Prize for New Materials, along with William

Klement, Jr., of UCLA and Ronald H. Willens of Bell Laboratories. The prize is sponsored by IBM.

The three researchers are being honored for work in the 1960s that led to the discovery of metallic glasses obtained by melt quenching. Over the years, the discovery has resulted in production of a vast array of metals with properties of unusual scientific interest and promise.

Alumni to visit Palomar Observatory

Three Caltech faculty members will be on hand to describe the work at Palomar Observatory when the facility is open for a visit by 100 alumni on Saturday, May 31.

Jesse L. Greenstein (the Lee A. DuBridge Professor of Astrophysics), Wallace L. W. Sargent (professor and executive officer for astronomy and a staff member of the Hale Observatories), Gerry Neugebauer, (professor of physics and Hale Observatories' staff member) share the program with the 200-inch telescope, which will be opened and rotated for the visitors.

Two buses, each accommodating 50 people, will travel to Palomar—one leaving the parking lot at Caltech's Beckman Auditorium at 8 a.m. and the other leaving Leisure World, Laguna Hills, at 9 a.m. Both will return to their points of departure between 5 and 6 p.m.

Lunch and wine will be provided for the visitors. Reservations are being taken by the Alumni Association on a first come-first served basis.

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EDITORIAL STAFF

Executive editor: Winifred Veronda.

Staff associates: Phyllis Brewster, Diane Davis, and Kay Walker.

Photographer: Chris Tschogel

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Some intense dialogue on the undergraduate program

by Winifred Veronda

Chemical Engineering Professor Fredrick H. Shair termed it "an event unique among top universities in the country." Certainly it was the first time that one hundred Caltech students and faculty members had sat down together to spend two days exploring the total undergraduate program at the Institute.

The idea for such a weekend faculty-student conference began over a year ago at a meeting of the Caltech Y Board of Directors. The idea gained momentum, and the conference took shape, as Y Board members — particularly Shair and 1979-80 ASCIT President Ray Beausoleil — mustered support among their respective colleagues. Meanwhile, Caltech Y Director Walt Meader coordinated a growing mass of scheduling and logistical details.

President Marvin L. Goldberger gave the idea his strong endorsement, as did other key administrators at the Institute, and JPL Director Bruce Murray offered an auditorium at the Laboratory as a meeting place — a neutral site away from daily faculty-student encounters.

Leaders of campus organizations were invited to represent the student body, and each house president nominated two delegates at large. Faculty members were chosen for their roles in administration or on committees or their involvement as teachers of undergraduates, and they were invited by President Goldberger. The final count: 51 students and 51 faculty members — an ideal blend.

Buses transported the entire contingent from campus to JPL for two full days of meetings over a taut-full agenda that included everything from the adequacy of athletic facilities to formal student grievance procedures to the quality of teaching in the core curriculum.

The pace was rigorous and sometimes exhausting, the exchange frank, open, and friendly, and both students and faculty articulate in expressing their opinions and concerns. Miraculously, each day's session (moderated by Meader) finished almost on time, its entire agenda complete.



At a break between sessions, David Goodstein (professor of physics and applied physics and chairman of the Faculty Board) discusses his views on the undergraduate core curriculum with Thomas K. Caughey (professor of applied mechanics), senior Jon Zingman, freshman Ollie Graves, and Caltech President Marvin L. Goldberger.

A major casualty of the conference: the myth, reiterated by faculty members during the first day, that Caltech students become depressed because of the competition with so many other young people who are as bright as they are. Not so, the students asserted staunchly. Rather, they become depressed when they feel unable to adequately master the massive amounts of information that they are expected to absorb, and they lose confidence and self-esteem.

During the last day, Ray Beausoleil presented a series of recommendations prepared by the students. "As a whole," noted *The California Tech* in reporting on the conference to the student body, "the recommendations are intended to maximize the chances that the courses, especially core courses, are taught effectively so that more students retain their interest in science while simultaneously acquiring the basic skills that they need to progress at Caltech.

"The students were especially impressed with the faculty's desire to improve conditions," the *Tech* continued, "and were delighted to find that some of the most articulate speakers for their suggestions were faculty members."

GALCIT Director Hans W. Liepmann (the Charles Lee Powell

Professor of Fluid Mechanics and Thermodynamics) was asked to summarize the faculty viewpoint. "The most important business we have here is teaching," he said. "What most of us are contributing to research will be a footnote in a handbook 15 or 20 years from now while the students we are teaching now will still be walking around and hopefully contributing to society.

"When I came to Caltech," he added, "it was a private club of Dr. Millikan. We never felt like employees but like members of a club or fraternity, and the students were part of that fraternity; their access to faculty members was easier than today.

"What has changed? Part of it is simply that people are too busy with red tape: government committees, faculty committees, a continuous writing up of proposals and reports, and so on. These conditions are difficult to change. But what can be changed is the students' understanding of the situation. It will help if they realize that, if faculty members don't seem to have time for them sometimes, it isn't because they don't want to take the time but because they have to be so involved with annoying and frustrating busy work that didn't used to be there."

The meeting ended late on Sunday afternoon after a vigorous delegating of responsibilities for following up on specific recommendations and for reporting on the proceedings at faculty committee meetings. "The

conference was quite a success," incoming ASCIT President Andy Gellman wrote in the *Tech*. "One of the most important points made by the faculty was that they get too little feedback from us. This is something we can remedy quite easily, provided everyone is willing to start voicing opinions."

If the 51 students at the conference are any indication of the undergraduates' ability to present their viewpoints about their education at Caltech in a logical and effective manner, then the faculty members are likely to get all the well-presented feedback that they could desire.

An alumnus reacts to the conference

Greg Stone, an attorney with Munger, Tolles, and Rickershauser, acted as official representative for the alumni at the faculty-student conference. Caltech News asked him to share his reactions with other alumni.

by Greg Stone
BS '74, MS '74

I was invited to the faculty/student conference on the undergraduate program to present what was advertised as "An Integrated Alumni Perspective." For obvious reasons, I was hesitant to undertake a talk of this breadth, but after retitling it to limit it to "My Personal Perspective," I agreed.

I want to take this opportunity to share my reactions to the conference. At the outset I would emphasize that everyone attending agreed that Caltech provides a remarkable education to a remarkable student body. But there is always room for improvement, and the theme of the conference was to identify ways in which the undergraduate program can be improved.

A variety of concerns were aired, but I believe the essence of the discussion will be conveyed if I summarize just three. First, both faculty and students, as well as this alumnus, were worried that too many students are specializing prematurely. Consequently, many undergraduates don't receive an education of optimum breadth, in spite of the fact that many Caltech

seniors carry a course load equivalent to that carried by most first-year graduate students, and many other students carry an overload — more than the normally allowed number of units.

There seemed to be a consensus that this trend toward specialization, and away from a broad-based education, is undesirable. I argued that the best training for an engineer or scientist in light of today's rapidly changing technology is not early specialization but a broad background with exposure to many fields. Such training, I felt, makes the engineer or scientist better able to adapt as technology progresses, and better able to apply new technologies and skills to tomorrow's problems.

Most participants agreed that greater breadth (more courses outside the student's option, including humanities and social

research. For many alumni, as for myself, this opportunity was one of the high points of four years at Caltech. President Goldberger was particularly sensitive to this area and entertained various suggestions for improvements. In fact, last summer Caltech funded a number of undergraduate research projects through the SURF program, and President Goldberger expressed continued support for this effort.

He also suggested that requiring a senior thesis might encourage more students to avail themselves of the research opportunities on campus. Harry Gray also strongly supported increased undergraduate research. He proposed that the second quarter of the year, or some variant, be reserved solely for research, with no classes offered during that period.

A third concern, quite difficult to articulate, was that students don't realize enough success during their



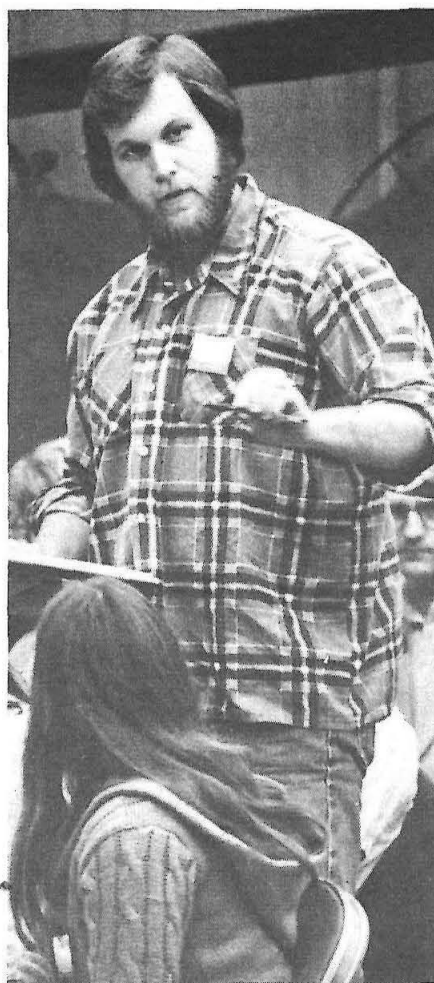
Listening intently to a presentation are Ray D. Owen (vice president for student affairs and dean of students, and professor of biology), James J. Morgan (professor of environmental engineering science), President Marvin L. Goldberger, John E. Bercaw (professor of chemistry), and Provost John D. Roberts (Institute Professor of Chemistry).

science) was desirable, but there was no consensus on how to achieve this. Some wanted to place the burden on advisors to ensure breadth. Others wanted to revise the Institute requirements. Some thought the best remedy would be to sensitize students to the disadvantages of premature specialization. The optimum solution wasn't identified, but I believe further thought will be given to alleviating the problem.

Another widely held concern (and one more easily remedied) was that students don't take full advantage of opportunities for undergraduate

time at Caltech. This was expressed in many ways. Some said that the courses were too demanding and under-united; i.e., that they require more homework than the hours officially allowed in the catalog. Others thought that the courses require students to absorb too much material too quickly, and don't give them time to develop an appreciation of the subject.

As I look back on my years at Caltech, many of these concerns ring true. Although I had a wonderful four years and received a comprehensive and challenging education, I wish now that I had



Outgoing ASCIT President Ray Beausoleil presents student recommendations for modifications in the core curriculum.

done more research and taken more courses outside of my option. At the time I didn't recognize the desirability of this route. In contrast, the students attending the conference demonstrated a better perception of the purposes of a Caltech education than I did as a student.

More importantly, the faculty and administration were responsive to the students' concerns. I believe the future promises improvements. I left the conference convinced that President Goldberger is committed to improving Caltech's undergraduate program and to ensuring that Caltech provides each student with the opportunity to realize his or her full potential.

Caltech: beneficiary of Brown's award

Secretary of Defense Harold Brown, former President of Caltech, has been named the recipient of the National Engineering Award by the American Association of Engineering Societies, and has designated Caltech as the recipient of the \$5,000 scholarship, which is donated to a college or university as part of the award. According to Caltech officials, the scholarship funds will be used to aid two undergraduates during the next year.

Computer graphics: coming of age as an art form

The ability of computer graphics to simulate objects and depict lifelike images is becoming an increasingly common part of our lives. Once limited to making pictures from line drawings, computer graphic artists now can choose from an almost unlimited range of colors and can produce virtually any picture that they choose.

As the price of computers continues to drop, they'll be used increasingly in art and entertainment, according to James F. Blinn, a member of the technical staff at JPL. In fact, Blinn told his audience at an Earnest C. Watson Caltech Lecture, computers may eventually give birth to a new art form, enabling a computer artist to create programs that would produce images on a viewing screen, and the computer viewer to play with the images by changing textures, colors, etc.

"The artist would use his talent to come up with some interesting visual programs, and the observer would be able to make interesting changes in the picture by twiddling knobs," he explained. Using music as an analogy, this would represent an intermediate step between playing an instrument and simply listening to the radio.

Computer graphics also will be used increasingly by the entertainment industry for special effects, Blinn predicted. Already computer graphics emulates a special effects technique, that of combining separately-created objects in one animated sequence. Separate computer-produced objects, each devised by a different program, can be combined into one picture sequence, eliminating the need for a gigantic master program, Blinn explained.

Computer-generated images today are produced by a combination of effects ranging from hand painting (with an electric pen on a digitized tablet that transmits coordinates to a computer) to mathematically simulating a three-dimensional world. These effects enable the specialist to put textures and irregularities on surfaces, simulate diffuse light reflection, overlay

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images, produce three-dimensional shapes and smoothly curved surfaces that reflect light, make globby molecules, fuzzy looking clouds, and little objects that look like dents on one side and bumps on the other; and depict lightning flashes on Saturn, volcanoes erupting on a Jovian moon, or comets whizzing through the solar system.

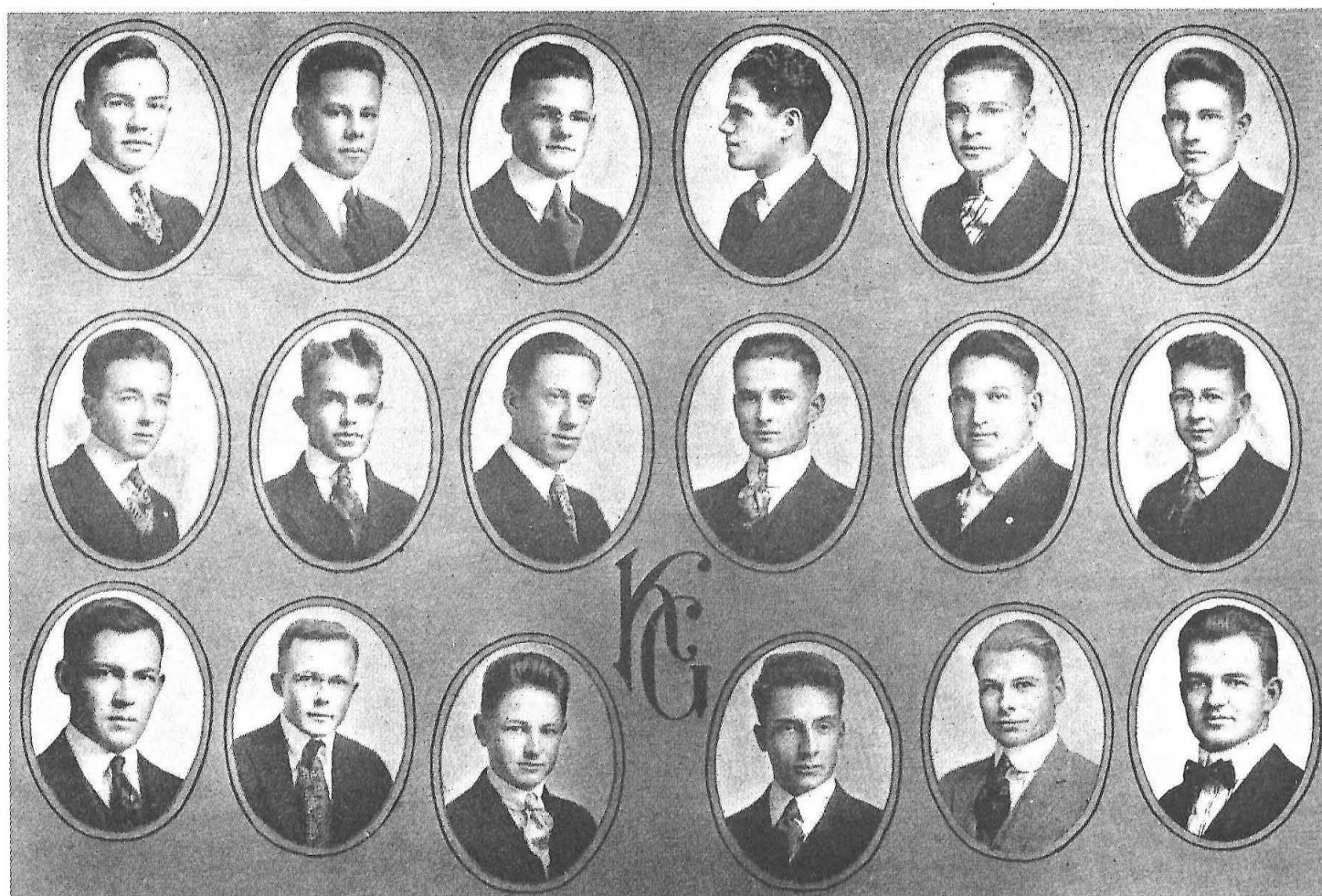
The cover photograph offers an imaginary look at the Voyager spacecraft as it peruses Saturn in the fall. The light and dark belts on Saturn's rings were generated by a computer program, the intensities deduced by calculations of light curves from the rings as detected on earth.

Specialists at JPL are especially interested in making images of planets, Blinn noted as he showed a film of the Voyager spacecraft on a Jupiter fly-by. In making the film, the computer first consulted its catalog of all stars down to the sixth magnitude (6,000 stars) and dubbed in those that would be visible from the vantage point chosen by the programmer.

Then it began to draw Jupiter, working from top to bottom and left to right, looking up latitude and longitude information on Jupiter in its program, calculating the orientation of the Jovian surface with respect to the sun, and scaling down light intensity accordingly. The computer then drew the spacecraft in the foreground, overlaying it on the planet's surface. (A list of coordinates from a blueprint of the spacecraft had been placed in its memory bank.)

The result: A two-and-a-half-minute movie with 4,000 individual frames generated during a week and a half of continuous computer time, showing Voyager closing in on the giant planet, passing close to its surface, and then pulling away.

Star Wars II (better known as *The Empire Strikes Back*), which premieres during May, will be short on computer-generated special effects, according to Blinn. But look out, Darth Vader: by the time *Star Wars III* comes along, those space ships firing at the Empire fleet may be flying straight out of a computer program.



Gnome members in 1918 as they appeared in the yearbook of Throop Polytechnic Institute (the predecessor to Caltech). Frank Capra (top row, second from left) wrote his senior thesis on "Conductivity of Picric Acid and Its Salts," but then his career took a different turn: He went on to become the film director holding the longest string of Academy Awards in motion picture history.

Gnome traditions: alive and well

Caltech's oldest continuous organization, the Gnome Club, has evolved over 83 years as a secret society, an off-campus living club, and more recently as an alumni service group that each year initiates outstanding members of the senior class.

Older Gnomes can recall when Caltech students might return to their dormitory rooms to find pranksters had filled them with branches from the orange groves behind Throop Hall, when clearing the brush off the big "T" on the mountainside above Pasadena was a regular fall activity, and when Caltech's football team defeated UCLA.

Those Gnomes join once a year with younger members (and with husbands, wives, and special friends) to share in a ritual created in 1897 by founder Joseph Grinnell and his 15 student colleagues at Throop Polytechnic — a ritual still symbolized in the Gnome pins by an owl atop a crescent moon.

Few of those 16 original Gnomes could ever have expected that the presidential gavel would one day

pass into the hands of a woman, but none of the 61 members present at this year's Founders' Day dinner flickered an eyelash when Louise Kirkbride, BS '75, MS '76, accepted the gavel from outgoing President Philip M. Neches, BS '73, MS '77.

The omens being auspicious, Kirkbride joined with the other new officers in pledging to serve the Institute, alumni, and students in a spirit of courage, loyalty, and truth:

Phil Naecker, BS '76, vice president; Fred A. Wheeler, BS '29, treasurer; Gregory L. Simay, BS '75, secretary; and William H. Mohr, BS '29, MS '30, sergeant at arms; along with directors Lisa M. Anderson, BS '74, Pam Crane, BS '79, Richard A. Dean, BS '45, Max S. Kreston, BS '50, Doug Josephsen, BS '65, Walt Meader, David W. Morrisroe, Robert C. Perpall, BS '52, MS '56, and Gregory P. Stone, BS '74, MS '74.

Absent from the dinner for the first time in many years was the organization's oldest member, Elmer Frey, Ex '07. Frey sent his greetings and reported that he's feeling fine but that at 96 he doesn't drive any more and that this year he didn't have his usual ride to Pasadena.

The Gnomes heard that their career counseling seminar series, begun two years ago in collaboration with the Caltech Y, is filling Winnett

Lounge as students come to hear alumni talk about their own career specialties. They also learned that \$2,344 in Gnome scholarship funds were awarded to Caltech students this year. Then they settled back to hear Caltech archivist Judith Goodstein talk about student life at Caltech during the 1920s and 1930s and to show some rare slides from the Institute archives.

The Gnome founders claimed they drew their inspiration for their traditions from a group of learned gnomes on an island in the Aegean Sea. With Caltech students drawing their career inspirations from modern-day learned Gnomes, those traditions are alive and well today.

Don't forget your class reunion

Alumni who graduated 50 years ago—and at 5-year intervals since then—are invited to the campus this spring for class reunions. Specially honored will be members of the class of 1930, who will be inducted into the Half Century Club on Friday, June 6, at a luncheon in the Huntington-Sheraton Hotel.

Other reunions include: **Class of 1935**—Friday, June 6, campus tour from the Athenaeum at 4 p.m., followed by a no-host cocktail reception at 5:30 p.m. and dinner at 7 p.m. in the Athenaeum. **Class of 1940**—Friday, June 6, campus tour at 4 p.m., followed by no-host cocktail reception at 5:30 p.m. and dinner at 7 p.m. in the Athenaeum. **Class of 1945**—Saturday, June 7, campus tour at 4 p.m., followed by cocktails at 5:30 p.m. and dinner at 7 p.m. in the Athenaeum.

Class of 1950—Saturday, June 7, details to be announced. **Class of 1955**—Friday, May 16, details to be announced. **Class of 1965**—Saturday, June 14, campus tour at 4 p.m., followed by a no-host cocktail reception at 5:30 p.m. and dinner at 7 p.m. in the Athenaeum. **Class of 1970**—Saturday, June 14, campus tour at 4 p.m., followed by a no-host cocktail reception at 5:30 p.m. and dinner at 7 p.m. in the Athenaeum. **Class of 1975**—Saturday, June 14, a picnic and barbecue in Tournament Park with details to be announced.

Obituaries

1932

CHARLES M. SCHWIESO, JR., honorary alumnus, on November 16 after a long bout with cancer. He was senior accounts executive with Putnam Financial Services in San Rafael, California, and had served as executive secretary of the Caltech Y from 1925 to 1935.

1933

EVERETT F. COX, PhD, on February 20 in Winter Haven, Florida. Cox taught physics and photography at Colgate University (1933-39), was a physicist for the Naval Bureau of Ordnance at Pearl Harbor and Washington, D.C., (1939-48), chief of weapons effects at Sandia Laboratories in Albuquerque, New Mexico (1948-56), and research scientist for Whirlpool Corporation (1956-68). He also served as a consultant to numerous government agencies. Survivors include a daughter, Nancy Brouillard, and a son, William.

1961

WAYNE A. MASSEY, MS '63, on July 8, 1979. He was killed in an automobile accident while fixing a flat tire near Indio, California. He had been senior staff engineer at TRW in Redondo Beach, California.

Personals

1923

WILLARD E. BAIER of Ontario, California, has been elected a Fellow of the Institute of Food Technologists for his "long and distinguished leadership in the research and development of the citrus products industry." Baier was with Sunkist Growers for 44 years, until his retirement in 1967.

1931

LAVERNE LEEPER, MS '32, writes from Arcadia, California, that he is "back at Caltech as construction manager on construction of the Braun Lab of Cell Biology and Chemistry and the Watson Lab of Applied Physics."

1934

KENNETH A. WILLARD, MS, MS '35, has been named editor-at-large of *Radio Control Sportsman* magazine. Willard lives in Los Altos, California.

1935

JAMES H. JENNISON, MS '36, reports, "On 9 February 1979 I retired from my position as head, product engineering department at the Naval Ocean Systems Center, San Diego. I had worked for nearly 34 years in essentially the same laboratory organization under five different names. Since retirement, I've done a little structural engineering consulting. I keep busy improving our homes at Encinitas and Idyllwild (California) and keeping in touch with our four married children and three grandchildren. We also enjoy our church activities."

1940

JEAN B. STEVENS, Eng '47, reports from Crestline, California, that he retired in October 1979 from Lockheed-California where he had been a senior design specialist "without apparent damage to the corporate structure. In summary, after 25 years U.S. Navy, 3 years McDonnell-Douglas, and 10 years Lockheed-California, during which nothing spectacular was accomplished, a benign fate and some astute planning have brought us to retirement in a mountain home. Here we split our own wood, and plant what few crops the miserable ground will sustain . . . these crops we generally share with the

ground squirrels and gophers on a first-come basis. The nearest commercial aggregate is about two miles away. For amusement, we cannot go to town and watch a few haircuts because there isn't even a barber shop. And we love it."

1942

S. KENDALL GOLD of Greenwich, Connecticut, has been elected a vice president of Caltex Petroleum Corporation. Regional director for the company's Bahrain region since 1977, he assumes responsibility for Caltex's strategic planning and planning and economics departments.

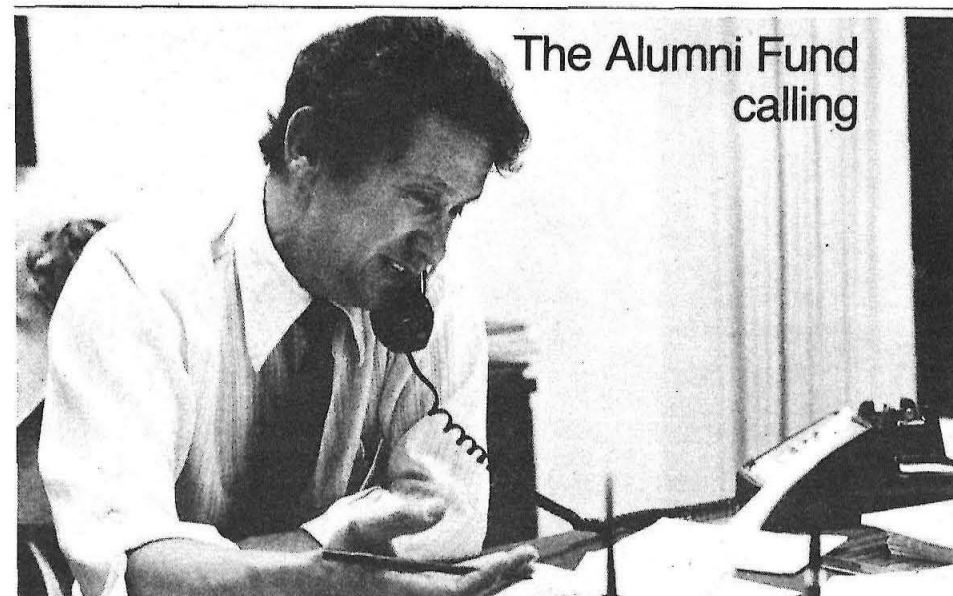
GEORGE P. SUTTON, MS '43, engineer at the Lawrence Livermore Laboratory, has received the Distinguished Engineering Achievement Award of the California Society of Professional Engineers. The award recognizes Sutton's outstanding individual achievement in engineering and lifetime contributions to the profession. Sutton designed some of the nation's first liquid propellant rocket engines in the 1940s and his *Rocket Propulsion Elements* is still considered a standard text in the field. He is currently leader of the Machine Tool Task Force, a coalition of more than 100 developers, manufacturers and users of machine tools. The task force is surveying machine tool technology and is expected to make a significant contribution to modernization.

1944

YE KE WU (GEORGE YIK) of Shanghai, the People's Republic of China, shares with us his activities since graduation from Caltech and his master's degree from the University of Michigan in 1945: "Returned to China 1950; married Grace Nieh 1952. Three sons, Ming, born 1953, Hong, born 1957, Ping, born 1960. Worked on factory design since 1952. Now senior engineer, Second Design Institute, first Ministry of Machine Building. Visited U.S. for a month in 1979 as member of official delegation. Since this is the year of the monkey, please allow me to wish you a happy Chinese new year!"

1945

JEROME HARRINGTON, MS '47, has been promoted to general manager of Honeywell's Motor Products Division in Rockford, Illinois. He was the division's first director of international business, named to that post in 1977.



Renewing ties with former classmates throughout the country is one of the fringe benefits for participants in the annual Alumni Fund telephone program. This year 200 alumni are spending eight evenings contacting 4,500 of their fellow graduates. Above, Rinaldo V. Guterrez, area chairman for Palos Verdes, calls a friend in San Francisco. Charles H. McDougall, BS '47, an executive with Sears Roebuck and Company, made Sears WATS telephone system available to the Alumni Fund again this year.

1948

HERBERT K. BARNETT, MS, is with Brown-Boveri & Co. in Baden, Switzerland, where he is section manager in the relay and protection department. His wife, Charlotte, runs a study camp at Lausanne/Chailly.

GEORGE GLEGHORN, MS, PhD '55, and his wife, Barbara, have been named Citizens of the Year by the Palos Verdes Peninsula (California) Chamber of Commerce. Peninsula residents since 1954, the Gleghorns are being honored for their service to the community, particularly for their devotion to the Peninsula Library District.

THOMAS G. LANG, BS '50, has retired from the Naval Ocean Systems Center in San Diego, where he was head of the Advanced Concepts Division, and has formed the Semi-Submerged Ship Corporation to engage in commercial SWATH ship design work.

PAUL S. ROGELL, MS, Eng '48, writes from Stamford, Connecticut, "I received a patent for a simulated gemstone and am now operating Cathay Corporation to manufacture and sell the stone."

1949

HUGH CARTER, president of Carter Engineers in San Diego, received a Fellow Certificate from the American Society of Heating, Refrigerating and Air-Conditioning Engineers. The award, given to less than one percent of ASHRAE members, recognizes unusual distinction in "advancing the arts and sciences of environmental control and human comfort."

1950

CAPT. JOHN T. SHEPHERD, USN (Ret), Eng, has retired from his position as a trial attorney in the Admiralty Section of the U.S. Department of Justice and is engaged in private law practice in Arlington, Virginia.

1951

STEPHEN PARDEE, MS '52, has been appointed director of the Design Process Development Center at Bell Laboratories in Whippany, New Jersey. Previously he served as head of the Computer Aided Design Department.

1952

HARRY C. HOYT, PhD, has been appointed acting associate director for energy programs at Los Alamos Scientific Laboratory.

1955

SIGMUND REDELSHEIMER, MS, was appointed manager of civil space programs of Advanced Space and Special Projects for McDonnell-Douglas Astronautics Company in St. Louis, Missouri.

1956

FREDERICK M. TRAPNELL, JR., MS '57, writes, "I joined the Amdahl Corporation just over a year ago as vice president, software. Family is now settled in Atherton (California) with one daughter in high school here and another about to graduate from UCLA."

Please turn the page

PERSONALS

1957

DONALD P. NIERLICH sends the following: "My wife, three children and I recently returned from Cambridge, England, where I spent a sabbatical at the MRC Laboratory of Molecular Biology. At home in Los Angeles, I am professor of microbiology at UCLA with research in the regulation of nucleic acid synthesis."

1960

GARY A. ZIMMERMAN reports, "On January first I was advanced from dean of science and engineering to vice president for academic affairs at Seattle University, where I have been on the faculty since 1964."

ROY REICHENBACH, PhD, is serving as the assistant for engineering technology in the Office of the Assistant Secretary of the Navy for Research, Engineering, and Systems. He lives in Arlington, Virginia.

1968

WALTER MATYSKIELA and his wife, Sharon, welcomed their first child, Mary Ellen, on January 1. Mary Ellen was the first baby to be born in the new year in Pacific Palisades, California. Matyskiela is in the engineering and applied sciences department of Rand Corporation.

1970

ROGER CHEVALIER has left Kitt Peak to become an associate professor of astronomy at the University of Virginia.

JOHN M. SHERFINSKI, MS, reports, "Went to law school at UCLA; practiced patent law in Hartford, Connecticut, for two years; am currently teaching physics at Kingswood School, a private prep school in West Hartford."

1971

FRANÇOIS WILDENBERG, MS, sends this update: "Since September I am living in the historic Quarter Latin in Paris. I am on a sabbatical leave at the Institut Auguste Comte pour l'Etude des Sciences de l'Action. This new center for advanced studies sheds light on the logic of action in relation to France's place in an interdependent world economy. In August I'll be back in my company, Constructions Mécaniques des Vosges MARIONI as directeur général. We are subcontractors in machine tooling and mechanical engineering, and everything is running very well there."

1972

BARRY M. COHN, MS, writes, "Since receiving my master's degree in '72, I've done doctoral research at UC Berkeley, published on 'Macromodeling of Operational Amplifiers,' worked for Intel Corporation for a few years, and am currently director of electronics at Information Systems Design, Inc., at Santa Clara, California, where I've been for over three years."

1973

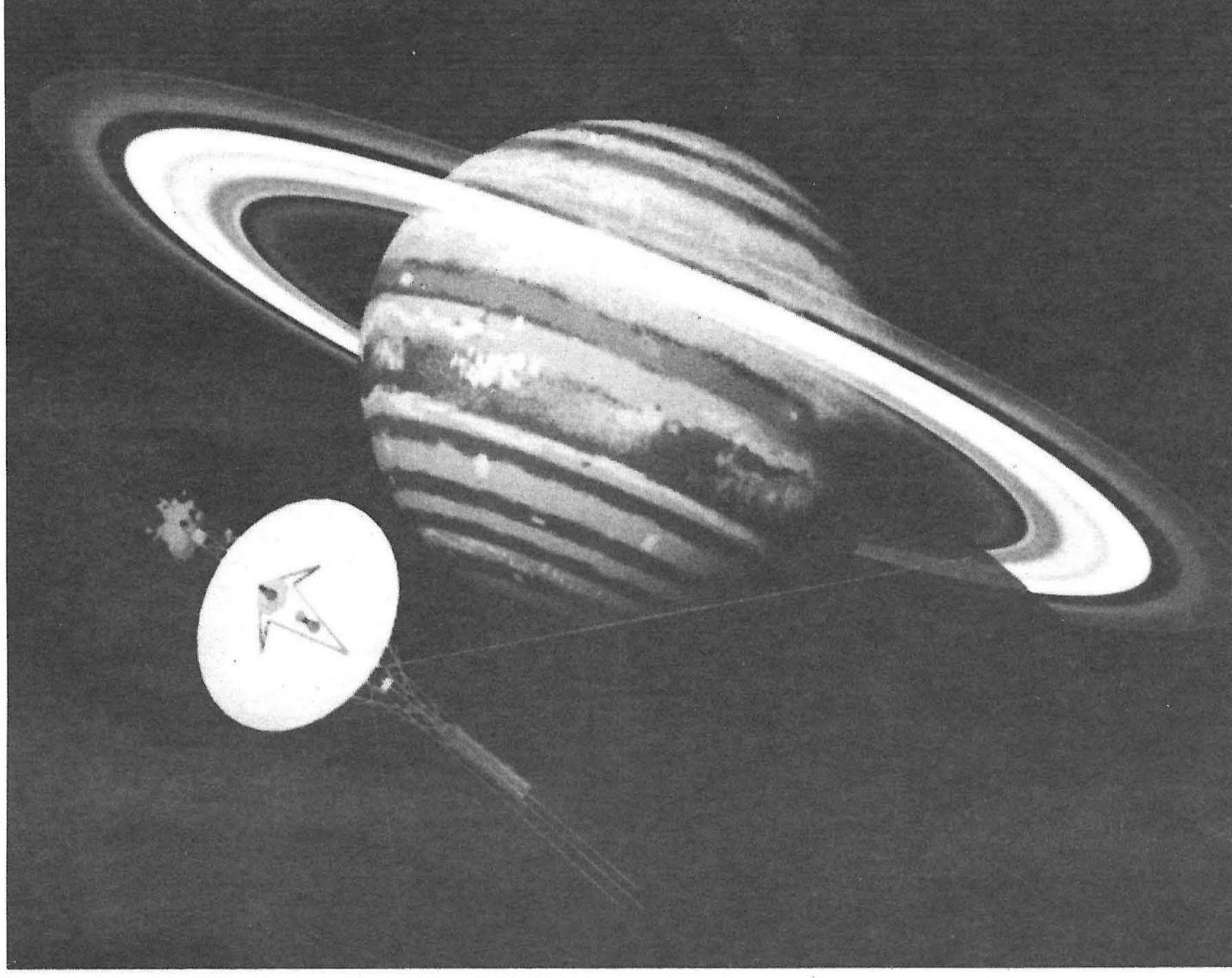
CLIFF I. DAVIDSON, MS, PhD '77, assistant professor of civil engineering at Carnegie Mellon University, has received a grant from the EPA to conduct background air pollution sampling in the Himalayas. He and his wife, Megan, who is a copywriter, traveled to Nepal in December 1979.

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Computer-created images are coming of age as an art form. This picture, created at JPL, depicts the Voyager spacecraft on a journey past Saturn. (Story on page 5.)