CALTECH NEWS

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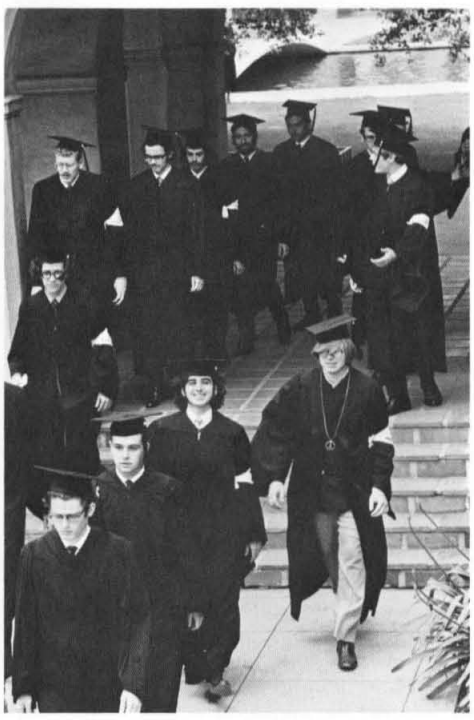


Commencement—1971

A near record number of degrees were conferred at Caltech's 77th commencement on Beckman Mall on June 11—164 bachelor's degrees, and 261 advanced degrees.

The class of 1971, the largest in over 20 years, included 50 students with engineering options, 109 in science, 5 social science majors, and 1 Renaissance man whose option was in the field of physical sciences. Three seniors, Leonidas Guibas, Andrew Odlyzko, and Alan Strickland, were also awarded master's degrees; six students with engineering or science options had a second major in the humanities or social sciences, and four majored in two sciences.

Seniors from California composed the largest geographical group—64; in addition, 26 were from the western United States, 61 came from other parts of the U.S., and 13 from foreign countries.

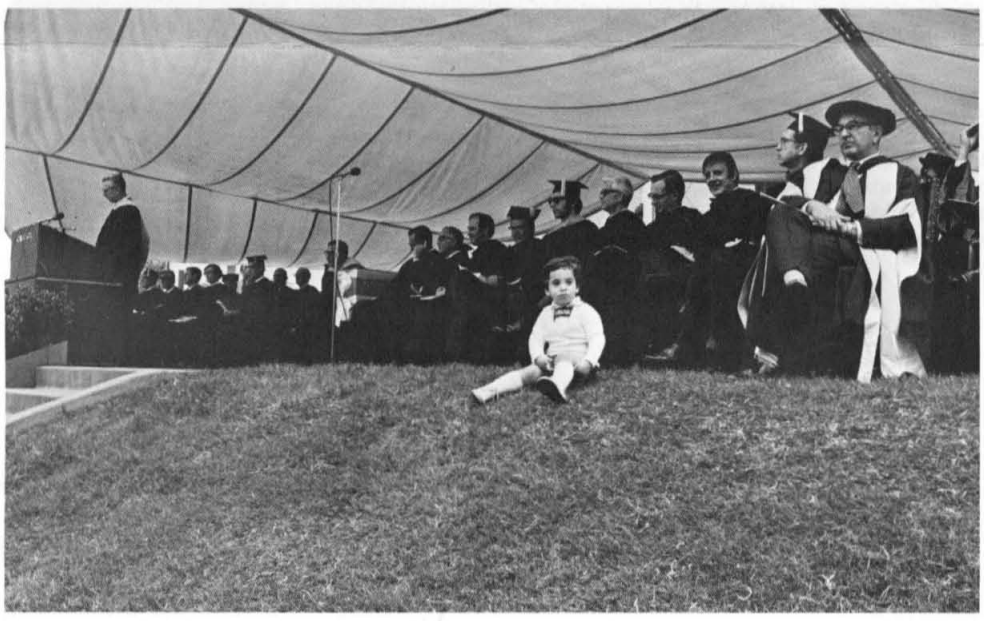
Almost half the class—76 seniors—graduated with honor standing (B+ average or better), and 29 men were honored with special prizes and awards for outstanding accomplishments in academic studies, extracurricular activities, or athletic skills.

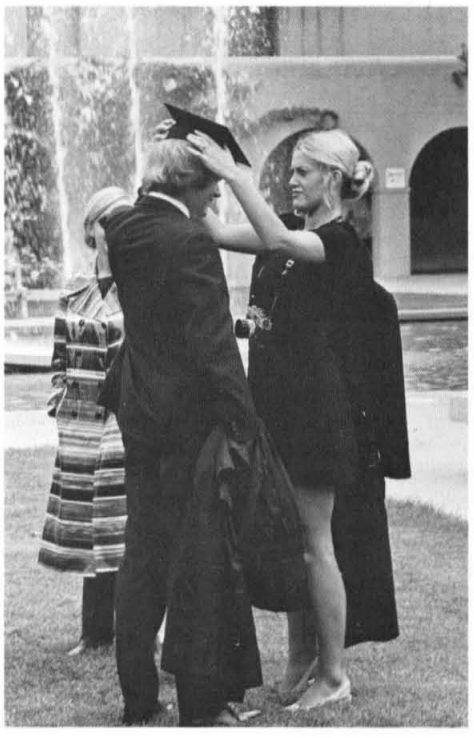
Of the 140 master's degrees (the largest number in ten years) and the 117 PhD's awarded, 133 were in the sciences and 124 in engineering, including the Institute's first two doctorates in environmental engineering science. Advanced engineering degrees were awarded to four graduate students; and one student, Henry Longfellow Shipman, received his PhD in astronomy a year early.

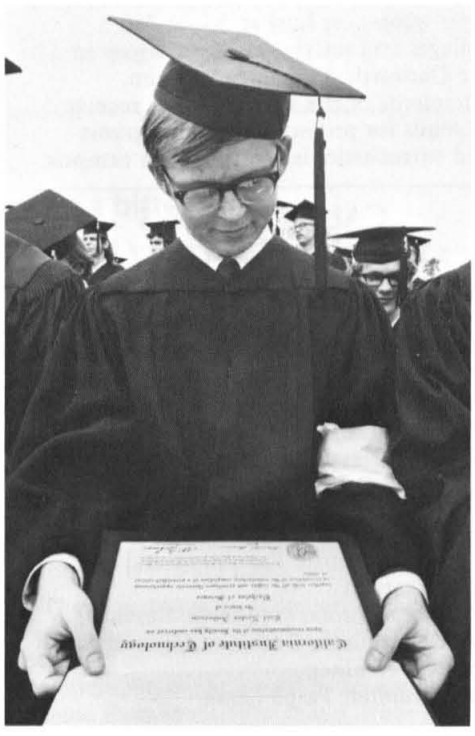
Alumnus James C. Fletcher, PhD '48, head of the National Aeronautics and Space Administration and former president of the University of Utah, gave the commencement address. His talk, "Poets and Carpenters," appears on pages 3 and 4.

In his remarks to the class of 1971, President Harold Brown suggested some alternatives to the academic career model that many science and engineering

Continued on page 5







Alumni host Mettler, Brown, 50-year club

June 9 was a memorable day for Caltech alumni. It started with the first annual Half-Century Club luncheon at the Huntington-Sheraton Hotel in Pasadena and ended with the annual Alumni Association dinner in the Athenaeum.

Fourteen members of the original 38-man class of 1921 came from as far away as Chicago and Hawaii for their 50th reunion. Three members of the class of 1916 were also on hand for their 55th reunion. Outgoing Alumni Association president Bill Freed and incoming president Reuben Moulton presented each class member with a special certificate and Half-Century Club membership card.

Richard Stenzel, secretary of the class of 1921, wrote about the luncheon to *CALTECH NEWS:*

"The Board of Directors of the Alumni Association recently founded the Half-Century Club to include all alumni whose graduation period has entered that magic time-span. At the luncheon given by the Board of Directors each member of the club gave a brief account of his activities since graduation; the great diversity and high achievements in their chosen fields—not all in the technical line—were most interesting. One recurrent theme was the high regard many expressed for their close associations with the faculty of the Institute.

"It is also of some interest that about 16 percent of the class went on to earn their PhD degrees, which was rather unusual in those days."

Nearly 300 alumni, ranging from the class of 1916 to the recent graduates of 1971, attended the annual dinner where Caltech trustee and alumnus Ruben Mettler was the main speaker.

Mettler (BS '44, MS '47, PhD '49) talked about the constituents of the Caltech community—students, faculty, administration, trustees, and alumni—who share in the problems and progress of the Institute.

Each of these groups has day-to-day responsibilities, but, Mettler said, there must be greater interaction between the groups on important issues in which they all share a responsibility.

"It's really no mystery why Caltech has been so successful in the past or can be successful in the future. All of us share an enormous opportunity and responsibility. We can do great things if we act together as a community."

President Harold Brown was welcomed into the Alumni Association as an honorary member, and made some observations about this year at Caltech.

Commenting on "an experiment" that admitted women undergraduates to Caltech for the first time in its history, the president assured everyone that the experiment was a success and announced that 29 more girls will be entering the Institute this fall. "They have improved the appearance and tone at Caltech,"

Continued on page 5

Paul Eaton retires after 25 years

Paul C. Eaton, dean of students at Caltech for 22 years, retires this month as professor of English, emeritus.

Eaton came to Caltech in 1946 as a visiting lecturer in English. The following year he was appointed associate professor of English and associate dean of students, and in 1953 he became dean of students. He gave up his duties as dean in 1969 but has continued to teach English for the last two years.

Eaton, who was born in Nashua, New Hampshire, took his SB at MIT in 1927 and his AM at Harvard in 1930. He taught in New England until 1946—first at Phillips Exeter Academy and then at MIT.

During World War II Eaton was a lieutenant commander in the U.S. Naval Reserve and saw sea duty in both the Atlantic and the Pacific with the Third, Fifth, and Tenth Fleets.

Paul Eaton

His interest in maritime activities continues; he is a member of a yacht club in Islesford, Maine; of the Marine Associates of the Peabody Museum of Salem, Massachusetts; and of the Bath (Maine) Marine Research Society.

Faculty honors and awards

Marshall Cohen

Marshall H. Cohen, professor of radio astronomy, and alumni Barry G. Clark (BS '59 and PhD '64) and Kenneth I. Kellermann (PhD '63), both staff members of the National Radio Astronomy Observatory (NRAO), are among 21 scientists given the 1971 Rumford Award of the American Academy of Arts and Sciences.

The Rumford Award, established in 1796 to encourage research in the fields of heat and light, is the oldest scientific prize in the Western Hemisphere. This year the academy departed from its tradition of honoring an individual scientist and recognized instead three research teams for their contributions toward the development of very-long-baseline interferometry.

Very-long-baseline interferometry is a new radio astronomy technique in which two radio antennae, separated by many thousands of miles, observe the same small radio source simultaneously. By acting as one giant telescope they produce angular resolution one thousand times better than that obtainable with the largest optical telescope.

A graduate of Ohio State (PhD '52), Cohen came to Caltech as a visiting associate professor in 1965 and returned as full professor in 1968. Clark's degrees from Caltech are in astronomy, and Kellermann got his doctorate in physics.

Jesse Greenstein

Jesse L. Greenstein, Caltech's Lee A. DuBridge Professor of Astrophysics, is this year's recipient of the Bruce Medal, the highest honor awarded by the Astronomical Society of the Pacific. The medal, which has been given annually since 1898 for distinguished services to astronomy, was awarded to Greenstein at the society's annual meeting in Hawaii on June 24.

Greenstein, executive officer for astronomy and a member of the staffs of the Hale Observatories and the Owens Valley Radio Observatory, is recognized for his research in astrophysics, particularly in the study of the origin of chemical elements formed by nuclear energy-producing processes in stars, the evolution of stars, and the spectra of low-luminosity white dwarf stars, with special reference to the final stages of cooling and fading of stars.

Greenstein is the fourth Caltech astronomer to win the Bruce Medal. The other winners were George Ellery Hale, solar astronomer and one of Caltech's founders, in 1916; Horace Babcock, director of the Hale Observatories, in 1969; and Fred Hoyle, of the Institute of Theoretical Astronomy at Cambridge, England, and visiting associate in physics at Caltech, in 1970. Winners of the medal are chosen by directors of the society from a list of nominees supplied by six major observatories.

David and Annette Smith

David and Annette Smith have been appointed Danforth Associates by the Danforth Foundation. These associateships are given to selected faculty members and their spouses "to recognize and encourage good teaching and to assist in humanizing the education process."

Both of the Smiths are faculty members at Caltech. Annette Smith, who received both her MA and PhD at the Sorbonne in Paris, is now a lecturer in French at the Institute. Before coming to Caltech in 1970 as a visiting assistant professor, she was assistant professor of French at Claremont Men's College.

David Smith is a graduate of the Claremont Colleges and came to Caltech in 1958 as instructor in English. He is now associate professor of English and master of student houses.

More than 2,400 faculty members and their wives—or husbands—at 750 colleges and universities participate in the Danforth Associates Program. Recipients of the associateships receive stipends for promoting new programs and extracurricular activities on campus.

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DIVISION REPORTS

Astronomy

During the last six months several experiments have been performed with the 200-inch Hale telescope to investigate the use of television techniques in astronomy. One of these was a cooperative venture between J. B. Oke, Caltech professor of astronomy and associate director of the Hale Observatories, and Princeton astronomers, in which a SEC vidicon, a special type of TV tube capable of integrating light for many hours, was used to obtain high-resolution spectra of faint quasars.

One quasi-stellar object observed was PHL 957 which Maarten Schmidt, professor of astronomy and staff member of the Hale Observatories, has found to have the second largest emission-line redshift known. This object is far fainter than any object heretofore observed at this spectral resolution, and the observation was successful because of the very impressive performance of the SEC vidicon tube. It was possible for the first time to resolve many of the 60 or more absorption lines in the spectrum which occur below Lyman-α. The lines are intrinsically narrow but have different widths suggesting that they may arise in different clouds near the quasar, or in intergallactic space between us and the quasar. The project was supported by NASA.

Because of the success of the above experiment, Caltech astronomers are joining Princeton University Observatory in an exciting project to build a completely digital, two-dimensional image-recording device. Funds for this work are being provided by the National Science Foundation.

The digital image tube will have high-quantum efficiency and will be capable of counting photons in 256,000 picture elements on the face of the tube. The counts in each picture element are accumulated in a computer memory with unlimited storage capacity. This is in contrast with all present devices such as the integrating SEC vidicon mentioned above, and with photographic plates, which have very limited storage capacity. With the limit on exposure time removed, it will be possible to record stars and galaxies 10 to 20 times fainter than is now feasible and obtain spectra some 10 times more rapidly than with present techniques.

Many questions concerning the expansion of the universe, the curvature of space, and the ultimate fate of the universe could be answered if we could observe sources of known luminosity ("standard candles") at very great distances. Supergiant galaxies seem to offer such standard properties, but they are so faint at large distances that they are exceedingly difficult to observe.

Modern photoelectric techniques now make these observations possible; and in particular the multi-channel spectrometer developed by Oke should, in its final configuration, be able to obtain brightnesses and redshifts of galaxies whose light left them halfway back to the beginning of the universe. These limits are some three times more distant and twenty times fainter than can be reached with conventional photographic or image-tube techniques.

Engineering

Stanley T. Wolfberg, Caltech alumnus and consultant in engineering management, is the new administrative officer for the division of engineering and applied science. He will be dealing with budgetary and personnel matters, proposal development, and facility requirements for offices and buildings.

Wolfberg graduated from Caltech in mechanical engineering in 1938, then went to Stanford University in 1940 for his MBA. A director and past president of the Los Angeles chapter of the American Institute of Industrial Engineers, he was one of the first registered professional industrial engineers in the state of California. Wolfberg is one of six new members of the Alumni Association's board of directors and is the alumni representative on the Caltech Athletic Council.

JPL

Caltech alumnus Lieutenant General Charles H. Terhune Jr., USAF retired, has been named deputy director of the Jet Propulsion Laboratory. He succeeds Admiral John E. Clark who retires after holding the position since 1968.
General Terhune graduated from Purdue University with a degree in mechanical engineering in 1938. He earned a second BS degree in aeronautics at Caltech in 1941.

After a 30-year military career, Gen. Terhune retired in 1969 to become manager of administration for the Data Processing Division of the National Cash Register Corporation in San Diego.

EQL gets major grant from National Science Foundation

Caltech's Environmental Quality Laboratory, which was set up last fall to study approaches to environmental problems, has received a $1.22 million grant from the National Science Foundation.

Approximately 50 cents in private support has been raised for every dollar of government support. Contributions have come from Atchison, Topeka and Santa Fe Railway Company; Michael J. Connell Foundation; E. I. du Pont de Nemours & Company, Inc.; The General Electric Foundation, Gulf Oil Corporation; John A. McCarthy Foundation; Dan Murphy Foundation; The Ralph M. Parsons Company; Southern California Edison Company; Southern California Gas Company; Standard Oil Company (California); Standard Oil Company (Indiana) Foundation, Inc.; and Texaco Inc.

These funds will enable EQL to make some critically needed studies on air pollution, land use, and power consumption. While the NSF grant was pending, studies by the initial eight-man EQL staff were made possible by funds from Institute, foundation, and corporate sources.

With the funds, EQL is now able not only to broaden the scope of its work but also to enlarge its staff of scientists, engineers, and social scientists. This summer UCLA law professor James Krier and UCLA law student Robert Fisher will work with the lab on the political and legal aspects of environmental problems.

Two recent appointments to the Caltech faculty are economists Charles Plott from Purdue and David Montgomery from Harvard, who will work part time with the lab. Luther Gerlach, a cultural anthropologist at the University of Minnesota, will spend his 10-month sabbatical leave with EQL beginning in September to study trends in public reactions to environmental issues.

The NSF grant will also allow the lab to expand its program for training graduate and undergraduate students in environmental studies.

"Poets and Carpenters"

The 1971 commencement address given by James C. Fletcher, Administrator of the National Aeronautics and Space Administration

When the word first began to get around that I would be the commencement speaker here this year, there were a number of interesting reactions—some from students I had met earlier on this campus, others from individuals I did not even know. The suggestions and comments covered quite a wide range, but they seemed to have one thing in common—namely, that there are certain subjects I should be wise not to talk about. Not that anyone thinks these subjects are taboo—just trite.

Let me give you a brief sampling of some comments I received:

—Don't give us any of the onward and upward, the future-lies-ahead kind of inspirational garbage.

—Try being relevant for a change.

—For heaven's sake, don't talk about the benefits of the space program.

—Don't talk down to us. Don't preach or pontificate.

—Skip the customary platitudes and truisms and talk about something really practical and close to home—like, maybe, the moral responsibility of the university to the inner city.

As you can see from these few samples —and there were lots more—the frequency count shows a predominance of "thou shalt nots," rather than "thou shalts." There wasn't any real unanimity of opinion, but, nevertheless, I was able to get a message. I'm sure I will not be able to avoid all the "shalt nots," but I'll try not to emphasize them unduly.

"The world is full of both poets and carpenters; I believe each of us has some capabilities for both."

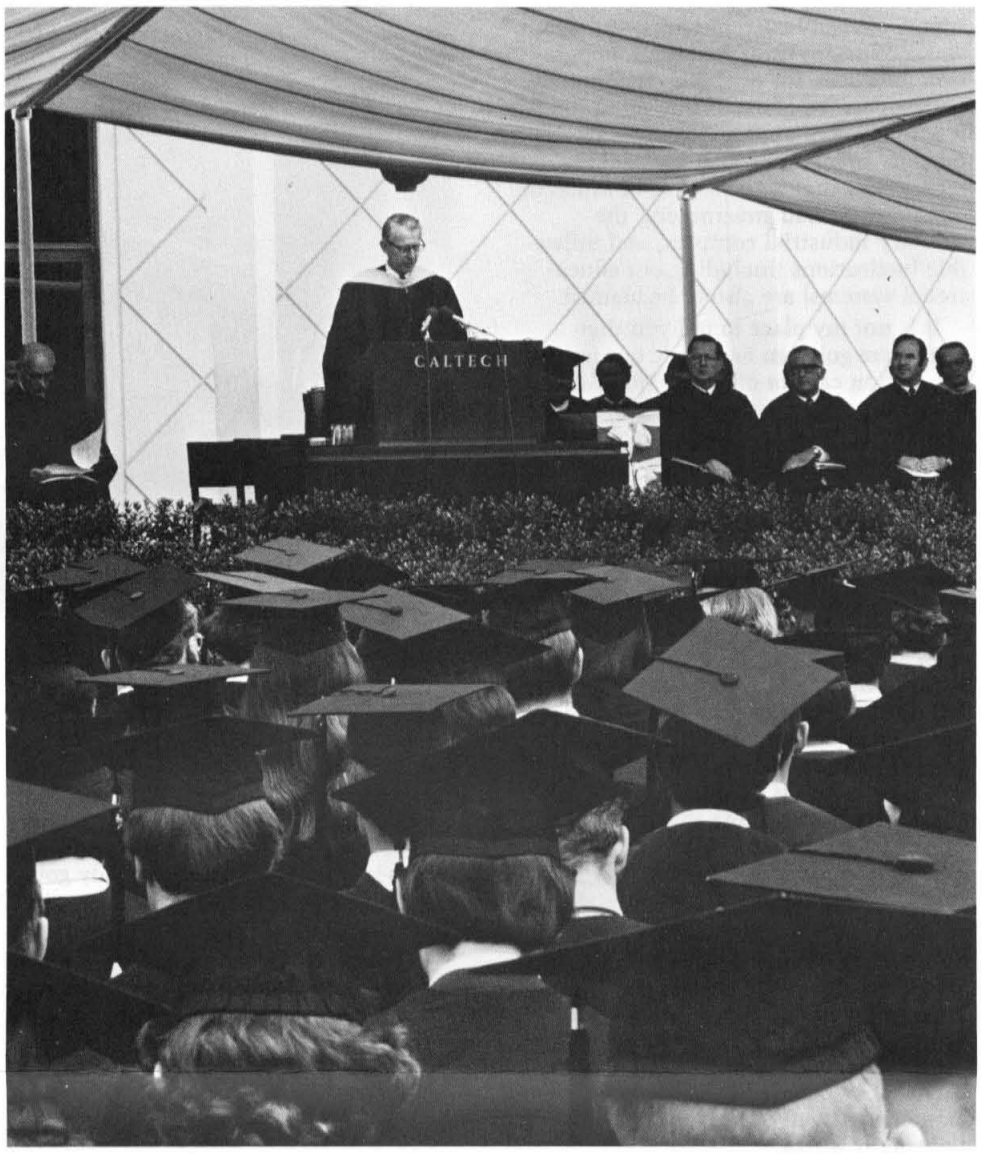
The world has changed a great deal since my own student days at Caltech, both materially and philosophically. But from my vantage point on the University of Utah campus for the past seven years I find it difficult to believe that students themselves have become all that different, whatever seem to be outward appearances.

In many ways students know more and learn sooner than they did a generation ago. Cynicism is prevalent and sometimes very apparent. But idealism, which has been the province of youth since the times of antiquity, is still to be found. Students are still able to show emotion over ideas and ideals.

I am aware that some members of your own generation may use the word "emotion" in a pejorative sense. In fact, they can get pretty emotional about it. But that's their hang-up. I believe most of us still consider emotion a good, honest word—and a good, honest human characteristic.

On this subject, let me recount a conversation I had last year with a few of our students. We had our problems during the Cambodian crisis, and the situation remained quite tense while I and several others in administration tried to keep communication channels open with some of our most alienated students.

One of the leaders flatly told me I was a "rotten president" and ought to resign. I asked him to describe a good president. The reply was quick: "A college president ought not to be an administrator or an authoritarian figure"; he ought to be a symbol—and a rallying point—for the students of his university. A good college president, he said, should participate in rap sessions with the students, understand their feelings, open up, and make sincere, stirring but honest statements from the heart rather than the mind. He should be inspirational—not coldly practical.



By the time he finished the description, I was beginning to get the picture. I said it seemed to me that he was really looking for a poet. He quickly agreed. Then I asked him what he thought I was. Again, he didn't take long to deliberate. "You," he said, "are definitely not a poet. You're a carpenter."

Well, maybe everyone has a secret desire to be a poet. And maybe some people might think it's a put-down to be described either as a carpenter or as a poet, but I don't look at it that way. The world is full of both poets and carpenters, and I believe each of us has within us some capabilities for both. The carpenters, the artisans, and the engineers are all problem-solvers, but I don't think this is necessarily bad. What is more, the achievements of carpenters often fire the imaginations of the poets.

Poetry in its broadest sense is a creative act; the poet presents to us his vision of the undefinable. It is my belief that there is an underlying poetry in the adventure of science.

I suggest that poetry is the words that men reach for—often inadequately—to describe the emotions that stir them when they see and hear of such deeds as men first walking on the moon. The Bible and much of religion are poetry, too.

You who are here today are concerned with problem-solving, or you wouldn't have come to Caltech in the first place. But from my conversations with you, and from what I know about your generation, I know that you are concerned with much more than mere mechanics—or carpentry, if you will. You cannot and will not ignore your moral responsibilities, your poetic selves.

All of us, whether poets or carpenters, must work within the limitations of our own abilities and our own talents. La Rouchefoucauld wrote, some three centuries ago, a statement that is just as true today as it was then:

"God has put as different talents in man as trees in Nature: and each talent, like each tree, has its own special character and aspect . . . The finest pear tree in the world cannot produce the most ordinary apple, and the most splendid talent cannot duplicate the effect of the homeliest skill."

"It is a bitter pill to spend your life learning particular skills and then find no suitable outlets."

So I think we must ask ourselves, where do our real talents lie? Should an apple tree try to be a pear tree? Should a carpenter try to act like a poet?

The question is a particularly tough one in this year of 1971, when so many members of the engineering profession are unemployed, or forced to accept work outside their specialties. It is a bitter pill to swallow, to spend your life learning particular skills and disciplines, and then to find that in many cases you cannot find suitable outlets for productive and creative endeavor.

The fact is, and we may as well face it, we are being confronted with a dilemma. Even though there are many fields that demand our best engineering skills, there seem to be no channels through which we can bring them to bear.

"Sound economics, sound technology, and sound culture go hand in hand."

NASA is probably as aware of the problem as anyone, because the agency has seen its aerospace work force drop from a peak of more than 400,000 a few years ago to something less than 150,000 today, with the curve only now beginning to flatten out. It is easy for those who are not affected directly to say that these things are always cyclical—and from the historical point of view they may be right. But it really isn't all that comforting to know that something has happened before and probably will happen again. As I recall, just about two decades ago, *Life* magazine devoted most of an entire issue to a very severe problem of that time—unemployed engineers.

Recognizing that the times are difficult, my considered opinion is that this country needs its engineers today more than ever before. One of the troubles is that not everybody knows it yet. Particularly in recent months, we hear strident voices raised on every side saying that science and technology lie at the root of all our problems.

To hear some people tell it, technology is an invention of the devil, and the best thing we could do would be to forget the whole thing. They apparently believe—and I think they are quite sincere about it—that all we need to do is to go back to the good old days of the sailing ship and the horse and buggy and all our problems will automatically fade away. This simply isn't possible; a society can never retrace its history. Even if society as we know it were to be destroyed and a fresh start made, there is no reason to believe that we would arrive again at the good old days or that they would seem so good if we did.

While it is true that technology lies at the root of some of our problems—certainly not all of them by any means—it is equally true that technology offers our best and sometimes our only hope of dealing with many of them.

In many ways I think we tend to take too narrow a view. We talk about poverty, for example, as if it were a single, distinct problem that we can single out and attack head on. But we really know that it is an intrinsic part of a much larger economic fabric.

One of the world's truly original thinkers, Buckminster Fuller, believes that the answer lies in learning to do more with less. Says Fuller:

"In this century we've gone from less than one percent of humanity to 40 percent of humanity enjoying a higher standard of living than any king we knew

Continued on page 4

"Poets and Carpenters"

Continued from page 3

of before the 20th century. This is despite the fact that during that time the resources per capita have been continally decreasing. The way we got to taking care of forty percent of the people was by doing more with less. And this is not in the economics books."

Something else that may not always be in the economics books, although it should be, is the interlocking relationship between economics and technology.

Sound economics, sound technology, and sound culture go hand in hand. I find it almost impossible to conceive of a modern country that has a well-advanced and successful high technology that does not also have a strong economic base, nor one with a strong economic base without a truly advanced technology. In ancient times that base was built largely on trade. The ancient Phoenicians, the master traders of their era, carried knowledge as well as goods throughout the then-known world.

"The lack of appropriate social institutions to direct advancing technology is one source of our concern."

The Greeks, who learned from the Phoenicians, built a golden age of art and culture and science and philosophy upon the same kind of solid economic base. It might also be argued that the trade itself grew out of the technology of ships; a more or less chicken-and-egg relationship. In any event, economics, technology, and the arts all flourished, and they flourished together.

During the Renaissance there was a repetition of the now familiar pattern. It was certainly not an accident that the age of the great explorers, like Columbus and Magellan, was also an age of intellect —science and poetry and art and music and architecture.

The economic and trade base is equally obvious today. I would submit that West Germany and Japan, along with our own country, are excellent cases in point—our economic base is strong because our technology is advanced. Because of this, the leading scientists, artists, and musicians of the world come from these countries.

I would like to stress my strong belief that the future prosperity of this country depends on our continued development of high technology.

In this century, world leadership in nearly every important area of human endeavor has shifted from Europe to America. But simply because we now are in the lead does not necessarily mean that we will continue to hold that position without further effort on our part. Japan, China, the U.S.S.R., the Common Market countries of Western Europe—all are challenging our leadership, and they are doing it by trying to beat us at our own game: technological pioneering.

The key to success in a great modern industrial state is productivity, and in the modern industrial state it has to be stated as *rising* productivity. We can't expect cost-of-living increases, retirement benefits, and medical benefits to occur simultaneously unless productivity increases. Nor can we maintain our current living standards and at the same time reduce poverty, alleviate urban blight, or improve our physical environment without increasing productivity. And productivity in our modern society is almost completely dependent on an advancing technology.

To be sure, advancing technology without appropriate social direction is a source of many current crises—nuclear war, pollution, rural depletion, population increases, for example. Technology perhaps can be blamed; but, more likely, it is the lack of appropriate social institutions to direct and control advancing technology that is the source of much of our concern. Bad government, the military-industrial complex, and inflexible institutions (including our educational systems) are also to be blamed.

It is not my place to tell you that things are going to be simple or easy. My generation cannot offer any homilies on how to choose your particular life styles. Mostly what we can offer is wisdom, but since wisdom is heavily experience-based, it's likely to be obsolescent in today's world of accelerating change. Anyway, you would probably resent it if I were to try. But I do think we can at least try to pass on to you some of the things we may have learned, and the acceptance or the rejection is up to you.

So I will simply say that it would seem advisable to keep as many avenues open as possible—I think "stay loose" is the phrase—and to realize that the world desperately needs problem-solvers, and since your talents more than likely lean in this direction, they can be applied in many different ways.

One of the paths we can take—the obvious one—is to help develop some new area of high technology that will serve to strengthen our nation's economic base, and thus indirectly, our whole culture. We don't necessarily have to perform this task with productivity foremost in our minds, as I have explained—even though that's really the way it works.

A second path—and the demand for this path will be growing rapidly, I believe—is to attack directly the social, economic, and other serious problems of our time that have a definite technological component.

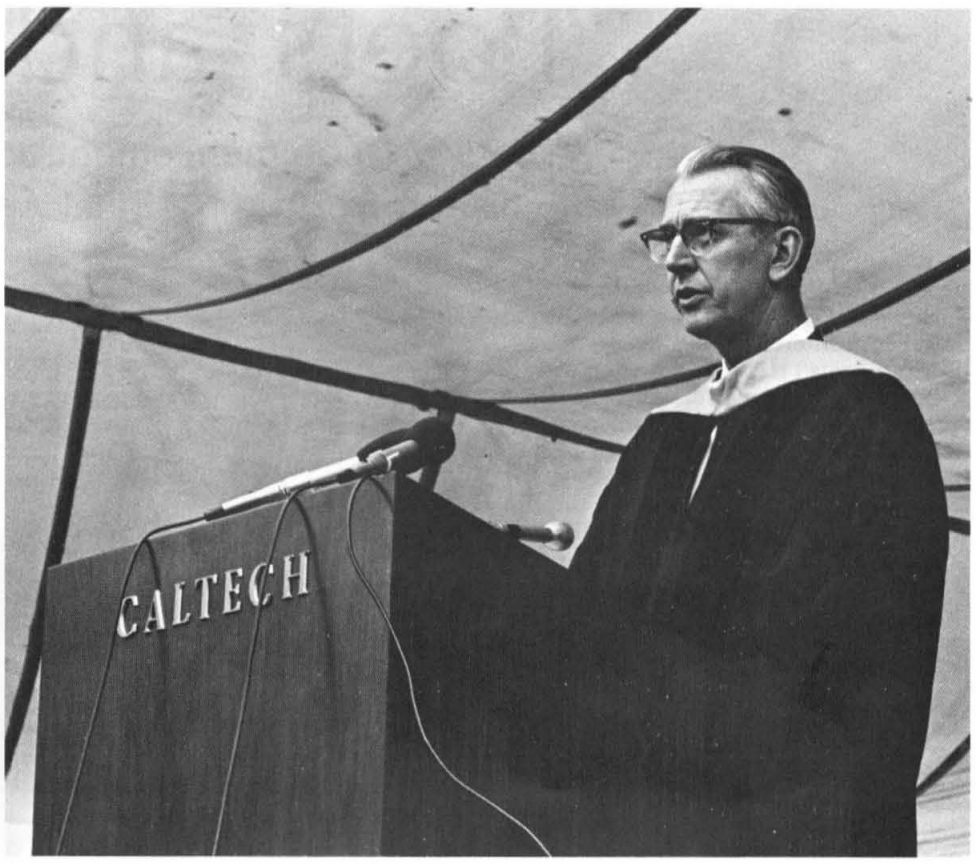
Problems of ecology such as air pollution and water pollution have technological solutions. Urban and interurban transportation have technological solutions. As soon as we determine the appropriate political system —one that will spend the time and money on these problems—we already know a good deal about how to solve them, and what remaining technology needs to be developed will undoubtedly appear.

Other problems, such as rural and ghetto health, housing, hunger, and poverty, have only a partly technological solution; still others, with strong human and sociological components, are even harder to deal with, and it may be a long time before problem-solvers learn to deal with "people" problems. Until then, we may have to rely on the poets.

Here I would remind you once again that—while it wasn't easy to land men on the moon—it was nevertheless a straightforward, engineering kind of problem. And as someone has said, there weren't any people between here and there.

Let's face it—problems that involve human beings as a major part of the equation are much harder to solve. That doesn't mean that the carpenters of the world shouldn't tackle those problems, too. It simply means that we must always be aware that there won't be any instant solutions. Some solutions take longer than others. Social mores are not changed overnight.

The third path, then, that lies open to our profession—and I think relatively few persons yet realize what a broad and important path it can be in the years ahead—is to pursue long-range study and research on the application of problem-solving techniques to some of the more purely human problems.



Some extremely interesting experiments in this direction are already going on, enough to show us that the promise is enormous. For example: I am sure you know that some of the pioneering studies were done in California a few years ago by some of the aerospace companies, applying systems engineering techniques to study problems of transportation, crime, and communications, among other things.

"The challenge we face is to delineate problems as clearly as possible, then go to work on them in any way we know how."

An extremely interesting experiment in what is called "incentive welfare" is now going on in New Jersey. Problems of this kind are being studied increasingly at universities and urban institutes.

Systems engineering techniques are now being applied even in some of our law schools to improve our criminal justice system, with the idea of trying not only to reduce the crime rate but, if possible, to speed up the system, i.e., to determine guilt or innocence much more rapidly but without diminishing the reliability of the verdict or denying the rights of the individual.

From all this, I think a pattern is emerging, and I believe that our country's leadership in technology will respond to the challenges of the times and continue to move ahead.

One final point: If we look at the industries which have contributed to our country's greatest growth during the last decade or two, we quickly uncover such fields as computers, electronics, automatic control, photography, new material, and new chemical or physical processes for consumer or industrial use. It is no coincidence at all that these are all high technology industries and that most of this technology was stimulated by government need in some particular field or another. It is well known, for example, that after each major war, from the Middle Ages on, new technology sprinted ahead. AEC and NASA are peaceful ways of accomplishing the same thing. In William James' phrase, what we need is a "moral equivalent of war." As a substitute, AEC, NASA, NSF, and NIH may serve, insofar as the technological aspects are concerned.

It is a source of wonder and amazement to me that there are still voices crying out to cut our science and technology programs even more deeply than they have already been cut—as if the money being spent for productive, economically valuable technology could be better spent on enterprises that spend existing capital rather than creating new wealth.

For example, Western Europe is seriously considering participating in our space shuttle development, because they can readily understand the value of shuttle technology to their own development. Other countries, even the economically weak emerging nations, appreciate the value of high technology, but some of our own citizens seem to be quite blind to it.

But that is the way of history. We are still really only at the beginning. I think the developments that take place in the next few years will be enough to convince even our severest critics that all such programs—and the high technology that goes with them—are relevant, and indeed indispensable, to the better world all of us hope for, provided we take care that this new technology is directed toward useful projects and that the side effects are manageable in our complex human socio-economic system.

Perhaps I could be permitted to quote George Wald, a distinguished biologist and Nobel Prizewinner: "Our generation cannot and should not assure the young of a real future." In light of the population explosion, pollution, and nuclear war, such a statement may be accurate but is certainly not particularly constructive. It does call attention to the problems we face, and although a bit poetic, does offer us a real challenge. The challenge we face—and I think we face it together, not as separate generations—is to delineate the problems as clearly as possible and then go to work on them in any way we know how, in whichever manner best suits our talents. We do have time, but not much, so let's get with it.

77th commencement

Continued from page 1

students adopt. With fewer opportunities for careers in university research and teaching, Brown recommended that graduates consider additional models upheld by many Caltech alumni who are successful in industry, government, and public service.

Special prizes and awards went to 29 students this year for outstanding achievements in academic work, contributions to the campus community, and excellence in sports. They are:

Donald S. Clark Alumni Awards
George Nicolaides, junior, chemical engineering
Steven S. Watkins, sophomore, environmental engineering

Joseph Warren Barker Fellowship in Engineering
Jerry H. Griffin, graduate student, applied mechanics

Haren Lee Fisher Memorial Award in Junior Physics
Craig Sarazin, junior, physics

Fannie and John Hertz Foundation Fellowship
Michael Odlyzko, senior, mathematics

George W. Green Memorial Award
David Dixon, senior, chemistry
Thomas A. Weaver, senior, physics

Frederick W. Hinrichs Memorial Award
Robert S. Fisher, senior, biology
Leonidas Guibas, senior, mathematics

Honeywell Award
David A. Smith, junior, applied science

David Joseph MacPherson Prize in Engineering
William T. Almassy, senior, engineering

Don Shepard Award
Masayuki Ono, sophomore, physics
Carroll Boswell, junior, mathematics
Michael Muskin, junior, engineering
Bruce Spalding, freshman
Paul Re, junior, physics

Sigma Xi Award
Robert S. Fisher, senior, biology

Southern California Academy of Sciences Award
Philip Thomas Carroll Jr., junior, history

Morgan Ward Award
Bruce Reznick, sophomore, mathematics

Athlete of the Year
Kenneth E. Hanson, senior, engineering (water polo)

Alumni Trophy, baseball
Thomas D. Howell, sophomore, mathematics

Don C. Campbell Trophy, swimming
Robert Coleman, freshman

J. Ben Earl Trophy, golf
James P. Simmons, junior, applied physics

Colonel E. C. Goldsworthy Memorial Trophy, track
Alan W. Kleinsasser, freshman

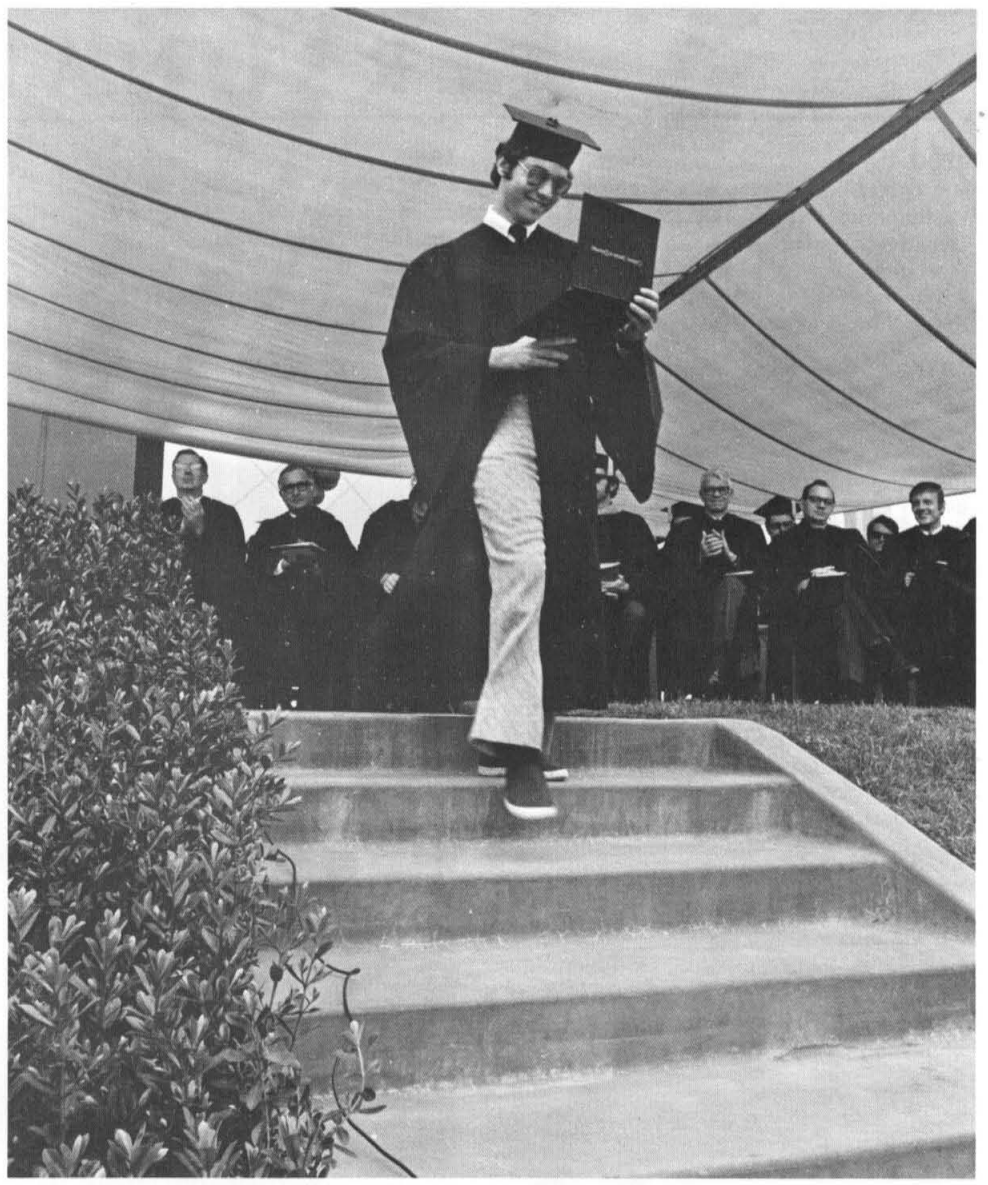
Thomas W. Latham Trophy, wrestling
Randolph Lewis, junior, chemistry

National Collegiate Athletic Association Postgraduate Scholarships
Joseph Templeton, senior, chemistry (soccer)
Thomas R. Heinz, senior, physics (basketball) First alternate

Frederick S. Scott Trophy, tennis
Andrew W. Chow, junior, engineering

Carl Shy Freshman Basketball Trophy
Durwin Wright, freshman

Howard G. Vesper Trophy, basketball
Thomas R. Heinz, senior, physics



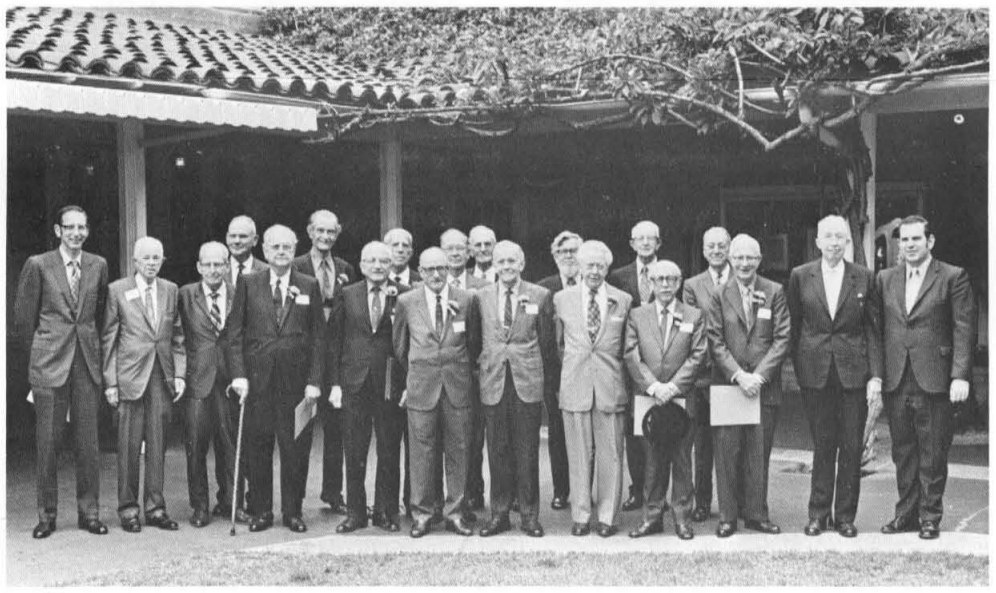
Bob Fisher, winner of two special prizes and former ASCIT president, looks at his diploma on the steps of Beckman Auditorium at Caltech's 77th commencement on June 11.

Administration announces two changes

In two recent administrative changes, Mrs. Margaret Crawford Fitch was made an assistant treasurer, and William P. Schaefer was appointed Caltech's new registrar.

Mrs. Fitch, who has been the assistant to Robert B. Gilmore, vice president for business and finance, since 1969, will join Kermit A. Jacobson as an assistant treasurer in the office of Treasurer Ivan F. Betts. She will work with securities portfolios, including endowment, trust, and life income agreements, and will also provide performance analyses on Caltech's outside investment management firms and internally managed investment funds.

This month Schaefer—currently assistant director of admissions and senior research fellow in chemistry—succeeds retiring registrar John B. Weldon, who has held the position since 1964. Schaefer first came to Caltech in 1960, and served as a research fellow, instructor, and assistant professor of chemistry. He moved to the University of California at Davis in 1966 and spent two years there as an assistant professor of chemistry before returning to Caltech.



Retiring Alumni Association president Bill Freed (far left) and incoming President Reuben Moulton (far right), flank members of the classes of 1916 and 1921 following the first annual Half-Century Club luncheon in Pasadena on June 9.

Ruben Mettler (right) greets a fellow alumnus before speaking at the annual dinner.

Mettler, Brown speak to alumni

Continued from page 1

Brown said, "and they have improved the social atmosphere. I think they have helped some of our male students mature in a lot of obvious ways, and some not so obvious ways." In addition, Brown said, the girls hold their own academically. All 32 girls attending last year are expected to return.

Brown also spoke about the current job market. Although the situation is poor at Caltech, particularly for those with MS and PhD degrees, it is better here than other places. Brown expects that most Caltech graduates who are looking for full-time employment will soon find jobs.

Bill Freed, presiding over his last alumni meeting as president, introduced the eleven classes celebrating special reunions this year: 1916, 1921, 1926, 1931, 1936, 1941, 1946, 1951, 1956, 1961, and 1966.

Freed then announced the newly elected officers of the Alumni Association. They are president Reuben B. Moulton (BS '57), general statistician for Pacific Telephone in Pasadena; vice president Arthur O. Spaulding (BS '49, MS '58), petroleum administrator for the City of Los Angeles; secretary Raymond L. Heacock (BS '52, MS '53), deputy division manager, Astrionics, Jet Propulsion Laboratory; and treasurer George E. Solomon (MS '50, PhD '53), general manager, TRW Systems.

New members of the board of directors are Stuart M. Butler Jr. (BS '48), Spicer V. Conant (BS '64), Douglas Josephson (BS '65), Wayne MacRostie (BS '42), Wayne T. McMurray (BS '45), and Stanley T. Wolfberg (BS '38). Freed remains on the board as immediate past president.

Retiring directors are Craig T. Elliott (BS '58), Robert V. Meghreblian (MS '50, PhD '53), Douglas Ritchie (BS '57), Charles Ray (BS '61), and David Wilford (BS '48, MS '51).

PERSONALS

1930
R. STANLEY LORD recently received the Distinguished Service Award of the U.S. Department of the Interior for 41 years of outstanding service with the U.S. Geological Survey in which he is the district chief for the California Water Resources Division.

1942
WILLIAM L. ROGERS has been appointed deputy assistant secretary for Indian Affairs by U.S. Secretary of the Interior Rogers Morton. For the past year he has been a deputy to the undersecretary of the department of the Interior. Prior to June 1970, Rogers was an executive with Aerojet-General for 27 years.

1944
WILLIAM P. BAIR, who recently received his PhD in education at USC, is completing his second year as president of the faculty senate at Pasadena City College where he teaches math. He has also completed a term on the executive committee of the California Community Colleges.

1945
WILLIAM R. DOTSON is supervising engineer for transportation studies for the California Department of Public Works in Sacramento. He was formerly with the California Division of Highways as a district adviser for planning engineering.


Lord, '33


Sarmento, '46

1946
HAROLD L. SARMENTO has been appointed Texas district manager for the construction services division of Owens-Corning Fiberglas Corporation in Houston. He was previously unit manager for the company's supply and contracting services in St. Louis.

1947
ROBERT ILFELD, MS, former president of Quick Industries, Inc., in Jackson, Mich., is now associate director of executive programs at the Sloan School at MIT.

MANFRED EIMER, MS '48, PhD '53, is now with the Department of Defense at the Pentagon.

1950
WILLIAM F. JONES, vice president and chief engineer in the soils engineering firm of Gribaldo, Jones and Associates in Mountain View, Calif., is the 1971-72 president of the California Society of Professional Engineers.

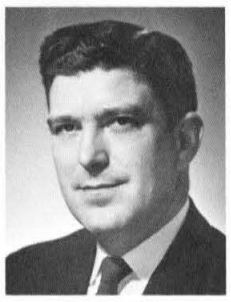
RICHARD S. PIERCE, PhD '52, formerly at the University of Washington, has joined the faculty at the University of Hawaii as professor of mathematics.

1951
ALLEN M. RUGG JR., MS, is now managing director for Tenneco-Australia, Inc. in Sydney.

1952
RODGER W. BAIER received his MS in chemical oceanography from the University of Washington in July 1970, and is now completing research for his PhD in the same field.

STANLEY GRONER, chairman of AMF Incorporated's capital equipment and engineering evaluation board, is one of the company's two newly elected corporate vice presidents.

1955
ORESTE W. LOMBARDI is teaching chemistry, physics, geology, and math at Ganado High School on the Navajo Reservation in Ganado, Ariz. He was a chemist with the New Mexico Highway Department.


Jones, '50


Groner, '52

1956
EDWARD M. DAVIS, MS, has been named general manager of IBM's components division facility at East Fishkill, N.Y. Prior to accepting the new post, Davis was division director of development for IBM.

1957
PAUL H. KING, MS '61, has been promoted to full professor in the civil engineering department at Virginia Polytechnic Institute in Blacksburg, Va. He was previously associate professor of sanitary engineering at Virginia Tech.

1964
DAVID HOLTZ is leaving his position as instructor of chemistry at Caltech for a position with the Environmental Studies Board of the National Academy of Sciences in Washington, D.C. He will be responsible for forming committees to examine problems related to the environment.

1965
RAYMOND ARRATHOON, MS, who recently got his PhD from Stanford University, is now a member of the technical staff at Bell Telephone Laboratories in Murray Hill, N.J.

GERALD R. ASH, MS, PhD '69, former captain in the U.S. Army's Satellite Communications Agency, is now a research staff member in the systems evaluation division of the Institute for Defense Analysis in Arlington, Va.

JOHN G. HARTNETT, MS, graduated from Harvard Law School this winter and is now a legal assistant for Kendrick, Subkow & Kriegel in Los Angeles.

ROGER W. HENDRIX, who received his PhD in biochemistry from Harvard University in January, is now a postdoctoral fellow at the Stanford Medical Center of Stanford University in Palo Alto.

STEVE S. WATSON has received his MD from the University of Texas Medical Branch in Galveston, Tex. He is currently doing family practice residency in Santa Rosa, Calif.

1967
DANA G. ANDREWS, MS, has been awarded one of 26 fellowships from the Fannie and John Hertz Foundation for graduate work in the applied physical sciences. He will use the fellowship for a research project and dissertation in aerospace engineering at Stanford University.

THOMAS R. BERGER, PhD, writes that he and his wife are now parents of a son, Scott Byron, born on April 30. Tom is taking a leave of absence from the University of Minnesota next year to teach at Trinity College in Hartford, Conn.

JOSEPH D. KINKADE JR., a data processing technician in the Navy, is assigned to the Center for Naval Analyses to work on a project for the Naval Warfare Analysis Group, one of five divisions at the center.

PATTAMADAI N. SHANKAR, MS, PhD '68, previously a mechanical engineer in the research and development center of General Electric Company in Schenectady, N.Y., is a visiting assistant professor in the department of aerospace engineering at the University of Maryland.

DENNIS M. WEAVER, a captain in the U.S. Air Force, has received the Distinguished Flying Cross and the USAF Commendation Medal for service in Southeast Asia. He was commissioned from the Air Force Reserve Officers Training Corps program at Caltech.

1969
MICHAEL R. BEAVER, who received his MS in solid state electronics from USC in June, is now a process supervisor for Hewlett-Packard Associates in Palo Alto.

WILLIAM H. LONG JR., an airman in the U.S. Air Force, has been assigned to a unit of the Air Force Systems Command at Wright-Patterson AFB in Ohio for training and duty as an engineering assistant.

JEFFREY M. MOLLER recently joined the Burroughs Corporation in Pasadena where he is a member of the programming systems department. Moller was a graduate student at the University of Chicago before he took his job with Burroughs.

LAWRENCE H. SHIRLEY writes that he is extending his stay with the Peace Corps in Sierra Leone, Africa, to a third year. He will help the Sierra Leone Mathematics Teachers' Association introduce a modern mathematics syllabus into the secondary curriculum.


Davis, '56


Long, '69

1970
RICHARD W. NOREN, MS, is now a member of the Peace Corps in the Philippine Islands.

1971
WILLIAM EVERETT, PhD, and his wife, Margaret Cosgrove Everett, MS '70, announce the birth of a son, William James, on November 11, 1970. The Cosgroves are living in Arlington, Va., where Bill is serving as a captain with the Army Security Agency.

Obituaries

1927
MURRAY N. SCHULTZ on April 22 of a heart attack. He worked in chemical engineering for 17 years prior to earning his DDS from USC's School of Dentistry in 1946 and was in general practice until his retirement in January 1970. He is survived by his wife, Dorothy, and two children, Mrs. John Kingsley and Dr. Donald N. Schultz.

1938
GARN A. RYNEARSON on September 13, 1970, of leukemia. He had been a geologist for the U.S. Geological Survey in Belo Horizonte, Brazil. He is survived by his wife, Olive.

1951
KENT STRATTON, on May 31 of a heart attack, in Paris, France. He had been employed with Pioneer Service and Engineering Company in Chicago as a nuclear engineer.

Placement Assistance To Caltech Alumni

The Caltech Placement Service may be of assistance to you in one of the following ways:
(1) Help you when you become unemployed or need to change employment.
(2) Inform you of possible opportunities from time to time.

This service is provided to alumni by the Institute. A fee or charge is not involved.
If you wish to avail yourself of this service, fill in and mail the following form to:

Caltech Placement Service
California Institute of Technology
Pasadena, California 91109

Please send me: (Check one)

☐ An application for placement assistance
☐ A form indicating a desire to keep watch of opportunities although I am not contemplating a change.

Name .....

Degree(s) ..... Year(s) .....

Address .....

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