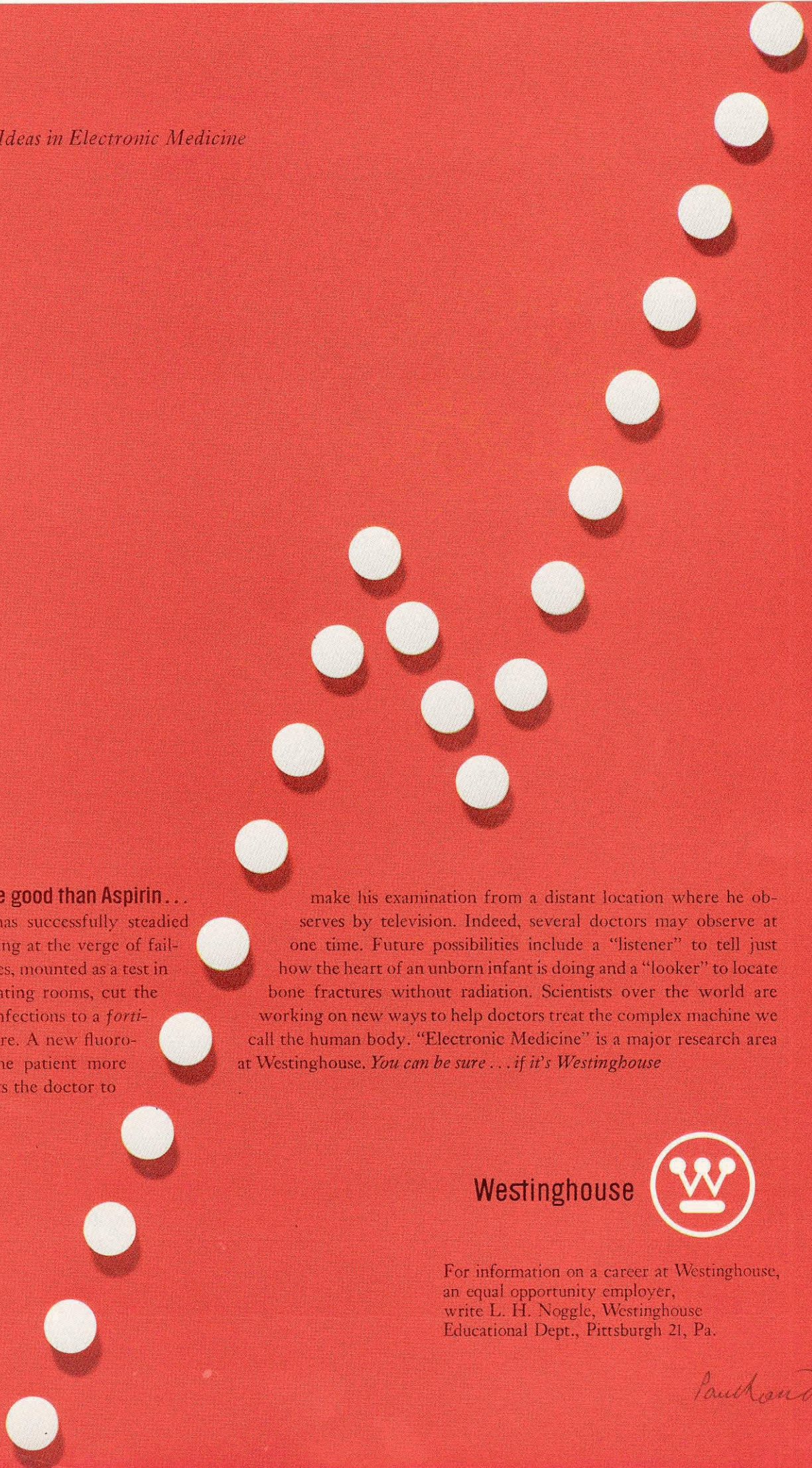
ENGINEERING | AND | SCIENCE

May 1963

Published at the California Institute of Technology

New **Westinghouse** *Ideas in Electronic Medicine*



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An electronic device has successfully steadied hearts that were fluttering at the verge of failure. Slim electronic tubes, mounted as a test in the ceilings of 15 operating rooms, cut the rate of post-operative infections to a *fortieth* of what it was before. A new fluoroscope system makes the patient more comfortable and permits the doctor to make his examination from a distant location where he observes by television. Indeed, several doctors may observe at one time. Future possibilities include a "listener" to tell just how the heart of an unborn infant is doing and a "looker" to locate bone fractures without radiation. Scientists over the world are working on new ways to help doctors treat the complex machine we call the human body. "Electronic Medicine" is a major research area at Westinghouse. *You can be sure . . . if it's Westinghouse*

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Lambert

INTERPRETER

Slide rules and petticoats . . . what a combination! Incongruous? Yet this home economist, who is employed by the Frigidaire Division of General Motors, is involved with each. She wears many "hats" . . . tester, designer, writer, demonstrator. She conducts classes in home economics in schools and companies—teaches how to get the most out of new GM-built household appliances.

She and her counterparts spend full time interpreting the desires, needs and habits of American women in the kitchen and laundry room. Her department, for example, will bake enough cakes to make a stack 125 feet high just in testing a single oven design! In checking a new washer design, thirty tons of clothes are washed. In fact, she's "the voice of women" to the men who engineer and manufacture these appliances.

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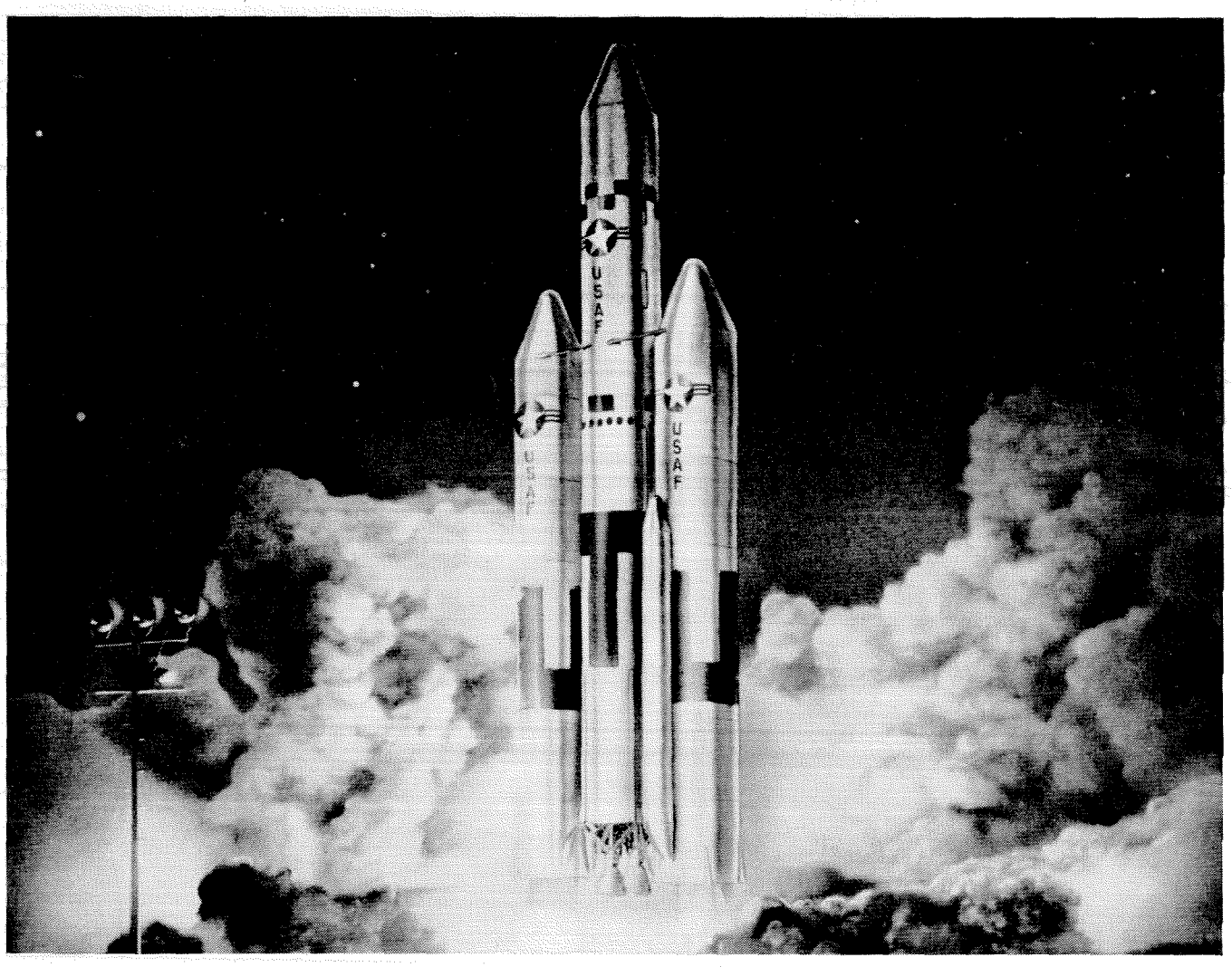

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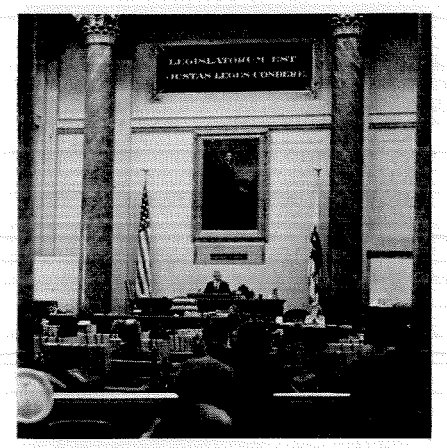
ENGINEERING | AND | SCIENCE

MAY 1963 VOLUME XXVI NUMBER 8



On Our Cover

President L. A. DuBridge addresses the California State Legislature in Sacramento. He was invited on the basis of a resolution passed by both branches of the Legislature to speak before a joint session of the Senate and the Assembly on May 3.

His talk, devoted to the challenges and problems which the nation and the state of California face in this age of space, appears in somewhat abbreviated form in "California and the Space Age" on page 7.

"Minitalk and Megathreat"

on page 15 is the text of the talk given by Albert R. Hibbs, chief of the Arms Control Study Group at Caltech's Jet Propulsion Laboratory, at the annual Alumni Seminar on May 4.

At JPL, Dr. Hibbs directs studies on problems of arms control and disarmament in the field of missile and space technology.

Dr. Hibbs is a 1945 graduate of Caltech and received his PhD from the Institute in 1955. He has been at JPL since 1950 and, in his previous capacity as chief of the Division of Space Sciences, was responsible for coordinating scientific experiments in JPL's space program.

This past year, Dr. Hibbs has also conducted a weekly NBC television show, "Exploring," devoted to both education and entertainment across a broad range of subjects for children. "Exploring" won a Peabody Award last month for distinguished achievement in television.

Picture Credits:

Cover, 7, 12-14 — James McClanahan

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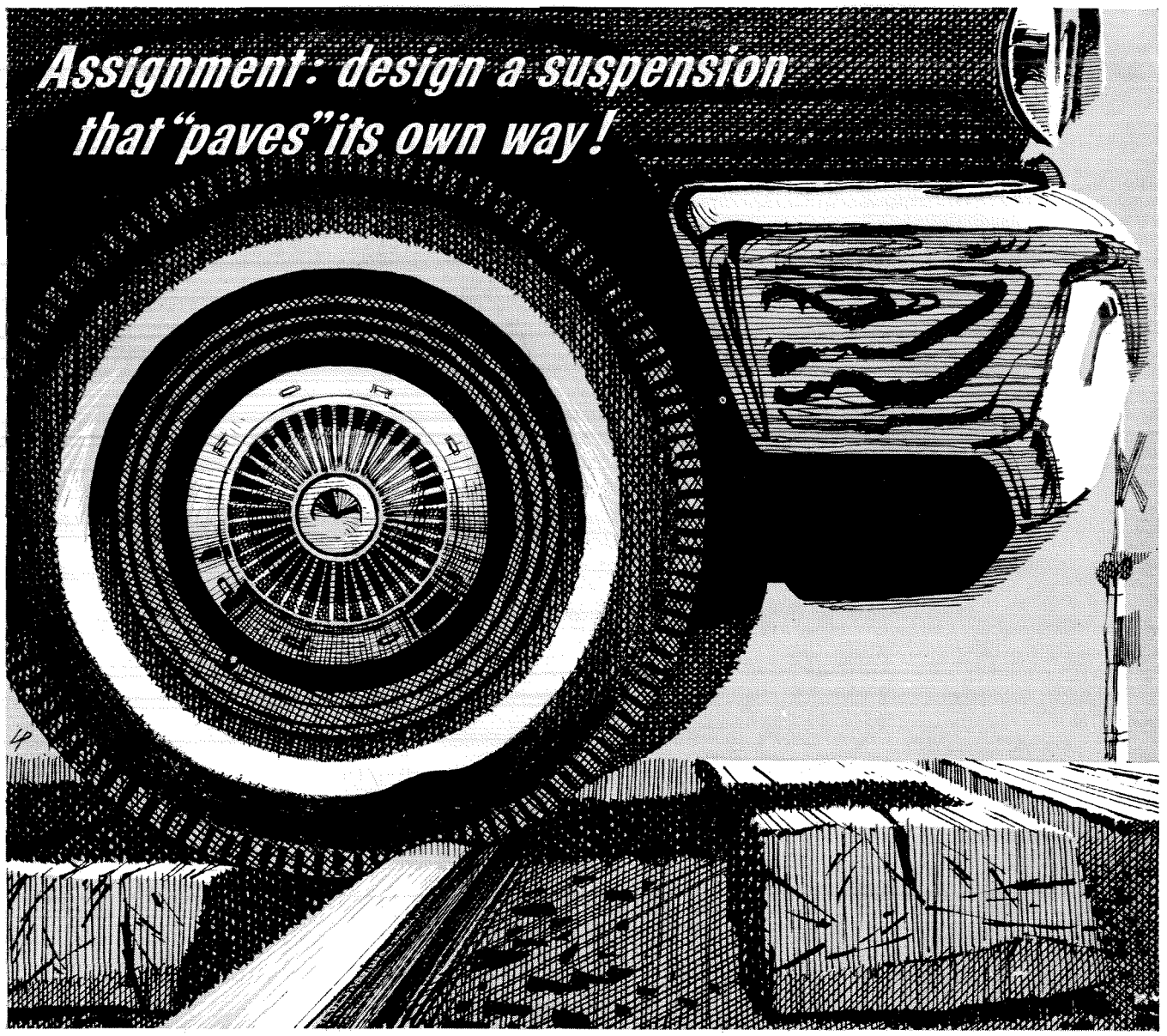

Result: "Cushion Recoil" provides a dramatically smoother ride in 1963 Ford-built cars

The challenge given Ford engineers was to design suspensions that would permit wheels virtually to roll with the punches—not only in a vertical plane but fore-and-aft as well. Conventional suspension systems provide only a partial solution to road shocks by limiting wheel recoil to an up-and-down motion.

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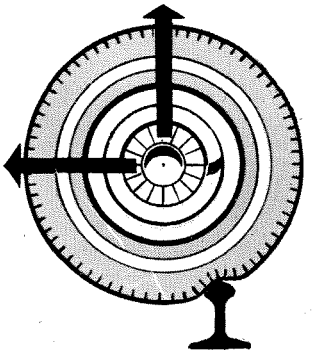

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ENGINEERING AND SCIENCE
May 1963, Volume XXVI, No. 8

President DuBridge speaking to the joint session of the Senate and the Assembly of the State of California in Sacramento, May 3, 1963.

California and the Space Age

by L. A. DuBridge

This age of space dawned in October 1957 when the first Russian Sputnik went into an orbit around the earth. All Americans were distressed that this first space event occurred under Russian and not under American auspices. And yet American technology was not as far behind as some supposed, for it was only four months later (which is a very short time, as such things go) that the American Explorer I successfully went into an earth orbit.

That Explorer I, as you know, was designed and fabricated at the Jet Propulsion Laboratory of the California Institute of Technology in Pasadena. The large booster which projected the capsule into orbit was, of course, fabricated at what was then the U. S. Army Ordnance missile development facility in Huntsville, Alabama.

Thus, California entered the space race at its very outset, and its space activities have been growing at an extraordinary — some might even say at an alarming — rate ever since.

Explorer I was not as heavy as was Sputnik I, but it carried a far more precious load of scientific instruments; it made far more extensive scientific observations; and, indeed, in that very first flight, it uncovered the first evidence for the ex-

istence of the cloud of charged particles trapped in the earth's magnetic field, hundreds to thousands of miles above the surface, now known as the "Van Allen Belt."

Since those early days of the space age, the United States has launched 128 successful capsules which either circled the earth or went off into other parts of the solar system. The Russians have launched 34. It has continued to be true that the Russian vehicles were heavier than the American. It has also continued to be true that the American vehicles were more efficiently equipped with scientific instruments and have yielded a vastly greater quantity of scientific data about the earth, the moon, the planet Venus, and the characteristics of the so-called "empty space" that lies beyond the earth's atmosphere. In the launching of every one of these American spacecraft California scientists and engineers and California industry have had some part – often a predominant part.

Scientific achievements

There are a host of scientific achievements which have come as a result of these American space projects. We have explored the earth's magnetic and gravitational fields. We have obtained valuable information on world weather phenomena. We have more fully explored the characteristics of the Van Allen Belt. We have sampled the radiations, the matter, and the gravitational and magnetic fields which exist in deep space. We have detected and measured the so-called "solar wind" – the flood of charged atoms which emerge continually from the sun itself, adding to the cosmic rays which strike the earth and influencing the earth's magnetic field.

We have measured the temperature of the atmosphere and of the surface of Venus and have determined that the planet Venus rotates only slowly about its own axis, possibly keeping always the same face pointed toward the sun, as the moon keeps the same face pointed toward the earth. We have determined that Venus possesses a zero, or at least a very small, magnetic field.

We have observed the face of the sun from space vehicles, getting information on radiations which cannot get through the earth's atmosphere to our surface observatories. We have launched communication satellites, and opened a whole new era in worldwide communication technology. We have achieved many other advances in science and technology, much too numerous to mention here. It is not too much to say that a real scientific and technological revolution has taken place in these few short years.

And yet we have made but a bare beginning in exploiting our opportunities for space exploration. We shall soon be sending spacecraft to land on the moon and tell us about its physical and chemical composition. We shall launch a vehicle to pass in the vicinity of the planet Mars. We shall send additional spacecraft to Mars and to Venus, and eventually we hope to land instruments on both of those planets. All these spacecraft aimed at distant objects will, during their hundreds of millions of miles of travel, gather new information about the sun and about the solar system. We shall someday launch astronomical telescopes into orbits far above the earth's atmosphere where, for the first time, man will be able to see the universe unimpeded by the murky, the wiggly, and the partially opaque blanket of air which shrouds the earth's surface.

We shall soon outrun the capabilities for instruments alone to make all the scientific and technical observations which are desired, and we shall then send men into space to enhance the value of our observations and our explorations.

Never before in human history has such an exciting and such a far-reaching scientific and technical enterprise been possible. Never before have man's horizons been broadened so far and so fast. And yet it was only a short 25 years ago that anyone who suggested that man would soon be able to embark on an era of space exploration would have been thought to be either demented or possibly a science fiction writer, or a comic-strip artist.

Dreams of the future

And yet here we are, already immersed in the five-year-old space age, already dreaming even grander dreams with each passing year; dreams now, however, which are based on fact, not on fancy.

What, then, is the major purpose of these dreams? What is the purpose of the huge national effort we are putting into the task of making these dreams come true?

You will find many answers to these questions.

Some will say, "We must catch up with the Soviets," which is to say we must prove that we can build just as big and powerful rocket boosters as they. Well, someday we *will* have bigger boosters, vastly more powerful than the ones we now have. But a big booster is surely not an end in itself; what do we wish to do with it? It's what's

up front that counts. Our present boosters are quite adequate for military purposes; that is what they were originally designed for. They can carry powerful nuclear warheads to any spot on earth. Our military striking power thus will not be enhanced in any critical way by larger boosters. Maybe the Russians had to have big ones because they did not, at the time, have such compact nuclear warheads as we did. And so we have just made a virtue out of their necessity.

We do need bigger boosters for our more ambitious space ventures, however. Yet we have, as I have said, done pretty well with those we have. They are adequate to send spacecraft to Venus and Mars. The fact that the weight of these capsules is smaller than the ones the Soviets launch only means we must be more clever in designing light and compact instruments. And that's what we have done. We need not be ashamed of what our spacecraft have achieved. And isn't that the final test?

But to return to the goal of our space program: There are some who say its only goal is to put Americans on the moon before any Russians land there. Well, that is an announced national policy. We are working strenuously to that end, and it will be several years before we know whether we shall succeed – whether we shall in fact be the first.

Our scientific goal

But *why* do we send men to the moon; why do we send so many instruments into space? As I have already pointed out, the goal is really a scientific one. We are seeking to *learn* more. We want to explore the moon, with instruments and with men. We want to find out what it is like, what it is made of. We think that a close look at the moon may tell us about its origin, and thus about the origin of the earth and the solar system.

There is recent evidence that the moon has something to do with the earth's weather. When the moon is "new" (that is, when it is between the earth and the sun), there is less rainfall than when the moon is full (that is, on the side away from the sun). Why is this? Does the new moon shield the earth from charged particles or dust streams emanating from the sun, and do such things affect our weather? We don't know. But it would be a good thing to find out.

But the moon is only our first step into space. Our space program will not cease when men first arrive there. We must send many expeditions to the moon. We must send instruments, and later men, to circle the planets Venus and Mars – perhaps, someday, to land on the surface.

Why?

Just to beat the Soviets?

Surely there is something deeper. Surely here, too, our aim is scientific exploration – to seek new knowledge. Mars and Venus are deep mysteries to us. We can never find out too much about them until we get there.

Think, for example, of the one staggering discovery that remains to be made: Is there, or is there not, some form of life on Mars? If not, why not? If there is life, what is it like? Is it like earthly life? Does it employ the same chemistry as does life here? Is the pattern of genetics, reproduction, and evolution the same as on earth? These are deep and profound and immensely interesting questions. Civilized men cannot be content until they are answered.

But even Venus and Mars are hardly a step from our door, as cosmic distances go. What about going still further? Yes, someday, Jupiter and Saturn and the other planets that rotate about our sun will be our goals too. They are much farther away, but the technology for reaching them is clearly in sight.

Will we visit other stars?

And what about beyond our solar system? What about visiting other stars, like our sun, which might have planets rotating around them?

On this point the news is not so good. Even the *nearest* large star, Alpha Centauri, is so far away that even if we could escape from the colossal gravitational pull of our sun (a tremendous task) and could then speed our capsule up again to, say, 20 miles per second (another stupendous task), we would still find it would take 40,000 years to reach Alpha Centauri. It would take a million years to reach other nearby stars, three-quarters of a billion years to reach the center of our Milky Way, 40 billion years to reach the next nearest galaxy of stars – and 40 trillion years to get to the most distant galaxies the Palomar telescope can see.

Reaching out to other parts of the universe will have to be deferred for a while – deferred forever, perhaps, for man's lifetime is just too short.

But we can, nevertheless, learn much more about the distant universe from our space capsules. Once we can get fine telescopes above our atmosphere, the distant reaches of the universe will come into sharper focus, and we can't even imagine all the new things we will learn.

So there are the goals of our civilian space program: to learn more about the earth, about the moon and the planets, about the empty space that lies between them, and to get a clearer view of the rest of the universe.

Does this justify the huge sums of money we are spending?

That, of course, depends on your point of view. Clearly, no great modern nation can stay out of the space age entirely; clearly, America cannot help but assume leadership in this great and new human enterprise. Whether our level of spending is too large or too small, I will not attempt to judge. But the space age is here, our nation is committed to a substantial program — and, whether Congress should appropriate 4.5, 5, or even 5.7 billion dollars for the space agency next year, we still face the fact that space exploration is to produce a tremendous impact upon our national life and upon the minds of men and women all over the world.

California's place in the space age

But let us turn our attention again to California's place in the space age. Why is it that this state occupies such a predominant place in this picture? Why do the expenditures in California for space work loom larger, by a factor of three, than for any other state in the union? Why is such a large fraction of the nation's efforts in the development and fabrication of large rockets, in the development and manufacture of intricate electronics, guidance and communication equipment, and in scientific instrumentation to be found in California?

The story, of course, goes back many years to the early days of the airplane when the first flight enthusiasts found that, because of its weather, California offered an excellent location for building and testing airplanes. Pioneers such as Donald Douglas saw here the opportunity to initiate an aircraft industrial development.

Those early aircraft were pretty fragile contraptions by modern standards, and they were fragile, undependable, and inefficient because, in those days, there was no real science of aeronautics. We did not really understand the principles which made it possible for heavier-than-air craft to fly through the atmosphere. In about 1927 a group of scientists and engineers perceived that further developments in the technology of flight could be carried forward only if the science of aeronautics were first explored. And so, with the help of the Guggenheim Foundation, the first university laboratory of aeronautical science was established at Caltech in Pasadena in 1929, stimulated by that farsighted scientist and educator, my predecessor, Dr. Robert A. Millikan.

Within a few short years the scientific work of that laboratory had uncovered quantities of new data on the nature of air-flow around such things as aircraft wings, had pinpointed the factors which underlie the lift and drag phenomena; and, more important, that laboratory was educating engineers broadly trained in the basic science and technology of flight.

These engineers joined the staffs of the growing aircraft industrial companies, and soon California-made airplanes were the finest in the world. Many additional aircraft companies began operations in southern California to be near the scientific and engineering developments which were revolutionizing aircraft design, and which eventually made possible the modern, highly efficient, high-speed jet aircraft, and also the modern rocket.

Here was one of the first startling examples of the way in which a relatively small educational institution, devoted to advanced education and scientific research, contributed so heavily to the economy of a great state.

But there were many more examples to come. At Stanford University a great research laboratory in the field of electronics was in the making in the 1930's. Scientific discoveries in this area led to technological developments which revolutionized communication, navigation, air defense, and led eventually to the modern era of automation. It is no accident that one of the great centers of the electronic industry in the country is to be found within a few miles of Stanford University in Palo Alto, California.

The Jet Propulsion Laboratory

As a third example, in this same Guggenheim Aeronautical Laboratory at Caltech there was emerging in 1940 the idea that jet propulsion had now become a practical technological possibility. A small test laboratory was set up near the mountains, in what was then an uninhabited part of Pasadena, to make tests on jet propulsion devices. During the war that laboratory developed to vast proportions as a center for the development of large rocket engines — and it is now the Jet Propulsion Laboratory, operated under the National Aeronautics and Space Administration by the California Institute of Technology, employing 4,000 people, and being responsible for the expenditure of some 200 million dollars annually. The science

and technology developed in that laboratory spread to the aircraft and rocket industries.

The present great Aerojet-General Corporation, with plants in southern California and also one near Sacramento, began as a small manufacturing concern to supply to the government the first jet propulsion devices developed at the Jet Propulsion Laboratory, initially used to serve as booster engines for aircraft taking off from short runways —the so-called JATO equipment. Aerojet-General is now one of the large industries of California. Dozens of other California companies began in a similar way as manufacturing agencies for electronic, aircraft, or rocket manufacturing to put into production new ideas developed in university laboratories.

Developing nuclear warheads

Another great boost to the missile and space industry of the nation was the development of nuclear warheads for military rockets. As everyone knows, the University of California at Berkeley was already, by 1940, one of the great nuclear science centers in the world. Because of the University's leadership in this field, it was asked by the Manhattan District during World War II to set up and manage the Los Alamos Scientific Laboratory in New Mexico which has been the center for all developments of nuclear warheads for bombs and rockets. The great laboratory at Livermore was later set up to supplement the work of Los Alamos. It was out of these laboratories that the first compact hydrogen-burning or thermonuclear warheads were first developed which made it feasible to mount these powerful warheads on ballistic missiles. The Atlas missile manufactured by Convair, with headquarters in San Diego, was the first such military intercontinental missile to be developed, and the Atlas has also been an essential element in our space exploration projects.

Thus, in California, through the collaborative efforts of universities and industry, *all* of the essential technical foundations of our space program were brought into being — flight science, jet propulsion, electronic science, and military missiles. No area in the country could bring together so rapidly and so effectively these four basic requirements for our entry into the space age. And no state had acquired the great resources of highly educated and highly skilled manpower as could be found right here.

A cogent illustration of how important economic and industrial impacts follow these centers of education and research is the study of what happens to the very large research and development budget now operated by the government. Last year some 12 billion dollars of government funds were spent for research and development in the fields of space, electronics, and defense, as well as for basic scientific and engineering investigations. Needless to say, a research and development contract can only go to those institutions and to those companies that have the brains, the know-how, and the access to new ideas. Of this large research and development budget, 41 percent was spent in the State of California. Next in line was the State of New York with 12 percent, less than one-third of California's share, and Massachusetts stood third with 5.7 percent.

It is no accident that these three states carry on 59 percent of the dollar value of the government's vast research and development program for these are also the three states in which some of the greatest universities in the world are located. Research money follows the brains, and the brains are developed in university centers. It is just as simple as that.

Revolution in education

Over two years ago, in a speech delivered to a Caltech audience, the great industrialist Alfred P. Sloan, Jr., formerly Chairman of the Board of the General Motors Corporation and now the Chairman of the Sloan Foundation, expressed this situation very clearly. He said:

> "I believe a revolution has taken place as to the status of education among the activities of our society. . . . In the new concept education is evolving as a problem of major social and economic significance in the deliberations of our society . . .
>
> "The business impact on education and the impact of education on business stand out crystal clear. . . . in fact, education becomes a competitive necessity in business."

I have already pointed out the way in which great universities and their great research centers are essential elements in modern industrial development. But it goes far beyond that. Professional schools in law, medicine, agriculture, and business also play an essential role, for a great and prosperous state requires men and women of many talents. Our liberal arts colleges add another major element, for educated citizens in all walks of life are essential to a civilized and well governed and prosperous community.

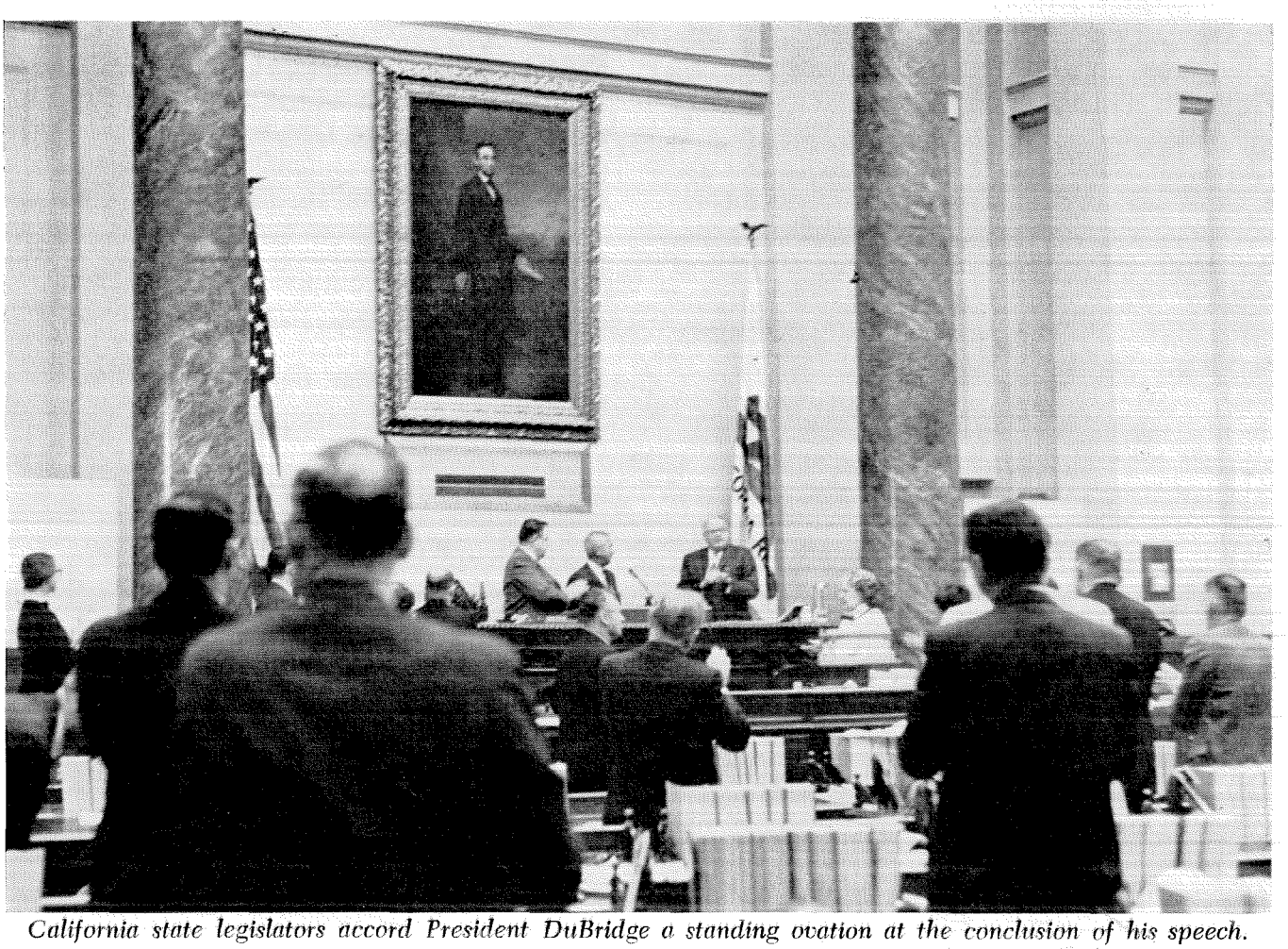
And whence come the young people who *enter* our colleges and universities? From our primary and secondary schools, of course. So they must be fine too. And I can assure you of this: our best high schools in California *are* pretty fine, and are getting better every year. The freshmen who are entering Caltech and Stanford and Berkeley and Occidental and Pomona and other colleges are much better prepared for college than they were a few years ago. They have had better courses in mathematics, in science, in English and history and foreign languages than they had ten, or even five, years ago. We have much further to go to make all our public schools even finer, but they are now on the march.

Yes, California has built a fine educational system. And, as I have said, these efforts are now paying off economically. For our fine educational system has been a major factor in the state's industrial and technological development. Our investment in education is paying off a hundredfold.

But I know you would not want me to leave you with the impression that the purpose of our educational system is ***only*** to contribute to economic and industrial development. Far from it. The purpose of education is to serve the needs of our young people, to enable them to develop and use their talents, to live richer and more fruitful lives, to be better citizens. In 1787 the Congress of the United States passed the Northwest Ordinance, leading to the development of the western states. That document said:

> "Religion, morality, and knowledge, being necessary to good government and the happiness of mankind, schools and the means of education shall forever be encouraged."

The State of California has followed that injunction. It has not been an easy task. Education is a large, complex, and costly enterprise. To encourage it properly requires wisdom, understanding, and farsighted judgment – and also money. But I hope I have helped to confirm your opinion that the building of a fine educational system is the most important task you have achieved – and the most important objective for the future, if we wish to maintain in California the finest environment in the nation in which fine people can live happy and fruitful lives.



California state legislators accord President DuBridge a standing ovation at the conclusion of his speech.

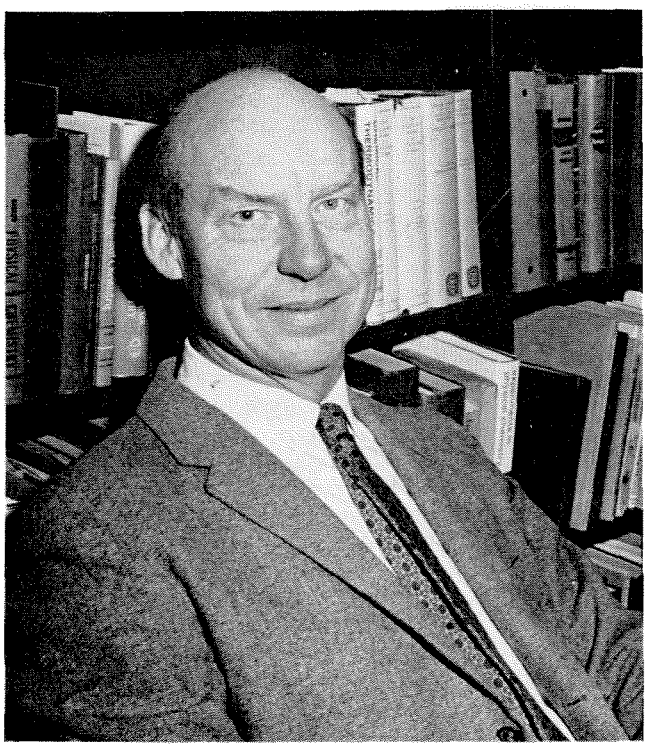
The Month at Caltech

Guggenheim Fellowship Awards

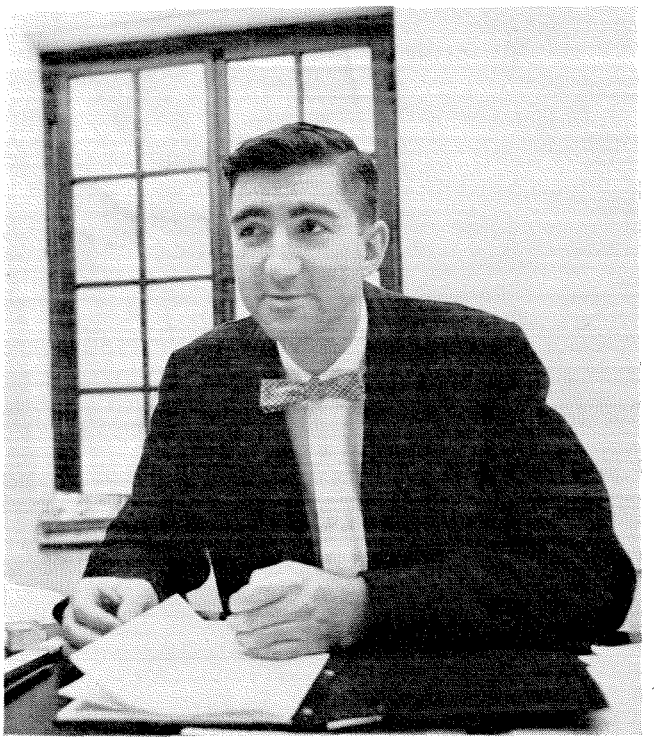
Two Caltech professors have been selected to receive 1963 Guggenheim Fellowship Awards — Jurg Waser, professor of chemistry; and Fred C. Anson, associate professor of analytical chemistry.

Dr. Waser will make his headquarters at the Eidtenössische Technische Hochschule in Zurich, Switzerland, while he visits a number of other European schools to investigate their methods of teaching chemistry.

Dr. Anson will continue his research in electrochemistry at the Université Libre de Bruxelles in Belgium. He will be collaborating with Dr. Lucien Gierst, an eminent authority on the electrical double layer.



Jurg Waser, professor of chemistry



Fred Anson, associate prof. of analytical chemistry.

Chemistry Award

Ernest H. Swift, professor of analytical chemistry at Caltech, has been selected to receive the Manufacturing Chemists' Association's 1963 college chemistry teacher award. He will receive a medal, a citation, and a check for $1,000 at the association's annual meeting in White Sulphur Springs, West Virginia, on June 6.

Esther Gilbert

Esther Gilbert, division administrative secretary to Dr. F. C. Lindvall, chairman of the division of engineering and applied science, died on April 21 of a heart attack. She had worked for the engineering division for over 30 years.

Miss Gilbert was a graduate of UCLA, where she majored in psychology. Her special interest was to make foreign students feel at home at Caltech, and she sponsored many get-acquainted parties to introduce those from foreign countries to Americans. She sponsored a brother and sister from Vietnam who are now at Pasadena City College. Miss Gilbert was a friend of many generations of Caltech students and kept up correspondence and personal contact with scores of alumni.

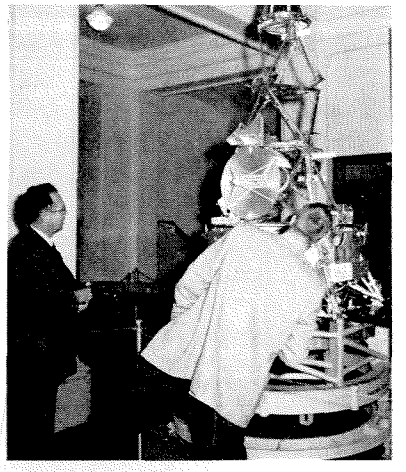
SEMINAR DAY

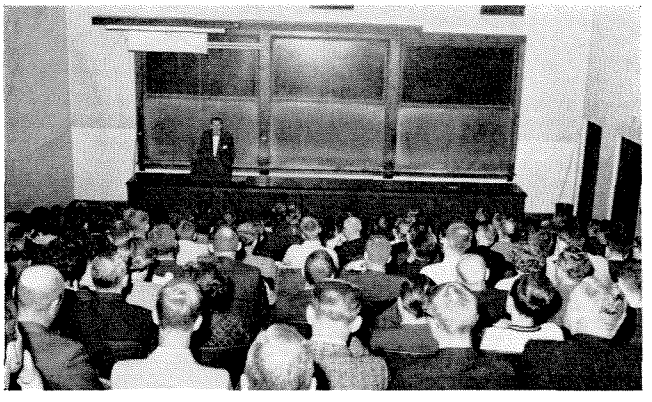
More than 1200 alumni, wives and guests came to the Caltech campus for the 26th Annual Alumni Seminar on May 4. Twelve lectures and a series of special events were featured on this year's program.

Left, below: F. C. Lindvall, chairman of the division of engineering and applied science, talks on "Engineers and Politics."

Right: Mariner III, on exhibit in Throop Hall.

Right, below: Seminar Speaker Albert R. Hibbs ("Minitalk and Megathreat") and Seminar Chairman Richard P. Schuster.





A Tribute to George P. Keyes

George P. Keyes, known to one and all as Pret, joined the Institute February 1, 1948, working with Professor F. W. Went on planning for the Earhart Plant Research Laboratory. Pret's background of engineering and of greenhouse work had prepared him well for this task and as the Earhart Laboratory, the Phytotron, moved from a gleam in F. W. Went's eye to physical reality, Pret made himself the master of its intricate design and of its intricate control systems. He knew where all the wires and pipes went and what they did, and what to do when his finely tuned ear detected disharmony in the phytotronic hum.

Pret organized the phytotron crew, which now numbers 15, to carry out, on a 7-day-a-week basis, not only the intricate moving of plants by means of which different night temperatures may be combined with a common day temperature, and so on, but also the planting, feeding, and general care of the experimental plants which constitute the laboratory's study material.

He organized the photographic-record methods now standard in the laboratory and iron-fistedly enforced the rules on decontamination of entering personnel and materials which have kept the phytotron free of insects.

As superintendent of the phytotron, including the new Campbell Laboratory, Pret exercised his authority from a command post in the control room of Earhart, and he did so calmly and collectedly, no matter how furious the bustle about him.

It is through Pret Keyes that our several hundreds of professional visitors have learned about the phytotron and phytotronics and have gone home, each to try to wangle a phytotron from his own country or organization.

In recent years Pret had taken up a hobby (his sole earlier hobby had been his phytotron) — namely, going on camping trips to mountain and desert with his wife Helen and their two sons, Lawrence and Allen, and as this hobby grew in intensity it brought to the Keyes family a beautiful pickup camper, in which, in addition, Pret drove to work and which has been a familiar sight outside of Earhart during recent years.

Pret was seized, without previous warning, with illness in December 1962, and although he struggled against it and kept at his work up to one week before the end, he passed away May 3, 1963. We miss him.

— James Bonner

MINITALK AND MEGATHREAT

by A. R. Hibbs

There are a number of ways to characterize traditions in the U.S. approach toward international affairs. Using modern jargon, one of these traditions might be called "The policy of minitalk and megathreat." This policy was stated in more commonplace terms by Teddy Roosevelt as "Speak softly and carry a big stick" — a proverb which he identified as "West African."

Although Theodore Roosevelt had always enjoyed having big sticks, he had never given much of an impression of speaking softly — at least before his succession to the presidency. His attitude toward a big stick can be found in many statements, such as in his speech of 1897, when, as Assistant Secretary to the Navy, he spoke before the Naval War College.

There he said, "All the great masterful races have been fighting races. No triumph of peace is quite so great as a supreme triumph of war. We of the United States have passed most of our few years of national life in peace. We honor the architects of our wonderful material prosperity . . . but we feel, after all, that the men who have dared greatly in war or the work which is akin to war, are those who deserve the best of the country."

In his autobiography, when he wrote of his experiences in the West, he said, "Every man who has in him any real power of joy in battle knows that he feels it when the wolf begins to rise in his heart; he does not then shrink from blood or sweat or deem that they mar the fight; he revels in them, in the toil, the pain, and the danger, as but setting off the triumph."

Of course, we all know of Teddy Roosevelt's Rough Riders and their participation in the Spanish-American War. But, even before this episode, Teddy, as Assistant Secretary to the Navy, had, without authorization from his superior, directed Admiral Dewey to launch his attack on the Spanish fleet in the Philippines. In response to the criticism which this act drew in later years from historians, he remarked to a friend, "Our generals . . . had to grapple with a public sentiment which screamed with anguish over the loss of a couple of thousand men . . . a sentiment of preposterous and unreasoning mawkishness."

His own description of his actions in the Spanish-American War tells not only of the incident but of the character of the man who participated: "I waved my hat, and we went up the hill with a rush. I killed a Spaniard with my own hand like a jackrabbit." And then, at the moment of triumph, he exhorted his men to "look at those damned Spanish dead!" Three years later he was President of the United States.

In a speech 13 years after a particular event, Roosevelt described one example of his "Big

Stick" policy. The parallel between this example and one of quite recent memory is so striking that it almost sounds as if it were made up.

In 1902, a Venezuelan dictator had committed various offenses against different European nations, including Germany and England. The German Emperor decided to exact some sort of punishment against Venezuela and sent a fleet of ships to bombard the Venezuelan coast and capture or sink the small Venezuelan fleet. Roosevelt states that he became convinced that "Germany intended to seize some Venezuelan harbor and turn it into a strongly fortified place of arms, on the model of Kiauchau, with a view to exercising some degree of control over the future Isthmian Canal and over South American affairs generally. For some time the usual methods of diplomatic intercourse were tried. Germany declined to agree to arbitrate the question at issue between her and Venezuela and declined to say that she would not take possession of Venezuelan territory, merely saying that such possession would be 'temporary' – which might mean anything. I finally decided that no useful purpose would be served by further delay and took action accordingly."

The action which Roosevelt took was to order Admiral Dewey to bring the U.S. fleet in the Caribbean to a state of one hour's readiness. Roosevelt then called the German Ambassador, Von Holleben, and delivered an ultimatum to Germany – an ultimatum demanding arbitration of the dispute and a promise for no seizure of Venezuelan territory.

According to John Hay, Roosevelt's Secretary of State at the time, "The German Government firmly counted on our well-established jellyfish squashyness and felt sure they had a free hand." After Roosevelt's ultimatum, "Holleben informed his Government that probably Roosevelt's attitude was a bluff."

Roosevelt called back the Ambassador a few days later and asked what the reply was from the German Government. There was no reply, so Roosevelt writes, "I informed him that in such event it was useless to wait as long as I had intended, and that Dewey would be ordered to sail for the Venezuelan coast 24 hours in advance of the time I had set."

According to Hay, the German Ambassador had second thoughts about the determination of Roosevelt and cabled his Government accordingly. As a result, Roosevelt reports, "Less than 24 hours before the time I had appointed for cabling the order to Dewey, the Embassy notified me that his Imperial Majesty, the German Emperor, had directed him to request me to undertake the arbitration myself."

Truly, this incident has a remarkable similarity to the Cuban crisis in the fall of 1962 – the threat of naval blockade, the few days' worth of ultimatum, and the retreat of the European power and its abandonment of its strategic base; but the most amazing thing of all, perhaps, is the name of the Venezuelan dictator – Castro.

Roosevelt's entry into the Morocco dispute between France and Germany is considered by some historians to be simply a display of his own desire for international publicity and to have had little, if any, benefit to the U.S. and, in fact, even perhaps some detrimental effects. On the other hand, there are those who think that Roosevelt here brought the United States out of its traditional isolationism in a very significant manner.

The dispute over Morocco centered around the desire of the French to establish a preferential commercial situation, much to the economic damage of German merchants. The Kaiser made a trip to Morocco where, in March 1905, he delivered a defiant, saber-rattling speech. The long predicted European war seemed at hand.

Roosevelt entered this situation somewhat reluctantly, for he privately admitted that America had no direct concern of any significance in Morocco. But he recognized that the crisis was serious and might indeed lead to general war which might thereafter involve the United States, so he gave in to some of his advisors who persuaded him to bring pressure to bear on Britain and France. Roosevelt's involvement in Morocco marked the sharpest departure from traditional isolationism that the United States was to experience before the outbreak of World War I in 1914.

The Japanese opened the Russo-Japanese War by a surprise attack on the Russian fleet at Port Arthur. This sneak attack, without declaration of war, was quite damaging to the Russian position in the Pacific. However, the Americans were sympathetic to the Japanese, who were looked upon as the underdog. The American press praised the "clever little Japanese for having caught the stupid and overconfident Slav with his guard down." President Roosevelt wrote admiringly, "Was not the way the Japs began the fight bully?"

The Russians, of course, were somewhat put out by all of this, since they expected to find traditional American friendship for that largest and most populous white Christian nation. However, Russian imperialism in Asia, the banishment of political dissenters to Siberia, the takeover of Finland, the pogroms directed against the Russian

Jews, had all taken their toll of U.S. friendship toward Russia. On the other hand, we saw the Japanese as protecting the Open Door policy in China. It seems surprising, then, that Roosevelt was instrumental in bringing this war to an end and acting as a mediator, when his announced sympathies were so one-sided. It turns out that he acted in this role on the basis of a secret request from the Japanese Government. Although the Japanese had been quite successful in the military theatres, it was at a tremendous expense and they were exhausted even in near victory.

Roosevelt's arbitration in this dispute won friends in neither Russia nor Japan, but his own reputation as a world leader and peacemaker was tremendously enhanced; and in the next year, 1906, the man who had once boasted of killing a Spanish soldier "like a jackrabbit'" was awarded the Nobel Peace Prize.

In spite of all the criticism, Roosevelt's concept of the balance of power in Asia turned out to be reasonably correct. Subsequent events indicated that neither Russia nor Japan, had either been completely victorious, would have maintained the Open Door policy. Only the balance achieved by Roosevelt's mediation worked to the long range interests of the U.S. and other powers.

After the close of the Russo-Japanese war, Roosevelt sent the U. S. fleet on a world cruise, including a stop at Japan. He undertook this venture in spite of a war hysteria whipped up by the Hearst press and fears on the part of many Senators that the unprotected East Coast would be attacked from Europe in the meantime or that the fleet would be destroyed by storms or Japanese treachery. Nevertheless, the cruise was a tremendous success. The fleet was received everywhere, including Japan, with great good feeling. It demonstrated to the world America's new awareness of world problems, and Roosevelt himself stated that he looked upon this act as "the most important service that I rendered to peace . . . " On the other hand, one of the results was a stimulation of a naval arms race in Japan as well as in other countries.

By 1915, Roosevelt was complaining to Lodge that the American people themselves "are cold; they have been educated by this infernal peace propaganda of the last 10 years into an attitude of sluggishness and timidity." In fact, Roosevelt was anxious to participate personally in the first World War and continued to protest American inaction, calling Wilson "purely a demagogue," "a doctrinaire," "an utterly selfish and cold-blooded politician always," for his refusal to commission Roosevelt and permit him to raise a division. This boyish demand for excitement continued throughout his life. A decade earlier, a contemporary had written of him, "You must always remember that the President is about 6."

Roosevelt had no more ability to see himself as others saw him than the rest of us. His Secretary of State, John Hay, in the March 20, 1904, entry in his diary of meetings with President Roosevelt, wrote, "He has heard that some people in New York have said that he was a grotesque figure in the White House, and wonders what they mean."

We must recognize that Roosevelt was a warlike man and desired Napoleonic fame. Nevertheless, in the White House he often showed amazingly peaceful intentions — although he himself often described them as being forced upon him by public opinion. But let us give him his due. He had a glorious opportunity to whip up a war with Japan, but instead went to extraordinary lengths to prevent it. Despite his bellicose ambitions, he is far better known for his efforts at peacemaking than at warmaking. And, what is more, he deserved this acclaim.

Another American president famous for his powers in the international arena was Woodrow Wilson. Some 30 years before his fathering of the League of Nations, Wilson had expressed an attitude toward social change which is in rather curious contrast to his subsequent action. "In politics, nothing radically novel may safely be attempted," he wrote in his study, *The State*, in 1889. "No result of value can ever be reached . . . except through slow and gradual development, the careful adaptations and nice modifications of growth."

Perhaps more basic to Wilson's motivation was his attitude toward himself and his relations with other people. He had a powerful need for affection. Combined with this, he had a deep sense of isolation and a very limited capacity for any sort of warm, personal communication. He wrote of himself, "When I am with anyone in whom I am especially and sincerely interested, the hardest subject for me to broach is just that which is nearest to my heart.

"It isn't pleasant or convenient to have strong passions; I have the uncomfortable feeling that I am carrying a volcano about with me. My salvation is in being loved . . . there surely never lived a man with whom love was a more critical matter than it is with me!"

Of his reserve, his difficulty in making friends, he wrote, "Sometimes I am a bitter shame to myself when I think of how few friends I have

amidst a host of acquaintances. Plenty of people offer me their friendship; but, partly because I am reserved and shy and partly because I am fastidious and have a narrow, uncatholic taste in friends, I reject the offer in almost every case; and then am dismayed to look about and see how few persons in the world stand near me and know me as I am — in such wise that they can give me sympathy and close support of heart."

He was writing these words to his wife, and continued, "Perhaps it is because when I give at all I want to give my whole heart, and I feel that so few want it all or would return measure for measure. Am I wrong, do you think, in that feeling? And can one as deeply covetous of friendship and close affection as I am afford to act upon such a feeling?"

Perhaps one of the reasons why Wilson chose politics as the main goal of his career was that he derived from groups of people the feelings of affection and support which he missed from individual contacts. As early as 1884, he wrote. "One feels no sacrifice of pride necessary in courting the favor of an assembly of men such as you would have to make in seeking to please one man."

In later years, when Wilson was in the White House, he told his friend Tumulty, "I want the people to love me, but I suppose they never will."

If these were part of his limitations and his drives, there were in addition strong forces from his family background. His father was a Presbyterian minister, and his mother a Presbyterian minister's daughter. Woodrow Wilson had learned to look upon life as the progressive fulfillment of God's will and to see himself as "a distinct, moral agent." Early in his life he was afflicted with an almost impersonal ambition to become great in order that he might serve greatly. His drive toward politics and toward a political career did not in any way involve the feeling of need to submit to political chicanery. Perhaps he persuaded himself that, even though such activities went on in somebody else's area, he could continue to hold himself aloof from them. When the political bosses of New Jersey approached him to run for the governorship, he was puzzled and could not obtain from them any satisfactory answer as to why they had chosen him as a standard bearer. "So I had to work one out for myself. I concluded that these gentlemen had been driven to recognize that a new day had come in American politics and that they would have to conduct themselves henceforth after a new fashion."

In his campaign, he stated that, if he was elected, he would enter the governorship "with absolutely no pledges of any kind." And, if the bosses imagined that he would go back on these pledges, they were mistaken. After his election, he called the bosses "warts upon the body politic" and refused to assist them, even though they had been instrumental in his election. Boss Richard Crocker of Tammany Hall said of Wilson, "An ingrate in politics is no good." But he was underselling Wilson by a long margin. For this policy on the part of Wilson was far more than simply ingratitude: it was a matter of dedication and moral conviction. During this period, he wrote to a friend, "I shall make mistakes, but I do not think I shall sin against my knowledge of duty."

The Wilson Administration had several significant diplomatic dealings prior to the events immediately preceding our entry into the first World War. The Marines were sent into Haiti in 1915, and backed up Roosevelt's customs house control (instituted in 1905) with the landing of Marines in the Dominican Republic in 1916.

Our attitude toward Haiti was represented by a telegram sent from Admiral Caperton to the Secretary of the Navy: "Next Thursday unless otherwise directed, I will permit Congress to elect a President." In the Dominican Republic, when the regime refused to accept our dictated treaty, a six-year military government was bodily established under the direction of the Navy Department in Washington.

In 1913, the Mexican Government was in the control of a ruthless military dictator, General Huerta. Wilson, objecting to Huerta's regime on moral principle, attempted to force its collapse by refusing diplomatic recognition. In a message to Congress, August 27, 1913, Wilson described why he elected this course of action. Now, it should be pointed out that this lack of recognition represented a sharp clash between the idealism of Wilson and a long-established precedent of United States foreign policy. From the days of Thomas Jefferson, the United States had generally, though not invariably, pursued the policy of recognizing established governments regardless of how they had come into office. A long list of other countries around the world had applied this simple test to the Mexican Government of General Huerta, and recognized it. But Wilson refused.

In his message to Congress, he said, "Clearly, everything that we do must be rooted in patience and done with calm and a disinterested deliberation. Impatience on our part would be childish, and would be fraught with every risk of wrong and folly. We can afford to exercise the self-re-

straint of a really great nation which realizes its own strength and scorns to misuse it.

"The steady pressure of moral force will before many days break barriers of pride and prejudice down, and we shall triumph as Mexico's friends sooner than we could triumph as her enemies — and how much more handsomely, with how much higher and finer satisfactions of conscience and of honor!"

Instead of "many days," it was more than a year before the Huerta regime fell, and then because of much more direct pressure than the "moral force" Wilson counted on.

In this same speech, Wilson had assured Congress that he was not going to permit traffic in arms to Huerta or to the two other leaders who were now doing battle with Huerta, Carranza, and Villa. However, within six months, Wilson changed this noninterventionist policy and lifted the arms embargo so as to permit war materials to reach Huerta's opponents.

Wilson was as highly criticized for this act as for his general policy toward Mexico. He was denounced in Europe as impractical and idealistic. The German Kaiser spoke for many European leaders when he said, "Morality is all right, but what about dividends?" Most people felt that Wilson's action was simply prolonging a battle and preventing the arrival of that day when the Mexican situation would be settled down enough so that European investors would feel safe again.

The Republicans in the United States called Wilson's action the policy of "deadly drifting" and a popular dance step was called the "Wilson Tango"— one step forward, two backward, a side step, and then a moment of hesitation.

But Wilson stood fast and remarked to his secretary, "I have to pause and remind myself that I am President of the United States and not of a small group of Americans with vested interests in Mexico."

But the situation continued to worsen. In Tampico, on April 9, 1914, a group of U.S. sailors were arrested by Huerta's militia. Although they were later released, the Commander of the U.S. Fleet demanded redress from the Mexican Government for its injury to American honor. Huerta replied with profuse apologies but declined to "hoist the American flag in a prominent position on shore and salute it with 21 guns," unless the Admiral gave the same honor to the Mexican flag. Since the U.S. did not recognize the Mexican Government, this reciprocity was diplomatically impossible — and the two governments were at an impasse. In America, tempers flared. Even the peace-loving Secretary of State W. J. Bryan felt that American honor had to be backed, and Wilson decided to use the incident to justify armed intervention in Mexico.

After receiving approval from Congress, Wilson ordered the Navy to take the port of Vera Cruz in order to prevent the landing of a shipload of munitions from a German merchantman. This invasion of Mexico was roundly denounced, not only by the dictator Huerta, whom Wilson was trying to oust, but also by the leaders of those insurrectionist movements in Mexico, which up till then had been conspiring with the U.S. for the armed overthrow of Huerta; and, of course, there was a general cry of outrage from other Latin-American countries. Wilson clearly wanted out of the spot he had gotten himself into and leaped at the offer of mediation received from the ABC powers (Argentina, Brazil, and Chile).

Even though a plan was finally evolved by this group at Niagara Falls, Canada, and even though Huerta was finally forced to flee to Spain within a month after the Vera Cruz incident, principally because U.S. pressure had finally crumbled his regime, his successor General Carranza refused to accept the results of the Niagara Conference.

Carranza had been one of the men the U.S. was pushing as a replacement for Huerta. The other alternate was Francisco Villa. It turned out that Carranza was not much better than Huerta, even though the U.S. finally recognized the Carranza regime about a year after it had taken office. Furthermore, Carranza and Villa, friends during their common fight against Huerta, had a falling out, and Villa decided to revolt against Carranza. One of his ploys in this circumstance was an invasion of the United States and the sacking of the town of Columbus, New Mexico, on March 9, 1916, with the shooting of at least 17 Americans. By this move, Villa hoped to involve the U.S. in a war with Carranza, which might bring Villa to power.

Wilson ordered General Pershing to invade Mexico with 12,000 men, after Carranza had grudgingly permitted the invasion to start. (Carranza had required a face-saving agreement which permitted "the pursuit of outlaws by either nation in the future.") Unfortunately, Pershing's cavalry never quite captured Villa, but instead indulged in a clash with the Mexican troops at the town of Carrizal. By now the Pershing expedition had been dubbed the "perishing expedition" and, in February 1917, threatened by the possibility of entry into war in Europe, Wilson withdrew the U.S. troops from Mexico.

In spite of his honest intention and high ideals, Wilson's policy in Mexico failed by a long way in meeting the objectives he himself had set. Many American lives were lost, and many more Mexican lives. Not only was American and other foreign capital investment destroyed, but the capital goods of Mexico herself were greatly depleted by the continuing revolution. Even when Pershing's troops were finally withdrawn, the armed conflict between Villa and Carranza was still boiling — a conflict that Wilson's actions had helped to promote and prolong.

In the first year of World War I, the course of American neutrality was indeed a difficult one. There was a great outcry over the sinking by German torpedoes of the *Lusitania* on May 7, 1915. Eleven hundred and ninety-eight persons were killed, 128 of them American citizens. Wilson recognized, however, that the country was not clamoring for war even though it objected most violently to this act on the part of the German submarine. He attempted to control the feelings of the nation in the same manner that he controlled his own. He continued to emphasize what he considered to be America's great moral mission.

Speaking in Philadelphia three days after the *Lusitania* sinking, he stated, "There is such a thing as a man being too proud to fight. There is such a thing as a nation so right that it does not need to convince others by force that it is right." Of course, his phrase "too proud to fight" was quickly taken out of context and used against him by the jingoes of the time, including Teddy Roosevelt.

After his reelection on the slogan "He kept us out of war," Wilson made another attempt to end the conflict. He requested both sides to clearly state their war aims, and, after contemplating the replies from both German and allied capitals, Wilson addressed the Senate (really the world) on January 22, 1917. Here was his first suggestion for a League of Nations, and he warned both sides in the war that only "peace without victory" could bring a permanent end. Americans were enthusiastic about the speech, but of course the Allies could not afford to accept the stalemate, so Wilson's attitude gained nothing as far as immediate objectives were concerned. Nevertheless, it put Wilson in the center of the stage as the moral leader of the world. Germany's answer to the "peace without victory" speech was to establish on January 31, 1917, unrestricted submarine warfare.

Germany knew this would push America into the war, but they also knew that America was essentially unprepared. Until the Naval Act of 1916, the American defense budget had been very small. And even this Naval Act had gone to buy large battleships, vulnerable to the submarines, instead of small, fast submarine chasers. So, at this point, America had no "big stick," and this lack was significant to German decision-makers. Fortunately, we built our big stick in time.

Wilson helped bring an early end to the first World War not only by the entry of the United States into that war but also by his enunciation of his famous Fourteen Points. The faith of the German people in Wilson and their acceptance of his Fourteen Points brought about an armistice much earlier than it would otherwise have occurred. Unfortunately, Wilson could not force the Fourteen Points onto France and England, whose bitterness toward Germany was not restrained by Wilson's idealism. Nevertheless, and harsh though the peace with Germany turned out to be, it undoubtedly would have been much harsher without the idealistic force of Wilson at the peace table.

Indeed, Wilson had almost insuperable obstacles in his dealings with France and Britain. Clemenceau habitually dozed off when matters unrelated to French security were under consideration at the conference. Lloyd George, on more than one occasion, lightheartedly admitted his ignorance of some of the most elementary facts of European economics and geography. "Please refresh my memory," he once asked an aide, "Is it Upper or Lower Silesia we are giving away?"

Every evening, Wilson came home to his suite, haggard and white, and, as one of his aides remarked, "with one eye twitching painfully." In the small hours of the morning, he would go down on his hands and knees, poring over maps and charts, trying to master the complicated maze of facts involved in the negotiations.

By compromise and retreat on many of his Fourteen Points, in fact on most of them, Wilson managed to save at least the basic doctrine of the League of Nations. It was eventually incorporated into the treaty. Then came the fight with the U.S. Senate. The Senate wanted some reservations. Actually, the reservations were rather mild. Certainly, in comparison with the compromises which Wilson had already given to France and England in order to secure the treaty, the compromises demanded by Senator Lodge and the Republicans who followed him were small. Nevertheless, Wilson refused to budge an inch before the Senate. When the possibility of Senate rejection was broached to him, he snapped, "Anyone who opposes me in that, I'll crush!"

An ambassador from France brought news to Wilson that the Allies would be glad to accept American membership in the League of Nations even with the set of reservations that would satisfy an influential group of Republican Senators, a set of reservations which, if accepted, would have guaranteed American entry into the League and the signing of the Versailles Treaty by the U.S. But to this suggestion Wilson replied curtly, "Mr. Ambassador, I shall consent to nothing. The Senate must take its medicine." But the Senate held fast, and Wilson then went out to stump the country.

Any logical reason behind this tour by Wilson is hard to discover. Even if his stumping efforts should have defeated every Republican senator up for reelection in that year, Wilson's party would still not have enough votes in the Senate to pass the treaty. Perhaps Wilson was in search of martyrdom. He had been warned by his physician not to undertake a strenuous campaign, and he told his friend Tumulty, "Even though, in my condition, it might mean the giving up of my life, I will gladly make the sacrifice to save the treaty." In Spokane he declared in a speech, "I am ready to fight from now on until all the fight has been taken out of me by death to redeem the faith and promises of the United States."

Who can say what might have happened if Wilson had actually achieved the martyrdom he appeared to be seeking? If he had killed himself with these exertions, the resulting wave of sympathy might have swept the League of Nations through the Senate. But, instead, he suffered a stroke which held him incapacitated for many months and even prompted malicious talk about his mental health. People pointed to bars on the windows of the White House as evidence that a madman lived inside, although the bars had been there since the days of Teddy Roosevelt and were originally installed to prevent Roosevelt's sons from breaking the windows with their baseballs.

Thereafter, the Democrats in the Senate were almost without a leader, and when, on March 19, 1920, the final vote on the treaty came up, the best that Wilson could do was to write a stern letter to his party leadership. The vote was 49 to 35, and thus fell short of the required two-thirds majority. Wilson had asked the Senate to give it to him his way or to give him nothing, and he got nothing. Senator Ashurst of Arizona, a fellow Democrat with Wilson, bitterly declared, "As a friend of the President, as one who has loyally followed him, I solemnly declare to him this morning: 'If you want to kill your own child because the Senate straightens out its crooked limbs, you must take the responsibility and accept the verdict of history.' "

Wilson tried to keep up the fight. He hoped that the presidential election of 1920 would be "a great and solemn referendum," giving a clear mandate for acceptance of his treaty and his League. But the Democratic candidate, Cox, together with his vice-presidential nominee, Franklin Delano Roosevelt, went down to a stunning defeat before the landslide of Harding, the high priest of normalcy. The verdict of history was against Woodrow Wilson.

This is the point where I cease my historical review. The America of the first 20 years of the century has similarities to the America of today which are more basic than the vast and obvious differences. We were then, as now, a powerful industrialized nation. We took our place as world leaders in international conflicts. We leaned upon the moral strength of our fundamental beliefs in democracy. We had arguments, quarrels, and major battles with dictatorial regimes and won them. We kept getting ourselves into trouble in Latin America and regularly lost friends in the process.

But we can look back upon these times with an air of rational judgment. The leaders who walked that political stage are gone. Although the Republican and Democratic parties were respectively conservative and liberal then, as now, it is hard to identify with the politics of those days any more deeply than by party label. Thus it may be possible to conduct a rational study of this age of America in such a manner that we can gain vital insights into the solutions of today's problems.

It is tempting to transform the lessons so learned into broad generalizations. Admitting that such generalizations are seldom accurate, limited in application, and quite often misleading, nevertheless they offer some virtues, if only as a guide to further thought.

Such a generalization derives from our comparison of the two presidents, Roosevelt and Wilson, who left the principal marks upon this score of years. On the one hand, there is Roosevelt, the Rough Rider, the Warhorse. And on the other, Wilson, the idealist, the moral agent.

Roosevelt was always ready for a fight, and approached the world with a chip on his shoulder. His attitude toward foreign policy was that of self-interest for the United States – and not always too well-enlightened self-interest. Wilson kept holding before him and before America the

basic morality of Christianity. In both policy and act, he was guided by a deep and real concept of principle.

Roosevelt seldom deviated from his Big Stick policy. His reliance on pure diplomacy was usually reserved for other people's problems – the Russo-Japanese War, the Moroccan conflict, and so on. In these, it seems clear that he was guided as much by a desire to enhance his own fame as a desire to bring peace between the disputing parties. Thus, one might say that, when it was not self-interest of the nation that guided him, it was self-interest of Teddy Roosevelt. Wilson was forced often to deviate from his fundamental morality. In spite of the guiding principles in his denial of recognition to Mexico and his determination to stay out of any conflict there, he was led by still other principles to eventually give arms to the insurrectionists and finally to invade the country. He gave up his principles with anguish, but give them up he did – time and time again.

Roosevelt found no conflict between his personal ambition, his concepts of running the country, and his policies of international diplomacy. Wilson was in continual conflict between the demands of his moral precepts and the requirements of workaday politics. In many cases, he could save one only by sacrificing the other.

Roosevelt's belligerence and self-interest won for us the Panama Canal (on terms of maximum benefit to the United States), preserved the Monroe Doctrine against a very real threat from Germany and England in the Caribbean, settled a bitter war in Siberia, prevented a war over Morocco, and won for the man himself the Nobel Peace Prize.

Wilson's continual conflict between morality and politics gained for us the animosity of Mexico and many other countries of Central America and the Caribbean, failed to prevent a war in Europe or to keep us out of it and, finally, in a most glaring display of wearing the wrong hat at the wrong time, doomed to defeat his own most beloved creation, the League of Nations.

The generalization is obvious: In world politics, self-interest is considerably more successful than moral principle. In this statement, the word "success" is not qualified. One can say that self-interest is a more successful basis than moral principle even in the achievement of morally desirable results.

Once one has created a generalization, the next step is to test out its potential application. There are a number of issues that face the nation today, domestically and internationally, to which one might apply this generalization. Among these, one of the most pressing is the problem of war. Here, both from a moralistic point of view and from the point of view of self-interest, there is no doubt that war must be avoided. If small wars seem unavoidable, and we should be prepared to accept this possibility, nevertheless a war between the major powers would very likely involve nuclear weapons and the probable destruction of civilization. From self-interest or morality, we are directed to take whatever acts are necessary to minimize the risk of major war. One of these acts might be the establishment of a disarmament agreement with the Soviet Union.

I say "might be" here instead of "will be" for this reason: Suppose we could achieve complete disarmament. Surely all of us would then breathe a sigh of vast relief. But what would happen next? What would prevent the rebuilding of armaments? The nonexistence of weapons does not mean that all trouble between the two major powers, the U.S. and Russia, are solved. And, if these troubles should flare up again, might not the leadership of either country feel forced into resorting to a rebuilding of armed might? In the ensuing frantic arms race, might not the danger of war be even greater than it is at present?

On the other hand, continuation of the present arms race involves constant risk – risk of accidental nuclear war, risk that many other nations will develop nuclear weapons, and use them to turn limited "brush-fire" wars into major nuclear holocausts.

Here is a place, then, where we might apply the generalization developed from history. We might approach disarmament as a moral process, an end in itself, something which is so obviously right that it transcends such considerations as power politics and national self-interest. Or, with equally powerful morality, we might say that any thought of disarmament in the face of the communist menace is evil. To surrender one iota of strength, regardless of the apparent guarantees of a negotiated treaty, is to make a pact with the devil and to surrender our honor and eventually our liberty.

On the other hand, we might set aside moralistic arguments from either side and approach the disarmament negotiations from the viewpoint of national political self-interest. In particular, we might look upon such negotiations as one way of avoiding general war while enabling us to advance our national goals in the international

continued on page 24

THE BELL TELEPHONE COMPANIES SALUTE: DALE NORBLOM

Dale Norblom (B.S., 1960) is Accounting Operations Supervisor for the Mountain States Telephone Company. In Denver, Dale and four supervisors on his staff spent three months preparing an operations plan to be used with a new computer soon to be delivered.

When the equipment arrived, Dale was put in charge of the computer facility where Long Distance billing is processed. With a variety of accounting jobs destined for future handling by the computer, Dale's know-how in this area is invaluable to his company.

Dale Norblom and other young engineers like him in Bell Telephone Companies throughout the country help bring the finest communications service in the world to the homes and businesses of a growing America.

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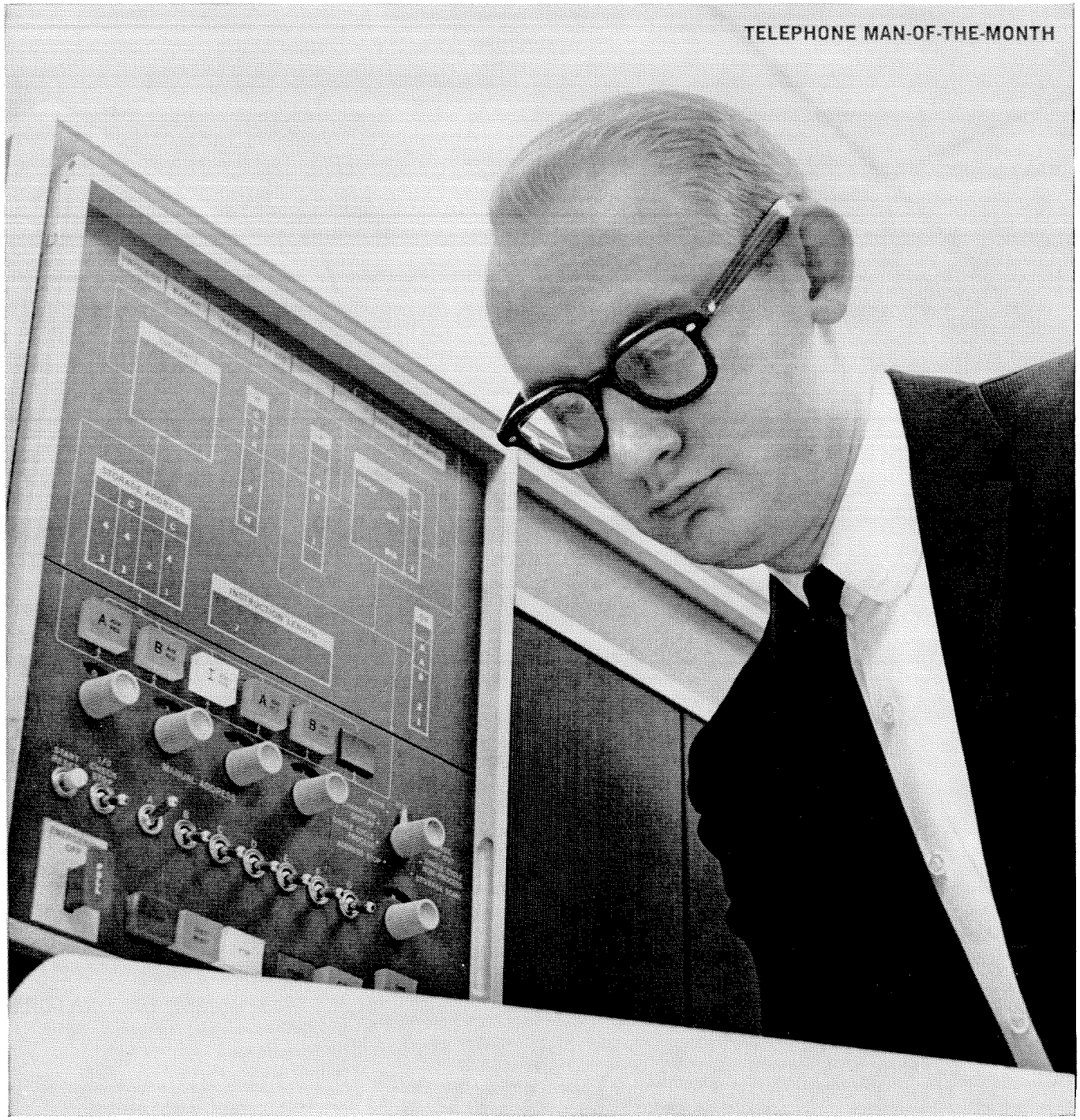

arena. Our historical generalization says that this latter point of view is likely to be the most successful.

Under this generalization, we do not seek to "ban the bomb" simply because the bomb is evil. Instead, we consider under what circumstances the banning of nuclear bombs serves the self-interest of the United States. Nor do we break off negotiations with the Soviets simply because communists always break promises. Recognizing the pitfalls that threaten any negotiations with Moscow, we ask ourselves quite objectively, "What are the risks? What are the gains? What sort of treaty will best serve the self-interest of the United States?"

Indeed, when we ask such questions, we find that there are a number of treaties affecting nuclear weapons that might serve our interests. At the present time, for example, we believe we have nuclear superiority over the Soviet Union. Therefore, if we could negotiate some sort of reasonably reliable treaty with the Soviets to prevent or even greatly limit the testing of new nuclear bombs, we might be able to preserve for a long period of time our present superiority — superiority which would be eroded more rapidly without a treaty. Such a treaty would also discourage the development of nuclear bombs by other countries presently without them. Clearly, a treaty limiting all nuclear testing is in our own best interests.

What about the possibility of doing away completely with the bombs — that is, with the bombs now in military arsenals? First, we must remember that there is no way of preventing the manufacture of new bombs at some future date even if all current bombs are destroyed in some sort of a treaty arrangement. Nuclear innocence cannot be regained. But, if we could do away with all nuclear bombs today, would that be in our national self-interest?

Actually, it doesn't appear that that measure alone would be beneficial to the U.S. Currently, we and our Allies are faced with a substantial disparity in conventional forces: the East having a significant margin over the West. The importance of this imbalance is minimized by the existence of nuclear weapons. Thus, it would not be to our

continued on page 26

AEROSPACE GERIATRICS

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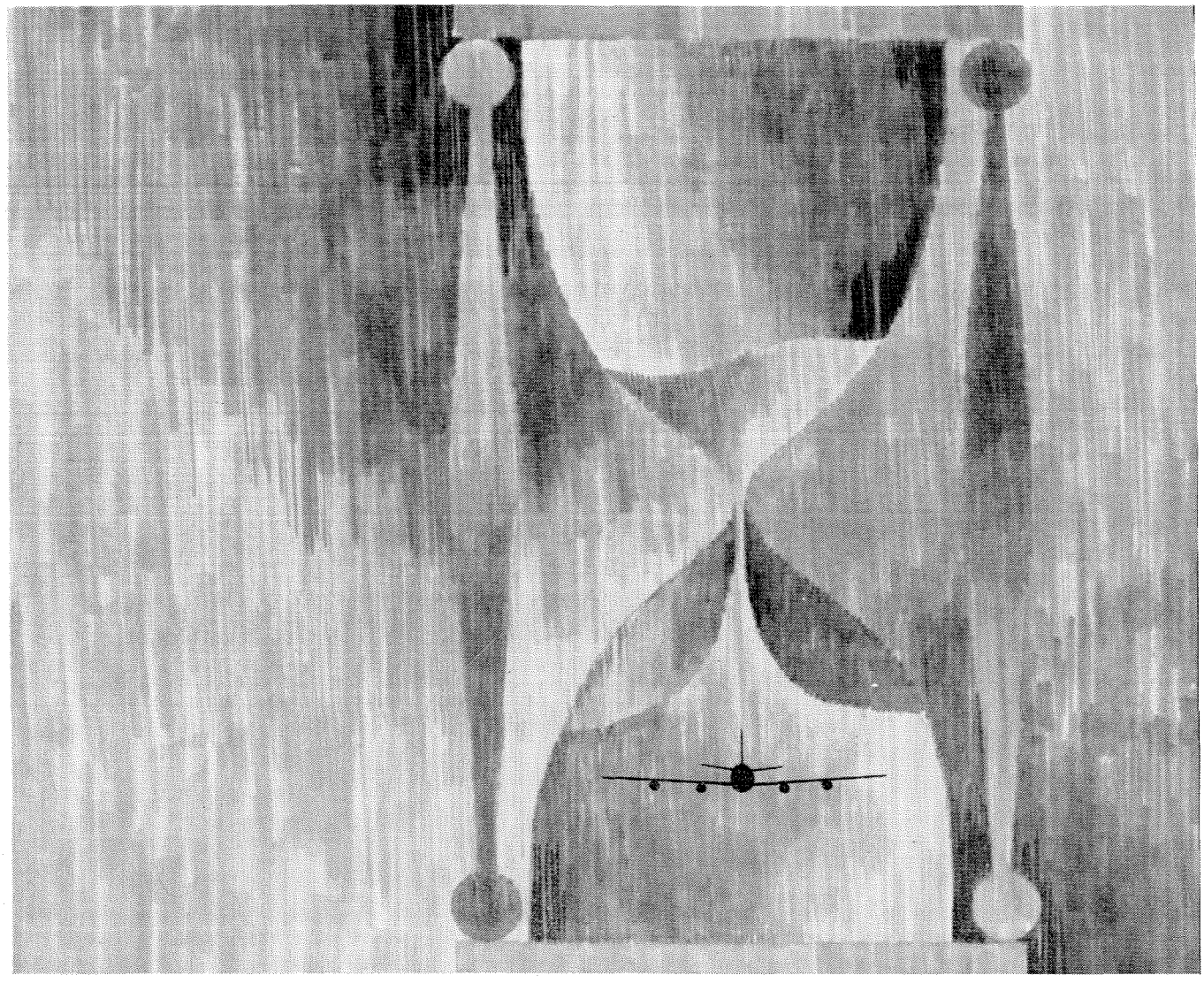
In aircraft parts, as in men, excessive stress accelerates the aging process. And stress aging per hour varies for each aircraft. Yet the present way of determining servicing schedules is based primarily on hours flown. □ Now Douglas researchers have developed a device which, when installed on an aircraft, provides a more positive method of determining check-up times for aircraft parts. □ Called a "Service Meter," and weighing less than 1½ pounds, the Douglas unit computes the accelerations encountered by its aircraft in relation both to number and severity. It allows servicing to be performed on the basis of the true work age of parts, and will be an important aid to maintenance procedures that keep aircraft young. □ Research like the foregoing has helped build the Douglas reputation for producing the world's most reliable aircraft.



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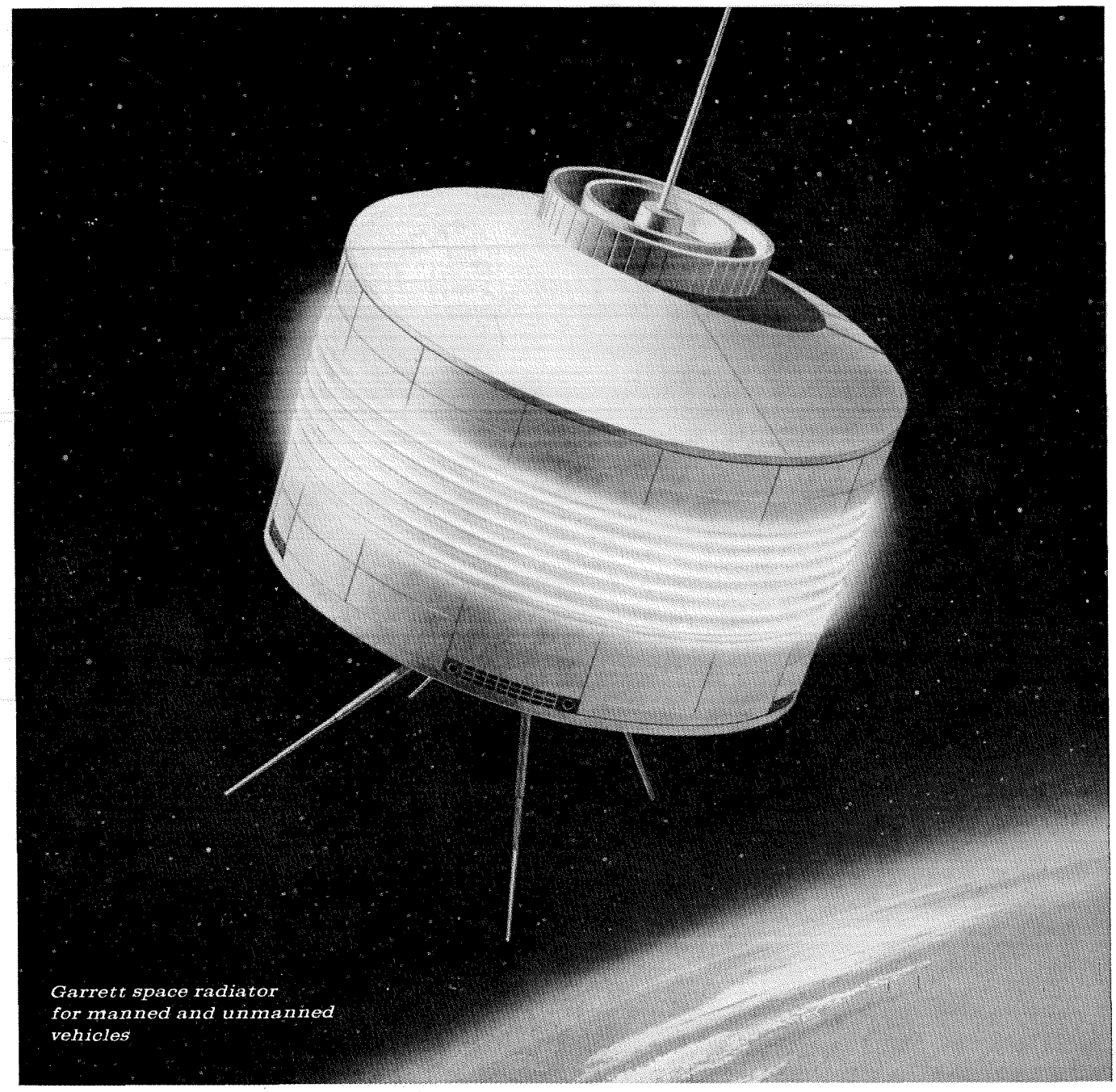
interest to do away with nuclear weapons alone. However, an arrangement which would simultaneously decrease both nuclear and conventional weaponry would be desirable. Such an arrangement would place more and more emphasis on economic competition with the Soviet Union and less and less on military. This move would clearly be to our benefit, since all the evidence of the last 40 years points out that on an economic battleground democracy can beat communism.

Of course, we still face a major problem: Is it possible to negotiate an arrangement acceptable to both East and West? Certainly there is every reason to believe that the Soviets approach the problem with the same basic attitude — that is, national self-interest for them. Is it possible, then, that both of us will find the same treaty acceptable? If this is possible, then it must be because the two of us have quite different points of view on the nature of reality. But, after all, this is true, isn't it? We do have different points of view. The Soviets still cling to the belief that, given an opportunity on an economic front, communism will beat capitalism; quite the reverse of what we believe to be the case. At the same time, both countries realize that on the militaristic level, neither side has very much to gain and both risk losing everything. It would appear then that both sides, each from their separate points of view, might consider an economic struggle in a disarmed world to be in their own self-interest.

Certainly such a result would be more desirable on purely moral grounds than either the continuing arms race or surrender to communism. But the lesson of our brief survey of history suggests that we rely on self-interest to direct our course through the maze of negotiation.

History gives us no guarantee that this approach — or any other approach — will lead to success. It only suggests. The importance of that suggestion I leave to your consideration. In the world of the megathreat, each individual is personally affected by the course of international negotiation. It is only reasonable that these negotiations should in turn be affected by the individual.



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Alumni News

Board Elections

In accordance with Section 5.02 of the By-Laws, the Secretary, having received no further nominations, cast a unanimous ballot at the Board of Directors meeting on April 23, 1963, for the following:

President – Peter V. H. Serrell, BS36ME, MS39ME	(1 year)
Vice Pres. – Patrick J. Fazio, BS53Ge	(1 year)
Secretary – Donald S. Clark, BS29ME, MS30ME, PhD34ME	(1 year)
Treasurer – John R. Fee, BS51CE	(1 year)
Director – William H. Corcoran, BS41ACh, MS42ChE, PhD48ChE	(2 years)
Director – David L. Hanna, BS52ME	(2 years)
Director – Richard P. Schuster, Jr., BS46EE, BS49ACh	(2 years)
Director – Herbert M. Worcester, BS40ME	(2 years)

These officers and directors will begin their terms of office following the Annual Meeting, June 5, 1963. The continuing members of the Board are:

Director – Robert Boykin, BS34ME	(1 year)
Director – G. Russell Nance, BS36ME	(1 year)
Director – Richard W. Powell, BS40EE, MS47EE	(1 year)
Immed. Past Pres. – William L. Holladay, BS24EE	(1 year)

Change in By-Laws

The Board of Directors of the Alumni Association, California Institute of Technology, amended By-Law 3.01 by letter ballot, which was confirmed at its meeting of April 23, 1963. This amendment was made in accordance with By-Law 12.01 and now reads as follows:

> "The affairs of the Association shall be managed by a Board of Directors, consisting of twelve (12) members of the Association, of whom the President, Secretary, Treasurer, and immediate Past President shall be members ex officio with voting privileges. Four (4) Directors shall be senior directors serving the second year of their two-year term, and four (4) Directors shall be junior directors, serving the first year of their two-year term. The President of the Association shall serve as the Chairman of the Board."

The purpose of this amendment is to increase the number of members of the Board of Directors to include the immediate Past President, the Secretary, and the Treasurer of the Association, who previously served without voting privileges.

– Donald S. Clark, Secretary

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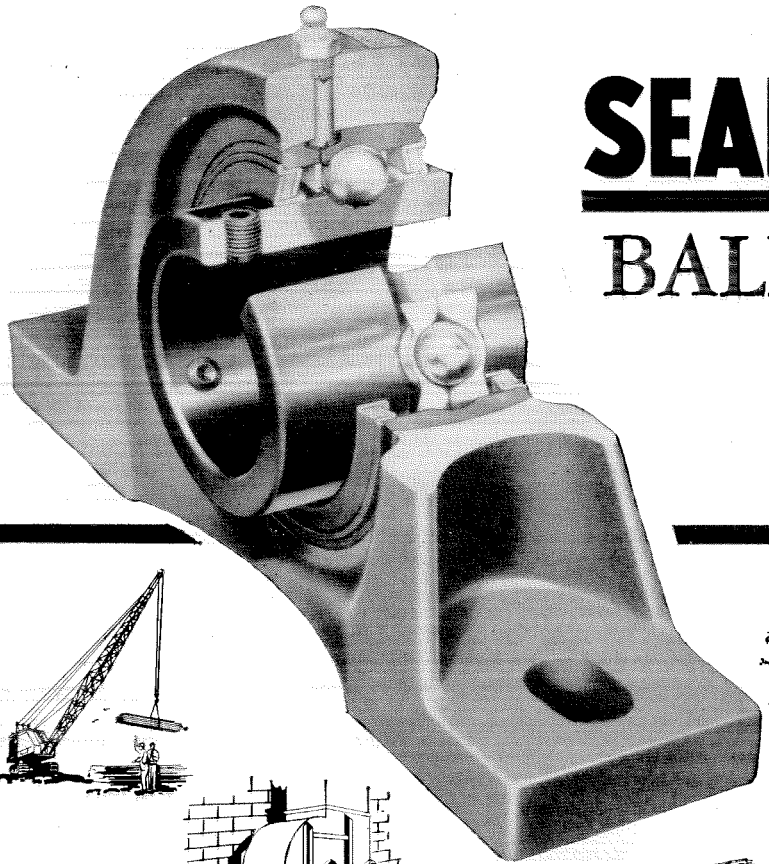

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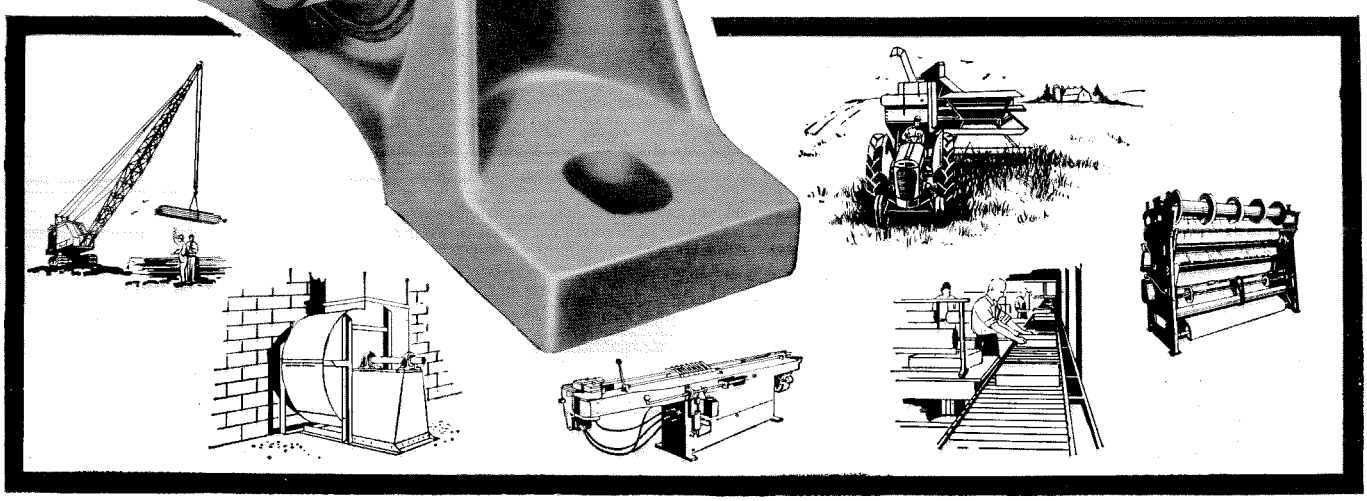

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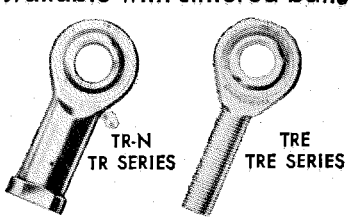

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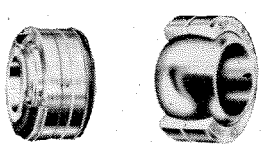

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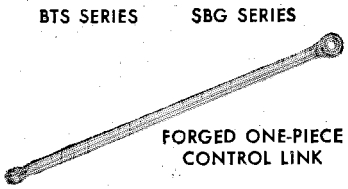

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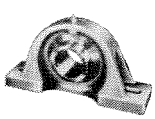
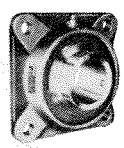


Normal-Standard Medium Duty PILLOW BLOCKS



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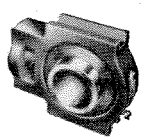

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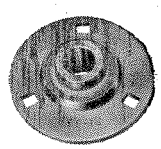

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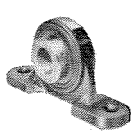

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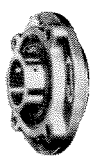

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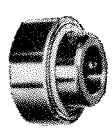

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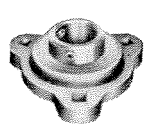

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" 'Lo, George? Yep, it's me again . . .

"Why did I call? Well, I'll tell ya; it's like this. I just joined the 'lumni Association last week, an' ya know what? They sent me *Engineering & Science*. Haven't seen it for years. Well, I'm flippin' through the pages and I *see* it: a word-for-word duplication of our telephone conversation last month.

"Well, I got curious. I went over to campus and asked to see *all* the *E & S* back issues for *two* years . . .

"George? You still there? . . . O.K. So, do you wanta guess what I found? . . . Precisely . . . You've been printin' *all* our conversations for the past twenty-four months! . . .

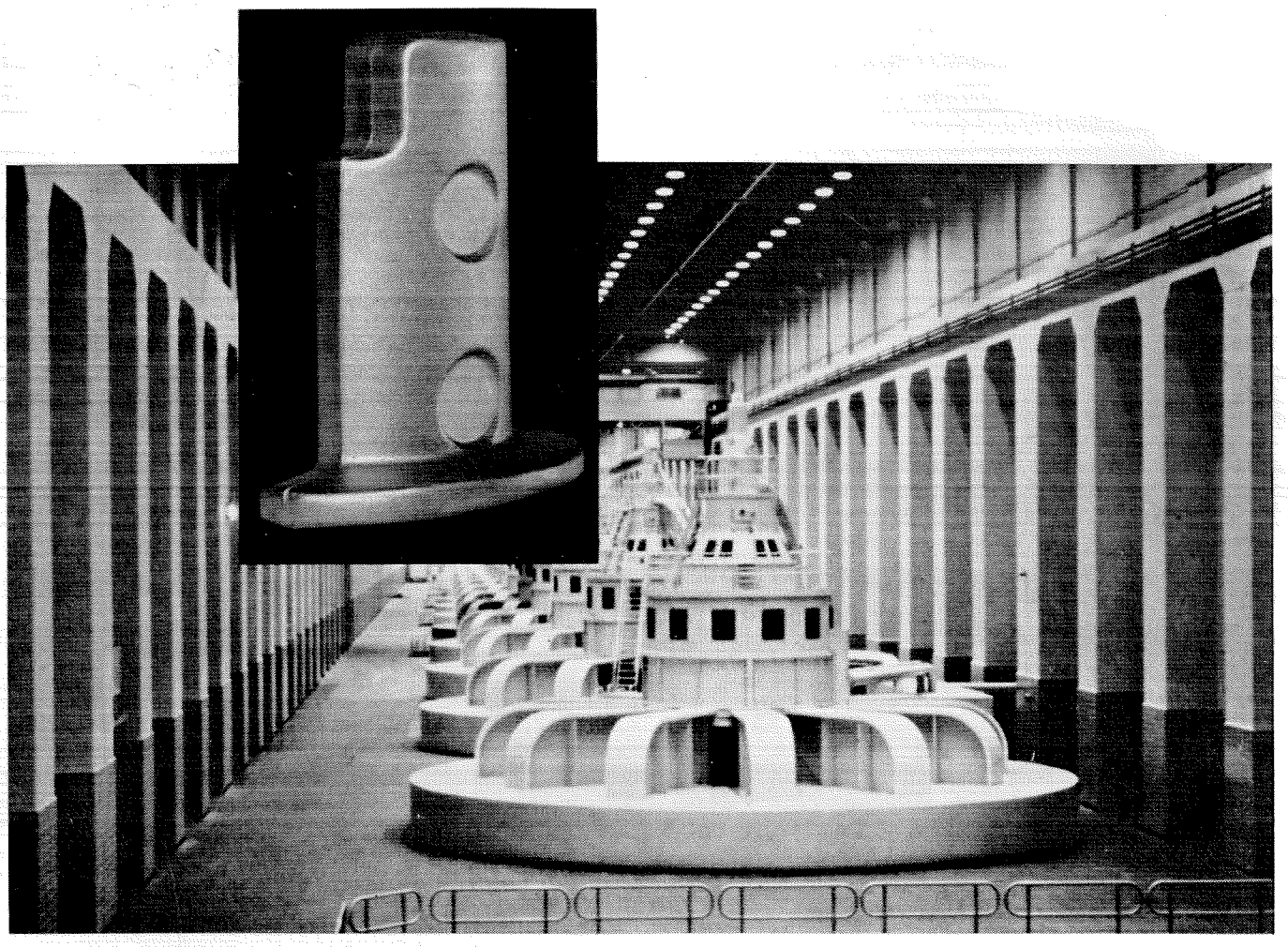
"You still there, George? . . . You were so quiet I — well. Know what I'm gonna do? . . . What's the total for the Fund so far this year? . . . About $68,000 with $7,000 to go, huh?

"All right, prepare to receive from my lawyer a libel suit for $75,000! . . . (heh, heh, heh.) "What? *Sure* I've got a leg to stand on. Everybody reads *E & S*. Everybody knows it's *me* you been makin' fun of. I'll take this to the Supreme Co - -

Name??? . . . *What* name??? . . . You never mentioned *my* name? Never??? . . . In twenty-four months . . . No name . . .

"Well, heh, heh, I was only foolin', George. You know me. Why, I wouldn't *really* sue. You know what I always say, George . . . 'Nothin's too good for ol' Caltech.' "

YOUR ALUMNI FUND DIRECTORS FEEL
THE SAME WAY. THEY HOPE YOU DO TOO.



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ANNUAL ALUMNI MEETING

June 5, 1963

Reunion of the Classes of

1903, 1913, 1918, 1923, 1928, 1933, 1938, 1943, 1948, 1953, 1958

Speaker: A. C. Rubel, President, Union Oil Co.
Subject: "The Duties and Responsibilities of Engineers and Scientists as Citizens"

and

Report to the Alumni by Lee A. DuBridge, President
California Institute of Technology

Cocktails at 6:00 — Dinner at 6:30

Rodger Young Auditorium
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This kind of engineer designs jobs instead of things

Once upon a time there was a creature known to jokesmiths as "the efficiency expert." When he wasn't being laughed at, he was being hated. Kodak felt sorry for the poor guy and hoped that in time he could be developed into an honored, weight-pulling professional. That was long ago.

We were then and are much more today a very highly diversified manufacturer. We need mechanical, electrical, chemical, electronic, optical, etc., etc. engineers to design equipment and processes and products for our many kinds of plants, and make it all work. But all the inanimate objects they mastermind eventually have to link up with *people* in some fashion or other—the people who work in the plants, the people who manage the plants, and the people who buy the products. That's why we need "industrial engineers."

A Kodak industrial engineer learns mathematical model-building and Monte Carlo computer techniques. He uses the photographic techniques that we urge upon other manufacturing companies. He collaborates with medicos in physiological measurements, with architects, with sales executives, with manufacturing executives, with his boss (G. H. Gustat, behind the desk above, one of the Fellows of the American Institute of Industrial Engineers). He starts fast. Don Wagner (M.S.I.E., Northwestern '61) had 4 dissimilar projects going the day the above picture was sneaked. He is not atypical. *Want to be one?*

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How Industry Tempers Theory with Practice to Get Good Design

An Interview with G.E.'s F. K. McCune, Vice President, Engineering

As Vice President—Engineering, Francis K. McCune is charged with ensuring the effective development, use and direction of General Electric's engineering talent. Mr. McCune holds a degree in electrical engineering and began his career with the Company as a student engineer.

For complete information on opportunities for engineers at General Electric, write to: Personalized Career Planning, General Electric Company, Section 699–07, Schenectady 5, N. Y.

Q. Mr. McCune, how do you define engineering design?

A. First let's look at what engineering really is. The National Society of Professional Engineers calls it "the creation of technical things and services useful to man." I would paraphrase that to add an industry emphasis: engineering is linking an *ability to do* with specific customer *needs and wants*. The link is an engineering design of a useful product or service.

Q. In the light of this definition, how can the young engineer prepare himself for industry?

A. In college he should absorb as much theory as possible and begin to develop certain attitudes that will help him later in his profession. The raw material for a design, information, flows from three general funds: Scientific Knowledge of Nature; Engineering Technology; and what I call simply Other Relevant Information. Academic training places heavy emphasis on the first two areas, as it should. Engineers in industry draw heavily on theorems, codified information, and significant recorded experience basic to engineering disciplines taught in college. The undergraduate must become knowledgeable in these areas and skilled in the ways of using this information, because he will have little time to learn this after graduation. He also must develop a responsive attitude toward the third fund.

Q. As you say, we learn theory in college, but where do we get the "Other Relevant Information"—the third fund you mentioned?

A. This knowledge is obtained for the most part by actually doing engineering work. This is information that *must* be applied to a design to make sure that it not only works, but that it also meets the needs and wants that prompted its consideration in the first place. For example, we can design refrigerators, turbines, computers, or missile guidance systems using only information from the first two funds of knowledge—heat flow, vibration, electronic theory, etc.—and they will work! But what about cost, reliability, appearance, size—will the prospective customer buy them? The answers to these important design questions are to be found in the third fund; for example the information to determine optimum temperature ranges, to provide the features that appeal to users, or to select the best manufacturing processes. In college you can precondition yourself to seek and accept this sort of information, but only experience in industry can give you specific knowledge applicable to a given product.

Q. Could you suggest other helpful attitudes we might develop?

A. Remember, industry exists to serve the needs and wants of the market place, and the reasons for doing things a certain way arise from the whole spread of conditions which a given design has to satisfy. Learn how to enter into good working relationships with people. Much of the Other Relevant Information can be picked up only from others. Also train yourself to be alert and open-minded about your professional interests. In industry you'll be expected to learn quickly, keep abreast in your field, and to grow from assignment to assignment. Industry will give you the opportunity. Your inherent abilities and attitudes will largely decide your progress.

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