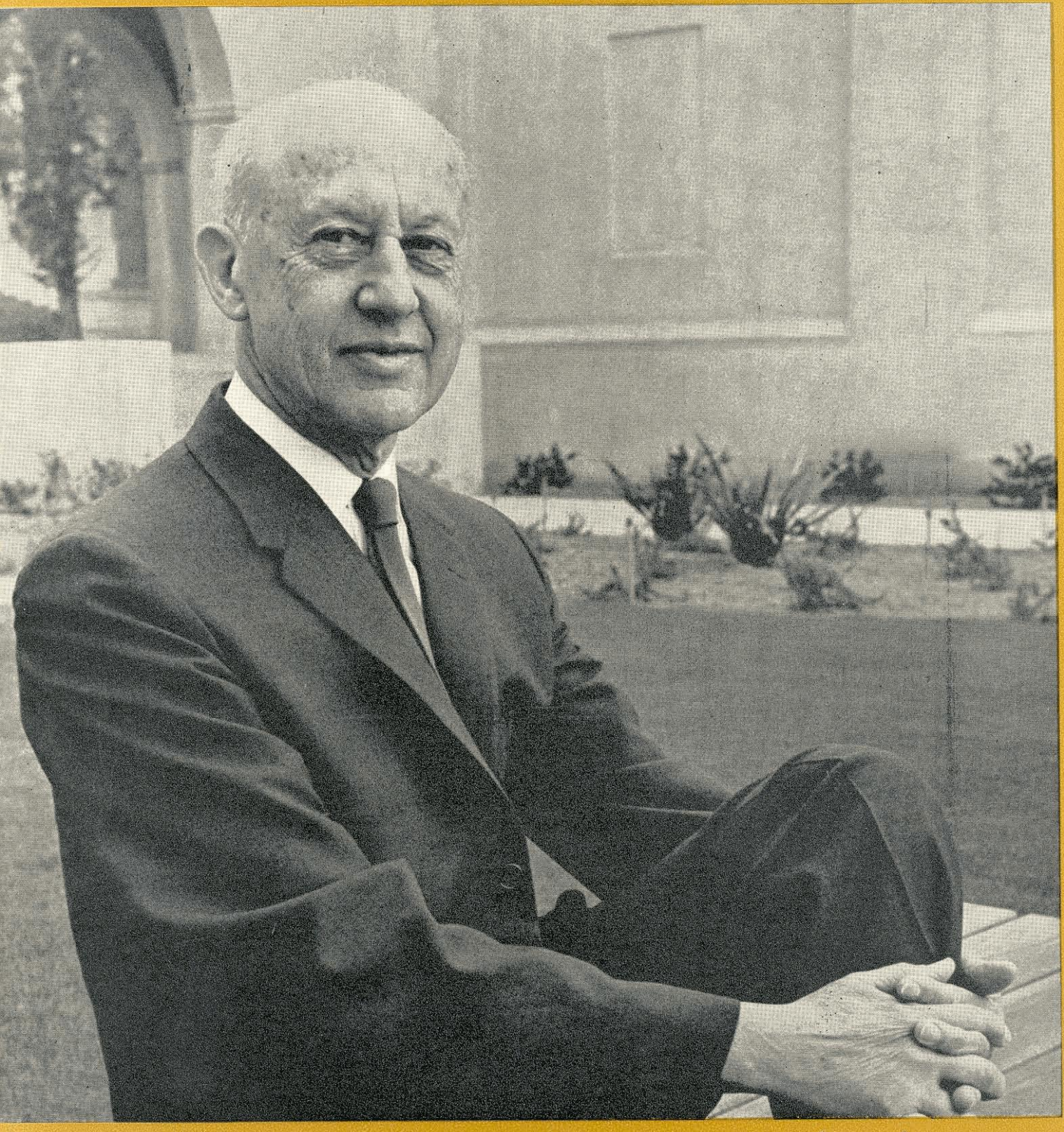
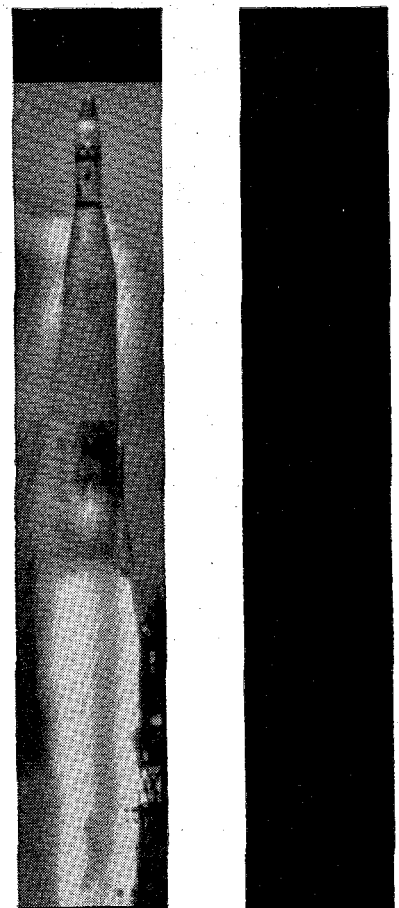
ENGINEERING | AND | SCIENCE

February 1961



Dean of the Faculty . . . page 26

Published at the California Institute of Technology



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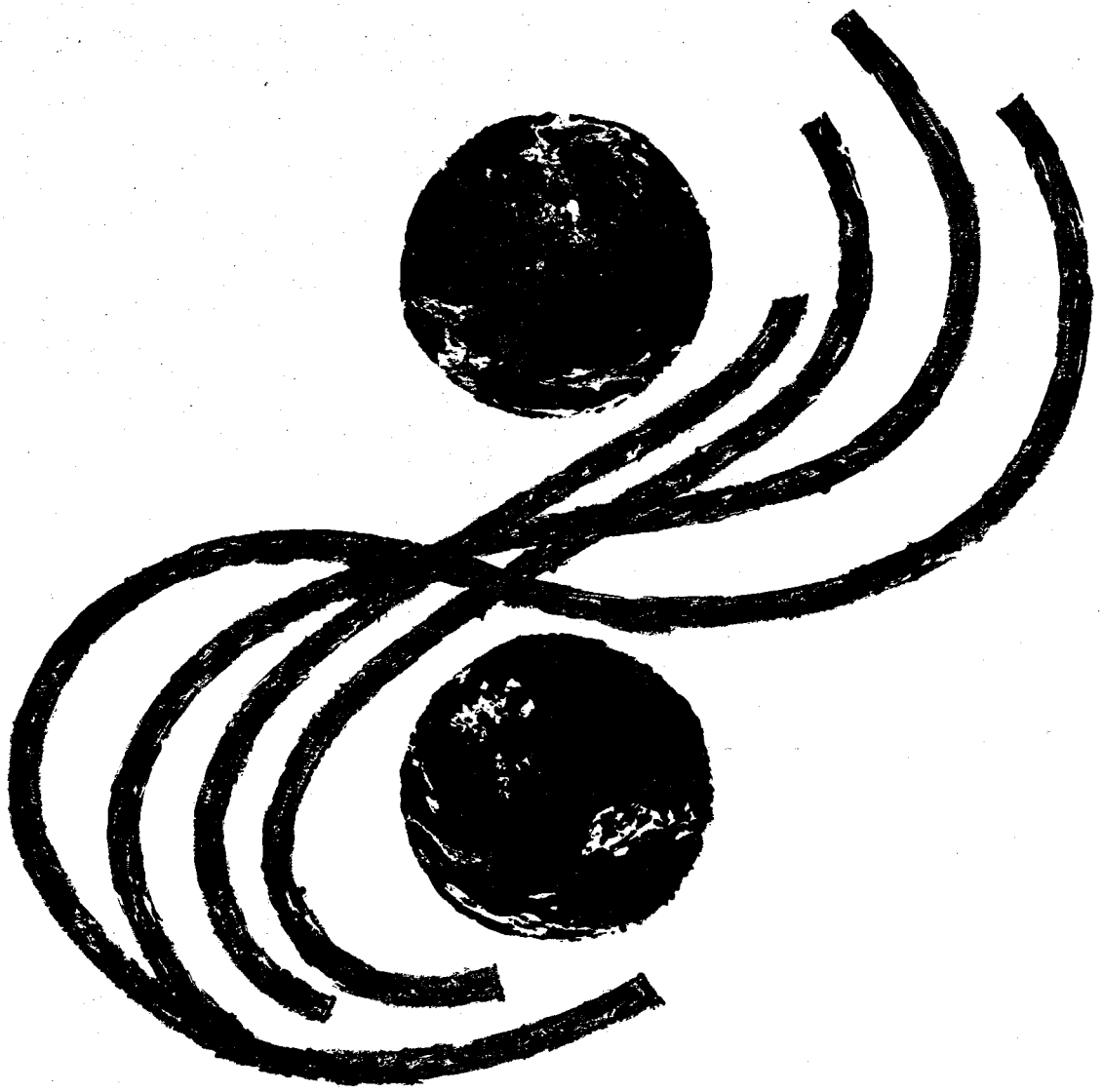

Said Johann Kepler: *"The planets move in elliptical orbits about the sun, and the square of their periods of revolution are proportional to the cube of their mean distances from the sun."*

With interplanetary voyages fast becoming a reality, complete information regarding the velocity requirements for travel between planets is of vital importance. With these data available, it is possible to analyze propulsion requirements, plan ultimate system configurations, and conduct feasibility studies for any particular mission.

Lockheed Missiles and Space Division scientists have actually evolved a rapid-calculation method, utilizing a high-speed computer. This has produced literally thousands of orbits, velocity requirements, and elapsed time, for design studies of trips to and from both Mars and Venus—every tenth day from now until January, 1970.

More simple to analyze are many factors which make Lockheed Missiles and Space Division a wonderful place to live and work. Located in Sunnyvale and Palo Alto, California, on the beautiful San Francisco Peninsula, Lockheed is Systems Manager for such programs as the DISCOVERER and MIDAS satellites and the POLARIS FBM. These, together with research and development projects in all disciplines, make possible a wide diversity of positions for creative engineers and scientists in their chosen fields.

Why not investigate future possibilities at Lockheed? Write Research and Development Staff, Dept. M-14D, 962 West El Camino Real, Sunnyvale, Calif. U.S. citizenship or existing Department of Defense industrial security clearance required.

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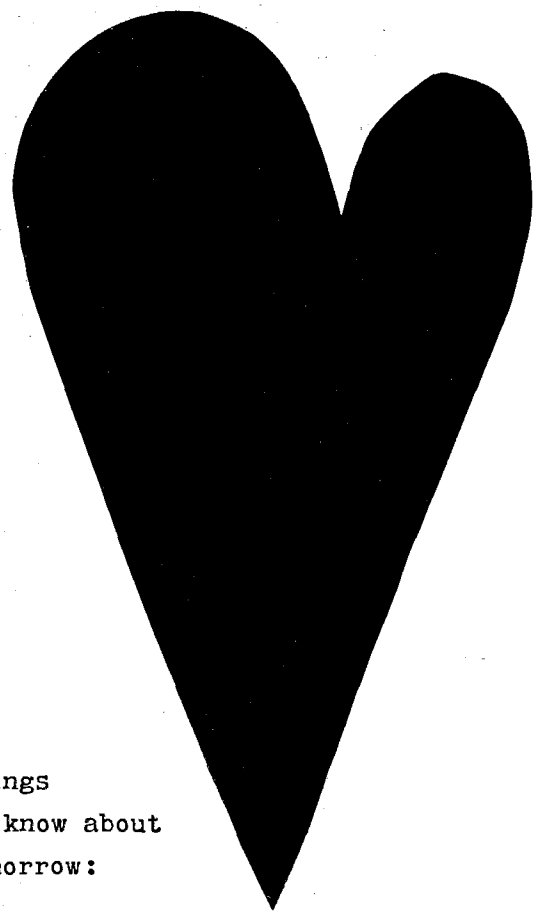

Things
we know about
tomorrow:

A new Westinghouse development could be your heart's best friend!

It is a little electronic device with the unusual name of "Cardiac Pacer." Originally, it was developed to provide a gentle boost to a patient whose heart faltered or stopped during an operation, or for use as a heart stimulant in hospital recovery rooms.

Now Westinghouse is working to perfect it for personal use on millions of heart patients by their physicians. It would be light and easy to carry about. It may not be cheap, but then life is worth a lot to any of us.

Part of the plan for the future is a radio receiver about the size of a pack of cigarettes which a doctor could carry with him and, if any of his heart patients had any trouble, the radio would beep-beep the doctor. He could then tune in to that patient, listen to his heart beats, if necessary, and advise emergency treatment. Wondrous are the uses of electricity.

To learn more about your future with Westinghouse, write L. H. Noggle, Westinghouse Educational Dept., Ardmore & Brinton Roads, Pittsburgh 21, Pa.

You can be sure ... if it's Westinghouse.

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ENGINEERING | AND | SCIENCE

On Our Cover

Caltech's new dean of the faculty, William N. Lacey, who succeeds George W. Beadle, now chancellor of the University of Chicago. For more about the new dean of the faculty, see page 26.

A Recent Grant

from the Carnegie Corporation of New York has made it possible for a group of faculty and graduate students to study the problem of arms control at Caltech this year. Among the distinguished visitors who have delivered lectures in this field is the Rt. Hon. John Strachey, M.P. You'll find an adaptation of his January 25 talk on page 13.

Mr. Strachey has been a Laborite M.P. from West Dundee since 1950. He is a graduate of Oxford University in England, and in 1929 became M.P. from Birmingham. From 1945-6 he was Parliamentary Undersecretary of State of the Air Ministry; from 1946-50 he was in the Ministry of Food; and in 1950 he became Secretary of State for War.

"Our Changing Cities"

has been adapted from a talk given on Alumni Seminar Day last year by Robert W. Oliver, assistant professor of economics at Caltech.

Picture Credits:

Cover – James McClanahan
19-23 – Harvey

FEBRUARY 1961 VOLUME XXIV NUMBER 5

Letters 6

Books 10

The British Attitude to Deterrence 13

"Many who have thought about this problem have come to the conclusion that reliable stability can only come through an international agency with an effective monopoly of force."

by the Rt. Hon. John Strachey, M.P.

Faculty Portraits . . . VII 19

by Harvey

The Month at Caltech 26

Our Changing Cities 30

Cities still have considerable vitality but they will require increasing attention if they are to be maintained.

by Robert W. Oliver

Alumni News 36

Personals 40

STAFF

Publisher.....Richard C. Armstrong '28
Editor and Business Manager.....Edward Hutchings, Jr.
Assistant to the Editor.....Gerda Chambers
Student News.....Lance Taylor '62
Roger Noll '62
Photographer.....James McClanahan

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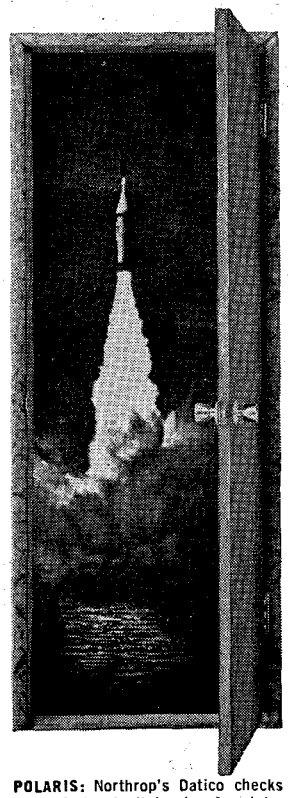
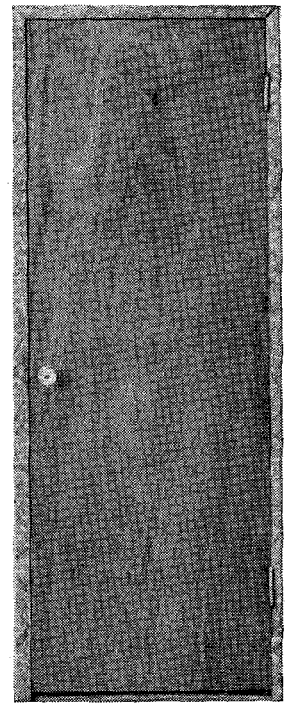
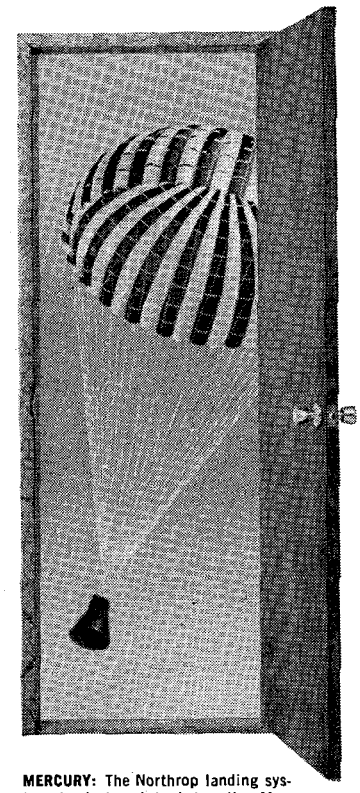


POLARIS: Northrop's Datico checks out Polaris at all levels of maintenance and operation.

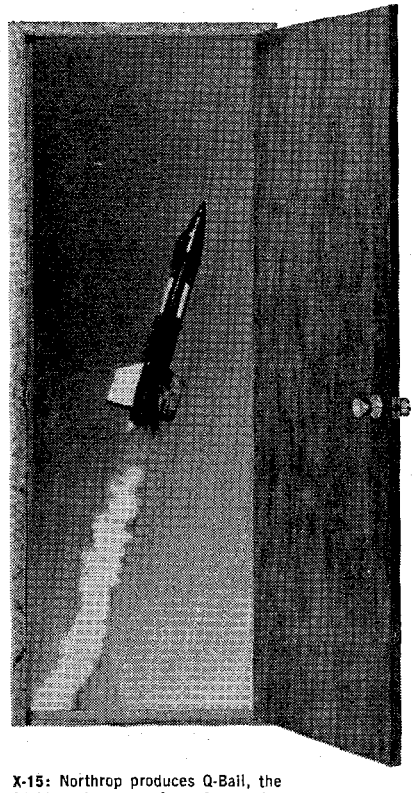


SKYBOLT: Guidance and navigation systems are being developed by Northrop for this new and highly secret *air*-launched ballistic missile.

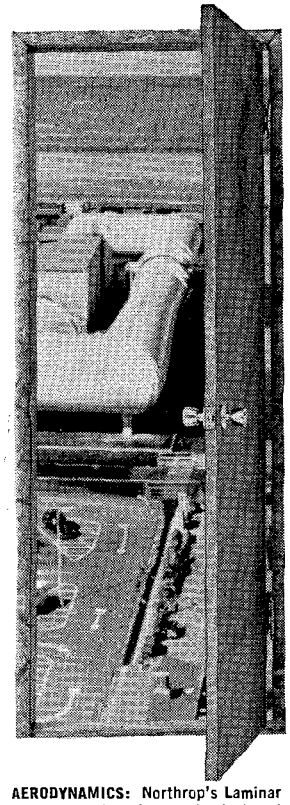


MERCURY: The Northrop landing system is designed to bring the Mercury astronaut down safely.

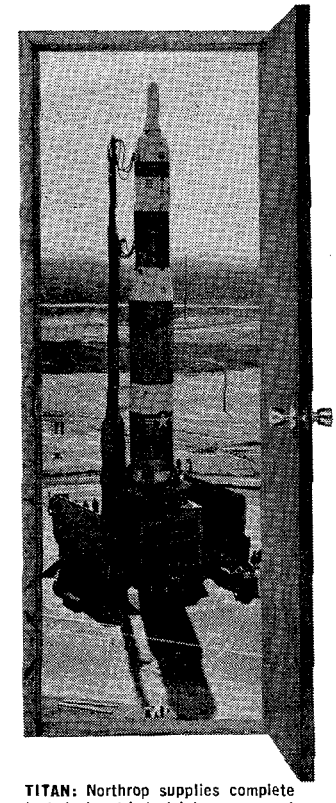
Northrop is now active in more



X-15: Northrop produces Q-Bail, the flight angle sensor for safe re-entry of X-15 and other aerospace vehicles.

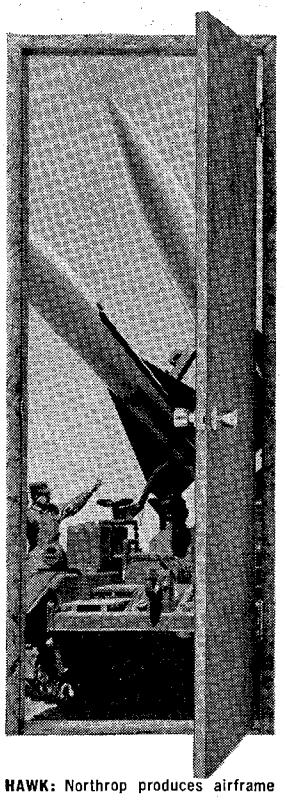


AERODYNAMICS: Northrop's Laminar Flow Control technique is designed to greatly increase aircraft range, flexibility, cargo and passenger capacity.

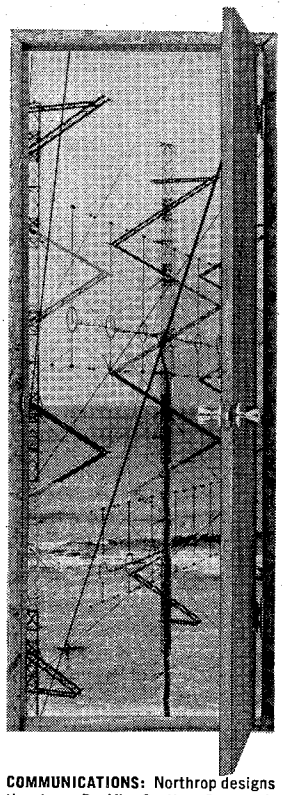


TITAN: Northrop supplies complete technical and industrial management to activate the T-2 Titan missile base.

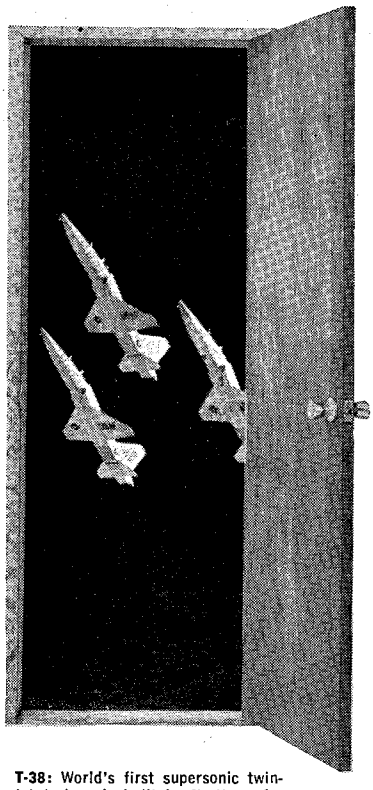
For work on these advanced programs, we seek exceptional engineers, scientists and mathematicians.



HAWK: Northrop produces airframe components, ground handling and launching equipment for this air defense missile.

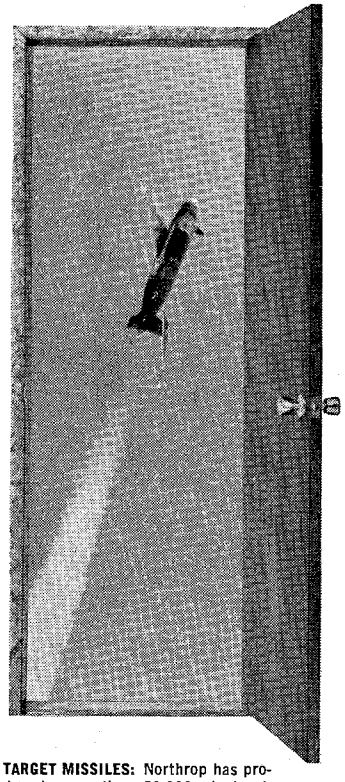


COMMUNICATIONS: Northrop designs the trans-Pacific Scatter Communications Network and other worldwide communication systems for U.S. and free world governments.

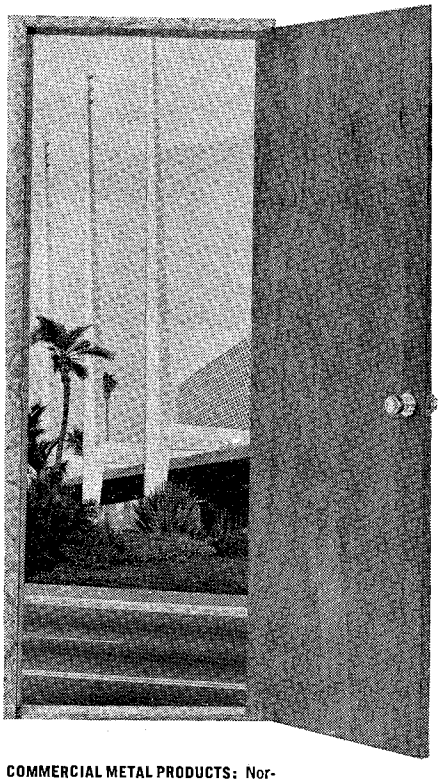


T-38: World's first supersonic twin-jet trainer is built by Northrop for the United States Air Force.

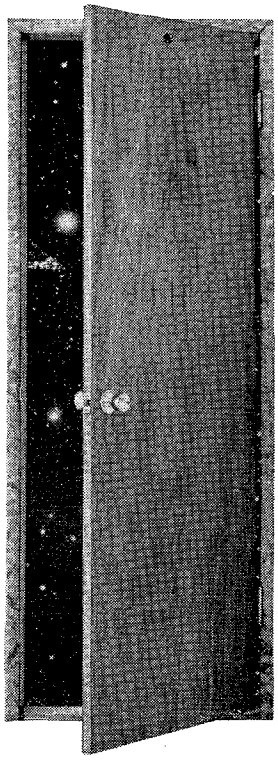
than 70 important programs



TARGET MISSILES: Northrop has produced more than 50,000 electronically-controlled aerial targets, and surveillance drones.



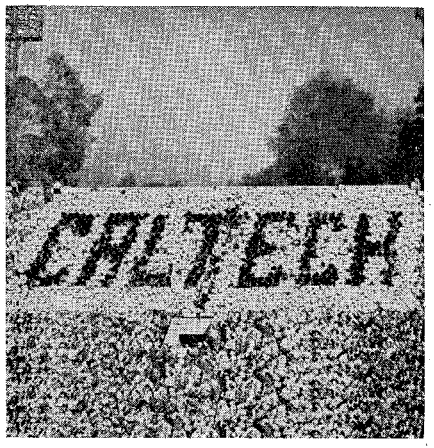
COMMERCIAL METAL PRODUCTS: Northrop produces aluminum architectural shapes for many important industrial and commercial buildings.



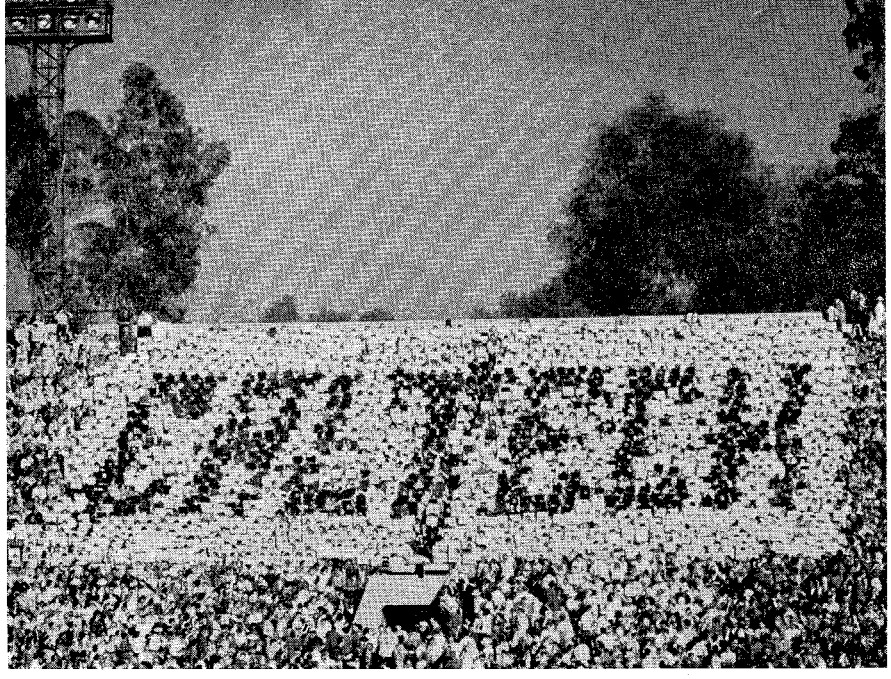
SPACE RESEARCH: Northrop's accelerated space research programs reach into such advanced areas as maneuverability, rendezvous, space vehicle maintenance, space probes, and the survival of men in space.

Write Northrop Corporation, Box 1525, Beverly Hills, California. Divisions: Norair, Nortronics, Radioplane.

Letters



E&S cover picture, January 1961



The picture in its pristine state.

Double Hoax?

Claremont, California

DEAR EDITOR:

Who's kidding whom? "The Great Rose Bowl Hoax" reported in your January issue is one of the best pranks heard of in a long time, but the "pictorial proof" on the cover is something of a hoax, too. Who pieced together that crowd in the foreground?

Congratulations to the Lloyd House Fourteen!

GRAYDON D. BELL, PhD '57

Culver City, California

DEAR SIRS:

It would appear that the Great Rose Bowl Hoax did not end on January 2, 1961, but is being perpetuated. One wonders whether the editors of *Engineering and Science* are among the conspirators or the victims. An examination of the picture on the cover of the January issue reveals that it is a montage, portions of the crowd below the card section being repeated several times. What's the story on the Great *Engineering and Science* Hoax?

W. H. PROUD '50

Cincinnati, Ohio

DEAR EDITOR:

Our beagle recently gave birth to seven puppies and I regrettably chose the half-time of the Rose Bowl game to go out and take care of the ravenous animals. As a result I missed the nationwide TV coverage of the great Rose Bowl hoax, so it was with great delight that I was able to read the intricate planning that was required to pull off this superb practical joke.

In looking at the picture on the front of *Engineering and Science* it would appear that the boys from Lloyd House did it again . . . It looks as though the picture has been tampered with . . . What happened?

C. F. CARSTARPHEN '39, MS '40

It was this way—

We can explain everything.

To begin at the beginning, Bruce Whitehead, research fellow in physics at Caltech, was at the Rose Bowl game on January 2, 1961. In his own words:

"I had just arrived in California to join Caltech as a research fellow, so I took plenty of pictures when I had a chance to see the Rose Bowl game. In fact, I had just taken several snaps with my Nikon camera of the half-time entertainment, including the bands and original card stunts, using the normal camera lens, when I decided to try a telephoto close-up of the drum majorette. My host, Mr. Robert Mackay Lawson, noticed the CALTECH appear in the card-section but he had just run out of film. He wanted to be sure *I* snapped it so he called it to my attention – just in time. Neither of us realized at the time that it was a hoax, but it did seem a little out of place."

As soon as we heard about Dr. Whitehead's kodachrome slide of the historic event, we promptly borrowed it and sent it off to have a black and white print made. (The *E&S* budget doesn't allow us to print color very often). The black and white print was superb; in fact, it looked good enough to run on our cover. We sent it out to our photo engraver, David Hettema. In his words:

"The photo submitted to us to make the coverplate was not proportioned right to fit the usual format of the magazine, and thus presented this problem: When the width was right, it lacked enough area to fill the space required for depth. We had two alternatives:

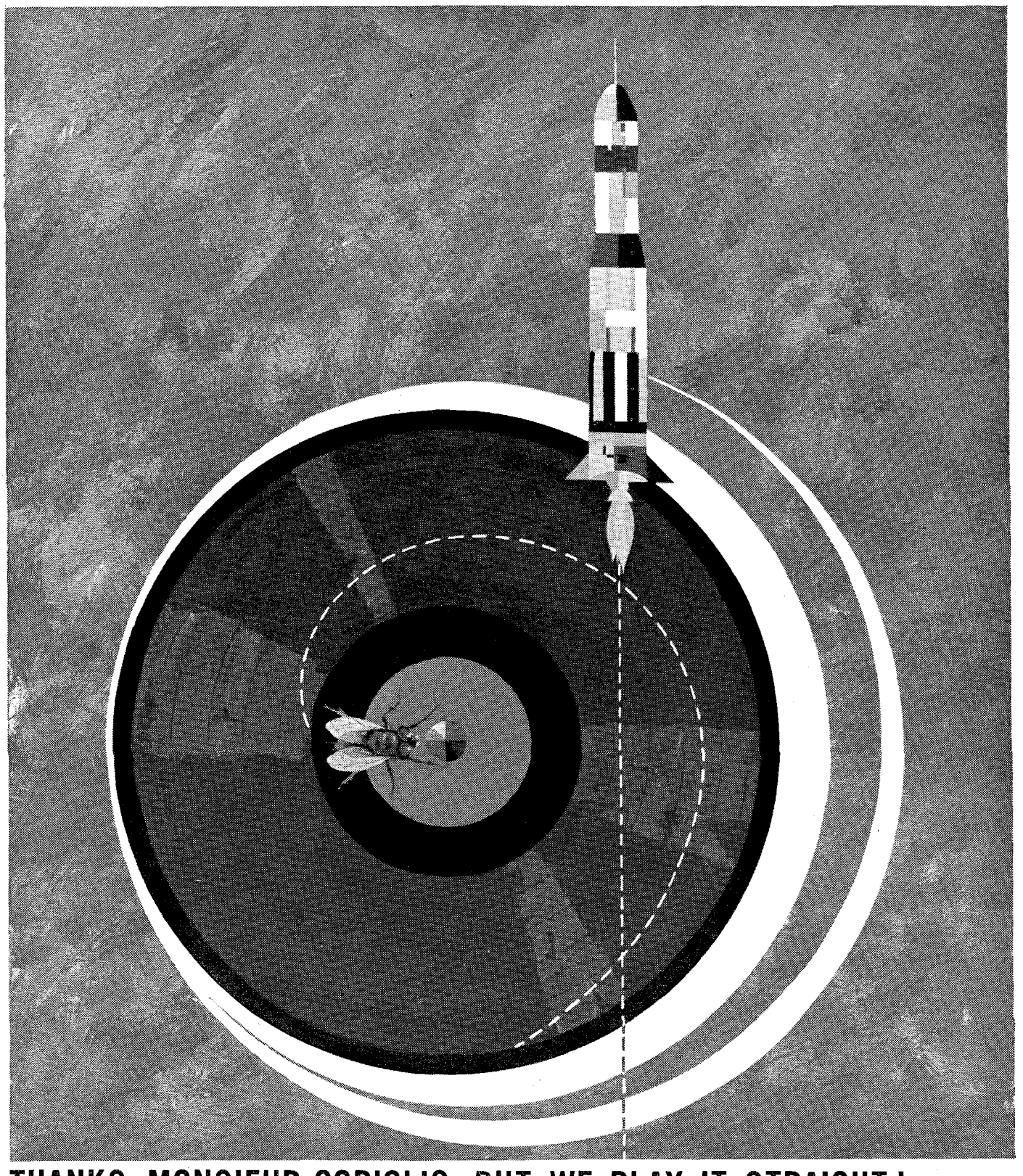
A. Photographically lengthen the sky and thereby fill the space needed.

B. Add to the non-rooting-section crowd, obtaining the same result.

"We selected alternative B for these reasons; it would balance the point of interest in the center of the cover, and mechanically it could be achieved with less time and cost.

"When photographing the print supplied to us for the cover we found we lacked two inches roughly to fill up the needed space for the cover format, so by making several extra shots of the main crowd at the bottom inch of the picture we had enough material to repeat the crowd two additional times and fill the space, even deleting the tunnel which of course could not be repeated.

"We felt the result was satisfactory; however, I would like to note that if the sharp-eyed graduates of your famous institution watch the welfare of our nation as they do their Caltech magazine, we have little to fear."



THANKS, MONSIEUR CORIOLIS, BUT WE PLAY IT STRAIGHT!

Your theory is a little complicated for us. Rather than work in rotating coordinates and compensate for your famous acceleration, we avoid the problem. Our guidance system platforms are stabilized in inertial space instead of rotating Earth space. The result is simpler guidance system computations for missiles like Titan. If you would like to be trained to work in this challenging atmosphere, please contact your college placement office, or write to Mr. R. E. Allen, Director of Scientific and Professional Employment, 7929 S. Howell, Milwaukee 1, Wisconsin.

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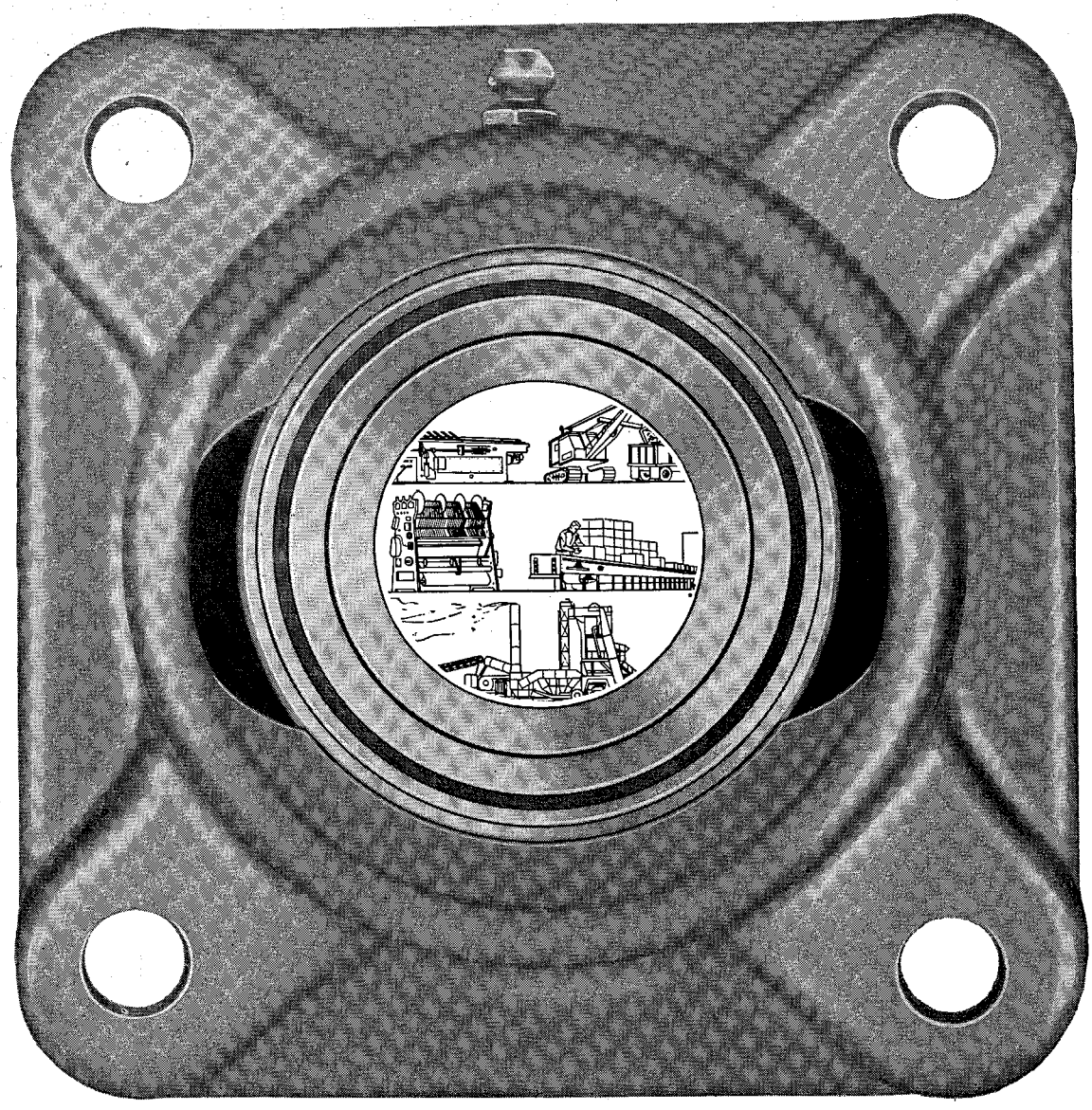

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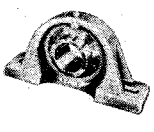
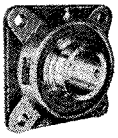
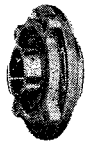


Normal-Standard Medium Duty PILLOW BLOCKS

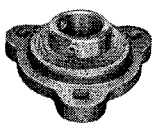


Standard Medium Duty FLANGE UNITS



FLANGE CARTRIDGE UNIT

LP PILLOW BLOCK



LF FLANGE UNIT

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A STUDY FROM LIFE FOR RYAN BY D. MILLSAP

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Books

Telescopes
(Stars and Stellar Systems, Vol. I)....$8.50
Edited by Gerald P. Kuiper and Barbara M. Middlehurst

Stellar Atmospheres
(Stars and Stellar Systems, Vol. VI) *$17.50*
Edited by Jesse L. Greenstein
University of Chicago Press

Stars and Stellar Systems, a new series of books on astronomy and astrophysics has been started with the publication of the volumes, *Telescopes,* and *Stellar Atmospheres.* The series will cover problems of stars and stellar systems in the multi-author reviews and original contributions. Volume I on telescopes contains two articles by Ira S. Bowen, director of the Mt. Wilson and Palomar Observatories, and one by John G. Bolton, former director of Caltech's Radio Observatory.

Volume VI, edited by Jesse L. Greenstein, covers the problems of radiation transfer, stellar spectroscopy, and variable and peculiar stars. Eight of the chapters were written by Mt. Wilson and Palomar Observatory staff members: Arthur Code (now director of Washburn Observatory in Wisconsin), Horace W. Babcock, Robert P. Kraft, Olin C. Wilson, Paul W. Merrill (retired), Armin J. Deutsch and Alfred H. Joy (retired).

Principles of Meteorites
by E. L. Krinov
Pergamon Press *$12*

An English edition of a book written by the Scientific Secretary of the Committee on Meteorites of the USSR Academy of Sciences. The book was translated from the Russian by Irene Vidziunas Goddard, analytical chemist in geochemistry at Caltech, and the translation was edited by Harrison Brown, professor of geochemistry.

As Dr. Brown says in an editor's note, ". . . this work gives a view of meteorites primarily from a Russian perspective. It is admittedly nearly as deficient in reference to English literature on the subject as our own works are deficient in reference to Russian literature. It is hoped that translations such as this will result eventually in sufficient interchange of knowledge and ideas to permit scientists of the East and West to be fully aware of each other's progress."

Cerebral Systems and Computer Logic
California Institute of Technology
$2.25 pp.

A record of the proceedings of the Conference on Cerebral Systems and Computor Logic, sponsored by the California Institute of Technology and the Rockefeller Foundation, that was held at Caltech February 8-11, 1960. The 72-page booklet, made up of summaries of the 36 talks given at the conference, is available at the Caltech Bookstore.

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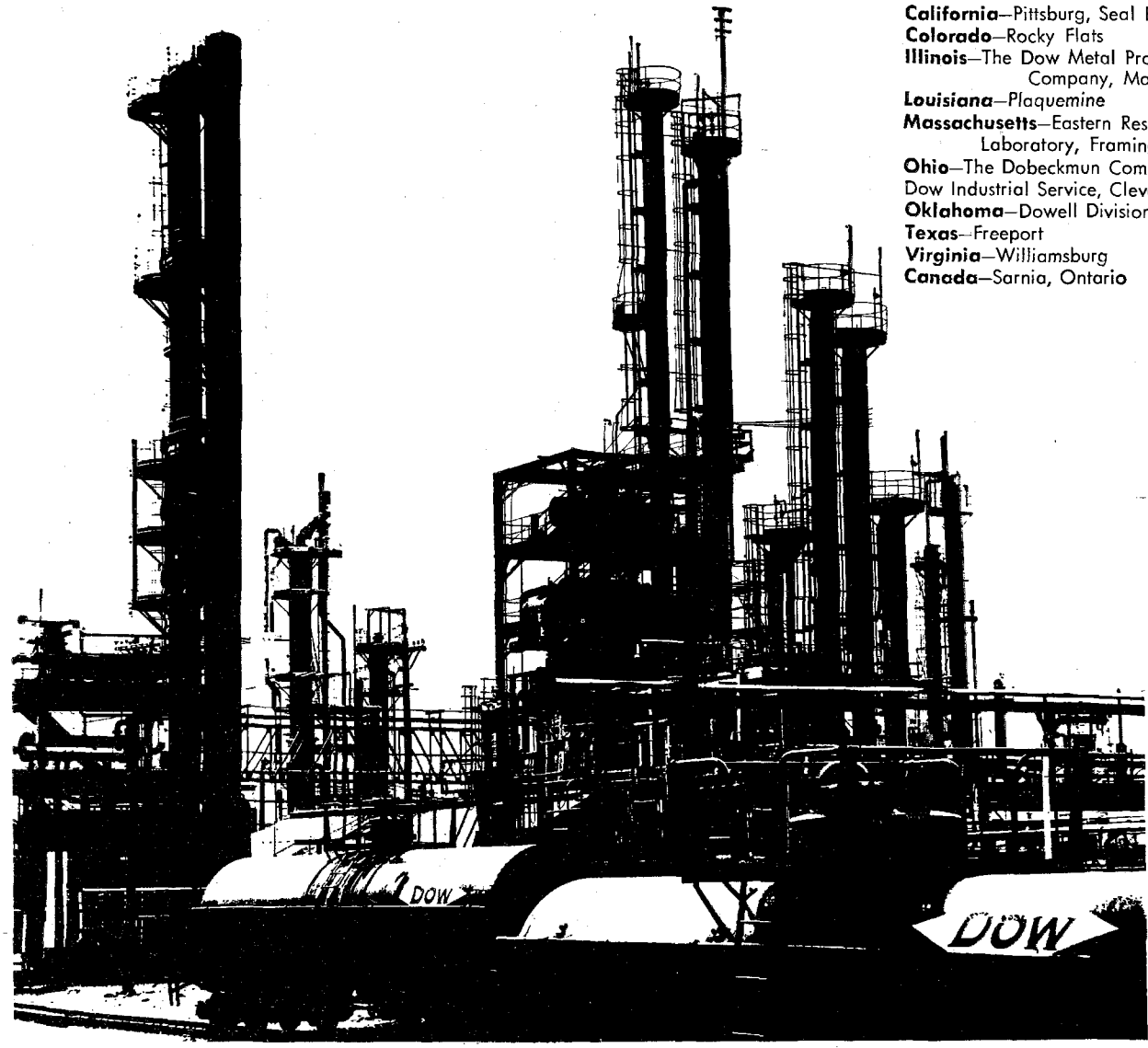

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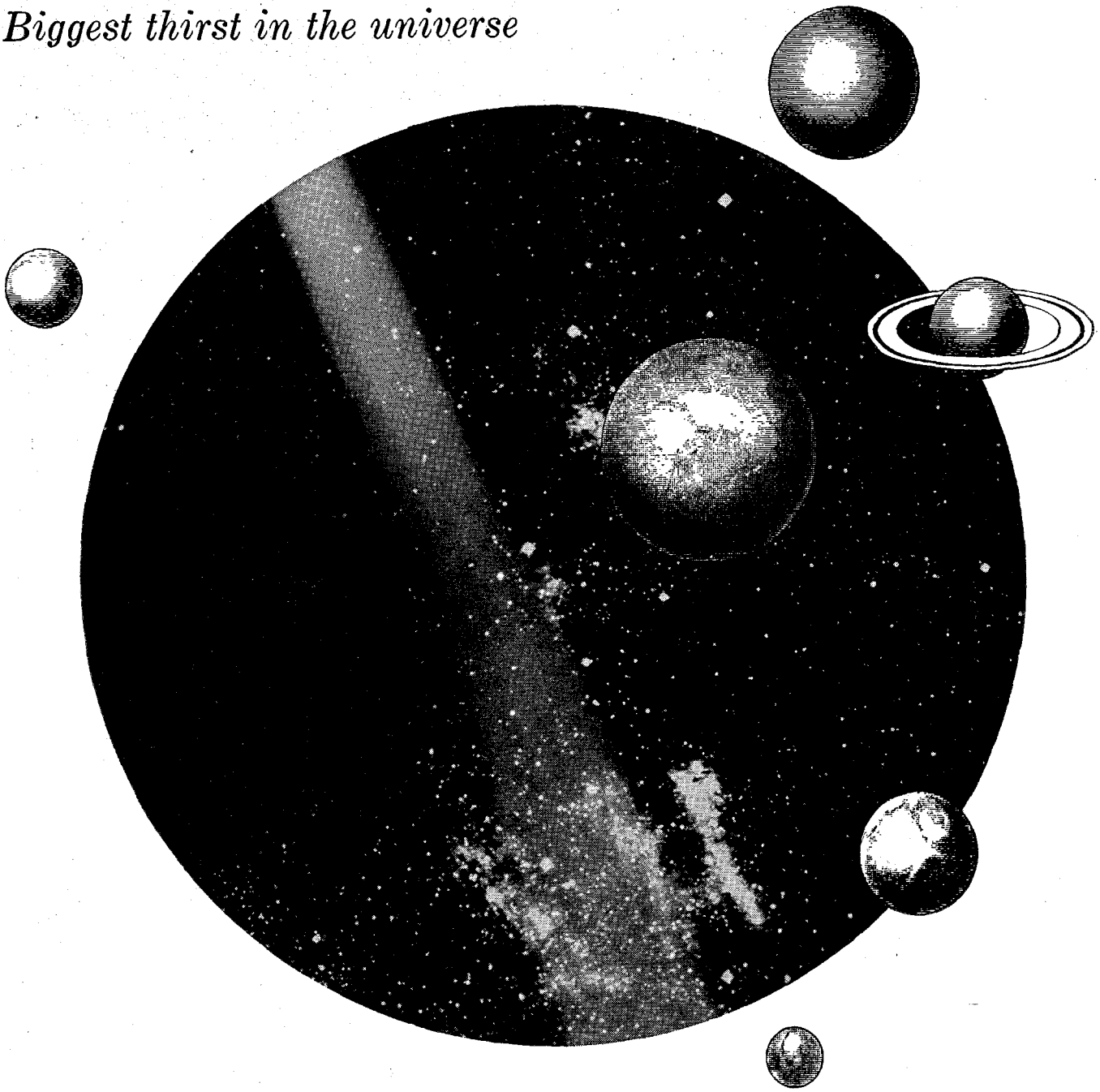

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The British Attitude to Deterrence

by the Rt. Hon. John Strachey, M.P.

Of course, there is no one universally, or even generally, held view in Britain on deterrence, nor on defense generally. But it is true that on one single aspect of defense there is wide agreement in Britain. That is as to the consequences of full-scale nuclear war. And that is natural; for, whoever else supposes that they can survive such an event, it is almost certainly impossible for the inhabitants of the U.K. to do so.

We are familiar with the Rand Corporation's calculations in, for example, their *Report on a Study of Non-military Defense* – calculations designed to show that if shelters were constructed on a sufficiently enormous scale, some people in some places would survive. No doubt they would. We are not appreciably reassured. For, as Dr. Herman Kahn, in his recent magnum opus *On Thermonuclear War*, has had to ask: "Would the survivors envy the dead?"

There is a more conclusive reason for supposing that, whatever number of individuals might survive a full-scale nuclear exchange, organized human society has become incompatible with nuclear war. For, what reason is there to suppose that if the world stays organized (or perhaps one should say unorganized) as it is, we face the prospect of only one nuclear war? Contrary, perhaps, to the common impression, most human societies have not been destroyed by single, particular, catastrophes. It has been the reiteration of natural disaster, or more often of war, that has undone them. And war has not failed to repeat itself. As Wordsworth wrote, in the context of his experiences of the French Revolution: "The earthquake is not satisfied at once." What chance would human society have of surviving the recurrent shocks of the nuclear earthquake?

I arrive, then, at the first proposition which I wish to put before you. War, in becoming nuclear, has become incompatible with the continuance of human civilization.

What are we to do about nuclear war? So far we have simply endeavored to deter other states from making nuclear war upon us. And during the first fifteen and a half years of the nuclear age we have been successful. Indeed, once upon a time, in the remote past – by which I mean four or five years ago – deterrence was thought to be a comparatively simple business. All that you had to do was to keep up an adequate stable of bombs and bombers; and then

CARNEGIE PROGRAM:
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As scientists and engineers become more and more deeply involved in non-scientific problems, there has been encouragement for a broader effort at the Institute in certain appropriate areas of the humanities and social sciences. A recent grant from the Carnegie Corporation of New York has made a beginning possible.

Particular interest has been concentrated on the field of science and government where there seems to be some real value in joining the efforts of scientists and of scholars in other disciplines. During the current academic year a group of faculty and graduate students from all Divisions has come together to study the subject of arms control within the broad context of national policy and of international competition.

Local resources have been reinforced with the talents of a series of outside visitors from academic and from public life, and these visitors have each been asked to deliver a lecture to the Institute. At the midpoint in our year's program we were privileged to welcome the Rt. Hon. John Strachey, M.P., a distinguished visitor from the United Kingdom. The accompanying article, "The British Attitude to Deterrence," has been adapted from his talk at the Institute on January 25.

–David C. Elliot,
professor of history

"Many who have thought about this problem have come to the conclusion that reliable stability can only come through an international agency with an effective monopoly of force."

you told the other chap not to be naughty, "or else . . ."

How different is our present situation! We are still, willy-nilly, adherents of the doctrine of deterrence; but how much more complex that doctrine has now become. For a number of things have happened.

First and foremost, of course, the other fellow has started to deter us. In a word, Russia has achieved nuclear parity; and that has changed a lot of things.

Second, a number of clever people have started analyzing the concept of deterrence, and they have concluded that it is in essence anything but simple. Just to start with, they have differentiated Type 1, Type 2, and Type 3 deterrence.

Now Type 1 deterrence, as I understand it, could be simply if crudely summed up by the saying: "If you vaporize me, I will vaporize you."

Type 2 deterrence might be equally crudely expressed by the words: "If you vaporize my allies or generally start out to conquer the world by military means, I will vaporize you."

Type 3 deterrence, on the other hand, might be expressed by the saying: "If you start nibbling me with conventional forces, I will start nibbling you right back."

Moreover, your defense experts seem to have come to certain conclusions about how much of each of these types of deterrence we have in fact got. They appear to hold that the West retains a great deal of Type 1 deterrence, but hardly as securely as we ought. On the other hand, they believe that we have precious little Type 2 deterrence left. And finally they warn us that we have been extremely negligent in building up our Type 3 deterrence.

A sustained defense effort

These conclusions are the reverse of reassuring. They appear to point towards the need not only for a long, expensive, and sustained defense effort on the part of the West, but also towards an effort directed far more clearsightedly and intelligently than has yet been done. That effort would be directed, as I understand this advice, towards two points: first, to securing our Type 1 deterrence, by giving to our ultimate, strategic deterrent the highest possible degree of invulnerability; and second, to improving both the quantity and quality of our conventional forces. In my opinion there is nothing incompatible between a vigorous defense effort in these fields, and the measures of disarmament which I am going to propose.

The arms race

Can we possibly be content even with the most sensible and intelligent prosecution of the arms race? No doubt we can minimize the chances of the outbreak of nuclear war in any given year, and so reasonably hope much to postpone its onset. We may do this by maintaining and reinforcing our deterrent forces at each of the three levels. But is that enough? In the nuclear age, all that the world seems to be able to achieve by prosecuting the arms race is a stay of execution. Now, no doubt for people like us who live in the condemned cell, a stay of execution is a very important thing to procure. But the stay, when it has been obtained, must be used. It must be used in such a way that the world can be released from the condemned cell of fear; it must be used for nothing less than to rid the world of nuclear war, for nothing less will enable us to survive. To paraphrase a famous annotation: The experts have explained the arms race in various ways – the thing is to stop it.

Now, of course, we can stop the arms race on our own any day. We can do so by ceasing to make new arms and by scrapping our existing arms. That is what is proposed by some people: that is what is called "unilateral disarmament." It has the immense appeal of simplicity. It is not my purpose to argue about this issue here. I want to say only this, that whatever else unilateral disarmament may or may not be, it is surrender. It may be said to be none the worse for that, but it is surrender in the precise sense that, if you have unilaterally disarmed, you

have got to do what anyone who has not so disarmed tells you. In other words, others can quite certainly impose their will upon you. You may suppose that these other people, or other states, will not, in practice, interfere with you. Or you may suppose that their instructions to you will be acceptable, or at any rate more acceptable than continuing to run the risks entailed in the arms race.

All right. I can understand people taking this view. But I do not understand people who pretend that unilateral disarmament is not surrender.

For that matter, those pacifists, or "unilateralists," as they are now often called, who have thought deeply about the matter are perfectly clear that unilateral disarmament is surrender: that it is, if necessary, the absolute surrender of all we have and are. The great pacifist tradition – and it *is* a great tradition – has been perfectly clear on this point. Recall, for instance, the tremendous declaration to King Charles II made by the original members of the Society of Friends. They wrote that they would never "fight or war against any man with outward weapons, neither for the Kingdom of Christ, nor for the kingdoms of this world." With respect, how trivial – indeed, how tawdry – the declarations of some present-day pacifists or unilateralists, even when they are great philosophers, sound in comparison with those unflinching words.

The dead end of hope

But what about those of us who cannot take the road of surrender? Is there anything for us to do except to persevere along the old, dusty, dispiriting road of multilateral disarmament negotiations – or, as you call it, "arms control"? That road has often seemed the very dead end of hope, the very alleyway of despair. Nevertheless, I believe that in principle that is what we must do. But, of course, if we are to have the slightest chance of making progress along the road of multilateral disarmament negotiations, we must seek to travel in a very different way and with a very different spirit than heretofore.

I will forbear to recall to you the desolating story of the disarmament negotiations since 1945. They have been an apparently aimless, empty, diplomatic quadrille in which first one side and then the other has come forward with proposals which they have known to be unacceptable to their opponents. The only interruption in this monotonous process has been when one side – usually the Russians – has achieved a political warfare coup by, in effect, accepting the other side's proposals, in the serene confidence that in that case these proposals will be immediately withdrawn.

How totally different would be serious disarmament negotiations in which both sides actually hoped for an agreement! We can judge of this from the proceedings of the nuclear test ban conference. Here was – and is – a conference which has evidently and undeniably sought to grapple with the real technical problem of control, verification, and inspection: a conference in which both sides have been willing to contemplate, at any rate, the possibility of the conclusion of an agreement.

We are now, I suppose, approaching the moment of decision on this matter. I am far from denying the existence of real risks in the signing of a test ban treaty this year. But when I envisage the risks of *not* signing such a treaty, I cannot help feeling that they are by far the greater.

The initial test ban

Dr. Kahn has lent his authority to the view that we ought to accept a disarmament treaty even if there are "some moderate" risks of its undetected violation. He implies that something up to a 25 percent risk might even be acceptable. At any rate I register my conviction that the chances of our being vaporized during the next two decades turn more upon whether a test ban has been achieved in the proximate future than upon any other single factor.

Nevertheless, a test ban treaty is only a first step, and a very short one at that, along the road to disarmament. True, the first step along that road may be all important. On this subject we may almost say with Madame du Deffand, when she was told that St. *Denis walked six miles carrying his head in his hand:* "La distance n'y fait rien: il n'y a que le premier pas qui coute." But the first step of a test ban treaty will only count if it is followed, and not too tardily, by others.

What, then, should be the next steps in multilateral nuclear disarmament after the test ban? I must say that the current suggestions do not seem to me very hopeful. I am afraid that we must accept the fact that the destruction of nuclear stocks, for example, is uninspectable and therefore impossible. The cutoff in production of fresh nuclear material is perhaps inspectable; but then it is not particularly important.

On the other hand, the current suggestions of the control of the means of delivery seem to me to point in the right direction.

Might I in this latter connection make a humble and limited suggestion? Much less vulnerable, and therefore characteristically second-strike nuclear weapons, such as the second generation of solid fuel rockets in general, and the Polaris-carrying submarine in particular, are now making their appearance. Why should we not take this opportunity to propose that both sides begin to scrap their older, highly vulnerable, and so essentially first-strike, nuclear weapons? For a start, why should we not propose that each side should scrap say 100 or 200 of their liquid-fuel highly vulnerable IRBM's or even ICBM's? The process would be extremely easy to inspect and verify. Inspectors from each side could verify that an equal

number of Russian and American weapons really had been simultaneously dropped into the middle of the Atlantic.

True, it will be said immediately that this is merely a proposal for the scrapping of obsolescent weapons as and when up-to-date weapons become available. So it is, in a way. But do not let us forget that the obsolescent, first-strike vulnerable weapons, though in my opinion almost useless as deterrents, are a highly provocative menace to the other side. For example, many of us in Britain felt that it really was trying the Russians' patience rather high to install those 60-odd Thor missiles in the U.K. There they are, right under the enemy's guns, sitting targets for any Russian first-strike, quite incapable of second-strike retaliatory action themselves, yet capable, if they were used first, of destroying a dozen or so great Russian cities. And, of course, the Russians have IRBM's of the same obsolescent but highly provocative kind.

Would it not make a profound difference to the whole character of the world situation — to the whole political climate of our time — if the West and the East each publicly destroyed even 100 or 200 of this type of weapon?

Scrapping first-strike weapons

But would Russia agree? None of us can tell. Let us assume for a moment that she would not. Deeply suspicious that this was one more Western plot to put her at a disadvantage, she might refuse. In this case, I think that we should seriously consider going further. Might we not seriously consider taking this particular step unilaterally? After all it is only *general* unilateral disarmament which involves our surrender and is therefore for most of us impossible.

Unilaterally to scrap one particular weapons system which has become largely useless as a deterrent — but which remains intensely menacing, and so provocative, to our opponents — far from involving our surrender, may well actually strengthen our genuinely deterrent, defensive strength. For that matter, if anyone tells me that even particular measures of unilateral disarmament are taboo, I can only answer him by saying that both the East and West have already undertaken several such measures as, for example, their respective and drastic scalings-down of their conventional forces.

I seriously suggest, then, that the West might consider announcing, in the event of a Russian refusal to agree to start scrapping essentially first-strike nuclear weapons, that we were going, nevertheless, to scrap a certain stated number of them and to invite Russian inspectors over to watch the process. We should announce, further, that this was the start of a general policy whereby we were going progressively to reduce toward zero our characteristically first-strike weapons, and to concentrate our efforts in the nuclear field on the perfection of an adequate (though not necessarily very large) but highly invulnerable second-strike deterrent force. Undoubtedly this would involve, not the abolition of the Strategic Air Command and Bomber Command, but a change of emphasis in the effort devoted to these forces. They would become smaller but incomparably better protected.

If such a policy as this has anything to commend it, then of course the recent proposals on the part of the late Administration for the re-arming of NATO were misconceived. For part of those proposals involved studding Europe with land-based IRBM's which, when so sited, must surely become vulnerable, essentially first-strike, weapons. They must become, that is to say, provocations instead of deterrents. (This criterion does not, of course, apply to the proposal to loan five submarines to NATO; that is a different proposition altogether.)

This was what caused some of us at the recent meeting of NATO Parliamentarians in Paris to protest against the proposal to put highly vulnerable IRBM's close under the enemy's guns in Europe. For to do so would inevitably shift the whole emphasis of NATO's effort away from the provision of conventional shield forces, which is its true, and sadly neglected, function. For these reasons the proposal seemed to us the very opposite of what should be done.

What can we lose?

I return to my suggestion: What should we lose by progressively diminishing — preferably, of course, multilaterally but, if not, even unilaterally — our vulnerable first-strike nuclear forces? Well, we should lose something, no doubt. We should in particular weaken our Type 2 deterrent power. But then, how much of that have we got left anyhow? On the other hand, we should lose nothing of our all-important Type 1 deterrent power. Indeed, we might hope notably to increase it by means of an emphasis upon adequate, highly invulnerable, and so characteristically second-strike, forces.

And, finally, what might we not gain? Would it really be advantageous, or even possible, for Russia, in the long run, to abstain from following our example? If the West really was undeniably, publicly and inspectably, scrapping its characteristically first-strike weapons, would not Russia inevitably follow suit sooner or later? She might do so, quite frankly, partly because she would see that this was correct military policy; but she would certainly also have to consider the sheer pressure of world opinion. And if once both of the great alliances had begun to scrap at least their characteristically first-strike nuclear weapons, should we not have taken a second — and this time not so short — step upon the toilsome road of mutual disarmament?

But when all is said and done, is disarmament enough? Can we really feel, that is to say, that any measures of partial disarmament, such as those suggested above, are enough? Specifically, are they enough to constitute that "major change in the present world situation" without which, as Dr. Herman Kahn writes in the recent arms control issue of *Daedalus*, "we may expect to get into a war anyway"? To be sure, total, universal, and general disarmament of all weapons by all states would certainly constitute such a major change. But then can any of us really imagine a world consisting in totally disarmed, but completely sovereign, states? Frankly, I cannot.

Whither, then, are we driven in the search for hope? I must admit – though no doubt at the cost of losing the sympathy of all practical men – that I, for one, am driven in the direction of the long term search for some sort of world instrument of authority. And I take comfort in the fact that I am not alone in being driven in this direction. I quote Dr. Herman Kahn again in this context because, whatever else he has been accused of, he has seldom been accused of being a visionary or sentimentalist. And, again, in *Daedalus*, he has written that "many who have thought about this problem have come to the conclusion that reliable stability can only come through an international agency with an effective monopoly of force."

A world authority

Nevertheless, "an international agency with an effective monopoly of force" is a very difficult thing to say anything convincing about. The trouble is, of course, that any advocacy of such a world authority seems, both to the man in the street and to the man in authority, wholly Utopian. The concept seems to have little connection with anything that is going on in the real world about us.

Perhaps I may be permitted to quote some paragraphs on this subject which I recently wrote in a pamphlet called *The Pursuit of Peace*. This pamphlet was directed to my own fellow countrymen, and in particular to those who share my political opinions. So this may perhaps convey to you better and more frankly than would words of mine consciously directed towards an American audience, what are at any rate some British attitudes on this whole subject:

> If we want the concept of a world authority to have an impact upon events we must address our minds to the issue of how, conceivably, the existing holders of ultimate nuclear power might be induced to pool that power in order to create and maintain a peaceful world. Those holders of ultimate nuclear power are, in 1960 (but not necessarily for an indefinite period), Russia and America.
>
> In the autumn of 1960 the very idea of there being any possibility of America and Russia, with or without their allies, combining for any purpose whatever, may seem hardly worth considering.

Be that as it may, one thing is certain. Unless there does dawn upon the Russian and American Governments and their allies (who are often even more intransigent than *they are themselves*) *that through, and in* spite of, and beyond all their searing conflicts (which will not be appeased for many years yet) some sort of ultimate common purpose exists between them, there is no hope for the world.

What could such a common purpose be? As a matter of fact it is not difficult to answer that question. At this stage in the world's development the Soviet and American Governments can have one, and only one, common purpose, namely to stay alive. It is a simple, but not an unimportant, purpose.

What are the chances that the instinct for survival will, in time, assert itself in those who control the destinies of Russia, America, and secondarily, but quite importantly, in their major allies? It would be foolish to ignore the obstacles that stand in the way of survival. There is first the ideological obstacle. Russia, overtly, and America only less overtly, have, as societies, much more clear-cut, definite and precise ideologies than the older nations of Western Europe. And they preach their respective credos with some passion to the rest of us. The Russian Government tells us daily that the world *must* and will be organized upon the basis of communism: the American Government that it *must* and will be organized upon the basis of free enterprise.

Who can have failed to notice one curious fact about the preaching and counter-preaching, the crusading and counter-crusading, to which the world is still being subjected by the great protagonists? The volume, and even the vehemence, of their exhortations do not diminish, but their interest does. Slowly but surely both of their gospels are *becoming a bore. The sap of life is draining* out of them. Nor is the reason far to seek. When we compare either the communist gospel with the actuality of Soviet society, or the gospel of free enterprise with the actuality of American society, we find a profound discrepancy between promise and performance. It is not that either Russian or American society is unsuccessful. On the contrary, as human institutions go, they are both successful above the average. It is rather that they are beginning to exhibit (quite unaccountably if we take either of their ideologies at face value) one telltale characteristic: namely similarity.

Naturally, the differences between them are still great. But the significant fact is that they are beginning to diminish. Apparently, huge, industrial, vigorous, highly organized, communities such as these come to bear certain resemblances to each other, however you organize their productive and social life. It is a sobering and in some respects depres-

sing conclusion. But it does carry within it one supreme gleam of hope. After all, what vital interest of the United States does Russia in fact need to menace? Or where do American purposes and aspirations in fact threaten the well being, let alone the existence of Russia? True, there are plenty of causes of dispute, from Berlin, to Cuba, to Formosa. But they are mostly in fact secondary, peripheral, and therefore *capable*, at least, of settlement. They are capable of settlement if once the Russian and American Governments come to realize that they both have a vested interest in settlements as such. For, like all dominant powers, they are in essence *conservative* powers. This may be a hard saying for governments representing, respectively, the oldest and the newest revolutionary traditions in the world. But it is a fact.

No doubt this is an attitude which will prove extremely irritating to some Americans. Neverthless, I thought it better that you should know that that is how some of us feel in Britain.

Naturally, I realize that we are still at an immense distance from that monopoly of effective power which, as it seems to me, can alone be expected to pacify the world. Nevertheless, the world is passing through certain phases which will be familiar to economists from their studies of the structure of modern industry.

In the past, the world of power politics might be compared to the world of capitalist firms in their competitive phase. It was a world of many contestants – a free-for-all. And then there emerged in power politics, as in industry, a world of oligopoly, a world in which power was shared by a relatively small number of contestants: oligopolists who made arrangements, alliances, truces, wars, between themselves.

But already the world appears to have passed beyond the stage of oligopoly into the stage of a duopoly of power. The supremacy of the two super states, Russia and America, may, it is true, not last forever, but it exists today. And would not the economists tell us that most experience suggests that the stage of duopoly precedes that of monopoly?

But here, of course, the world of economics provides a poor analogy to the world of power politics, for duopoly is accustomed to pass into monopoly by means of the conquest of one of the two survivors by the other: and that is just what the world in the nuclear age cannot stand.

How then can we imagine Kahn's "monopoly of effective force" coming into being? Perhaps we cannot yet imagine what the process might be like. We can only see its necessity for survival. At present we have got no further than the stage of Russia and America recognizing each other's existence, of recognizing each other in the simple sense that they face the fact that their respective social systems and ways of life are there, and are there for keeps. But I suggest that we *have* about reached this stage. We have reached the stage when each of the super powers recognizes the other as a permanent feature of the international landscape.

I would remind you how recent and still, no doubt, incomplete even this elementary form of mutual recognition is. Russia, until very recently, refused to recognize America in this sense: she loudly proclaimed, and originally at any rate believed, that America and Western capitalism generally were inherently so self-contradictory that they must destroy themselves in the near future.

Conversely, the United States pretty well up to the end of what we may call the Dulles epoch, failed fully to recognize the existence of Russia as, I repeat, a permanent feature of the international landscape. In some American quarters at any rate there was the concept of the "roll-back" or the "crusade." And behind this concept lay a presupposition that the socialist structure of the Russian economy, and of Russian society generally, was inherently impermanent, if not impossible.

For that matter, both sides still accuse each other of harboring these attitudes, and of attempting to push reality into conformity with them by means of attempting to subvert their opponent's social systems. And no doubt there exist in both countries lunatic fringes – and still quite wide and noisy fringes – which have not achieved mutual recognition in this sense. Nevertheless, I am inclined to think that the bargain of co-existence – for such it is – has just about been tacitly struck. And even that elementary bargain is extremely important.

I recall to you in this connection the seventh chapter of *Through the Looking Glass*, in which Alice encounters the Unicorn.

"What is this?" the Unicorn asks. He is told that it is a child.

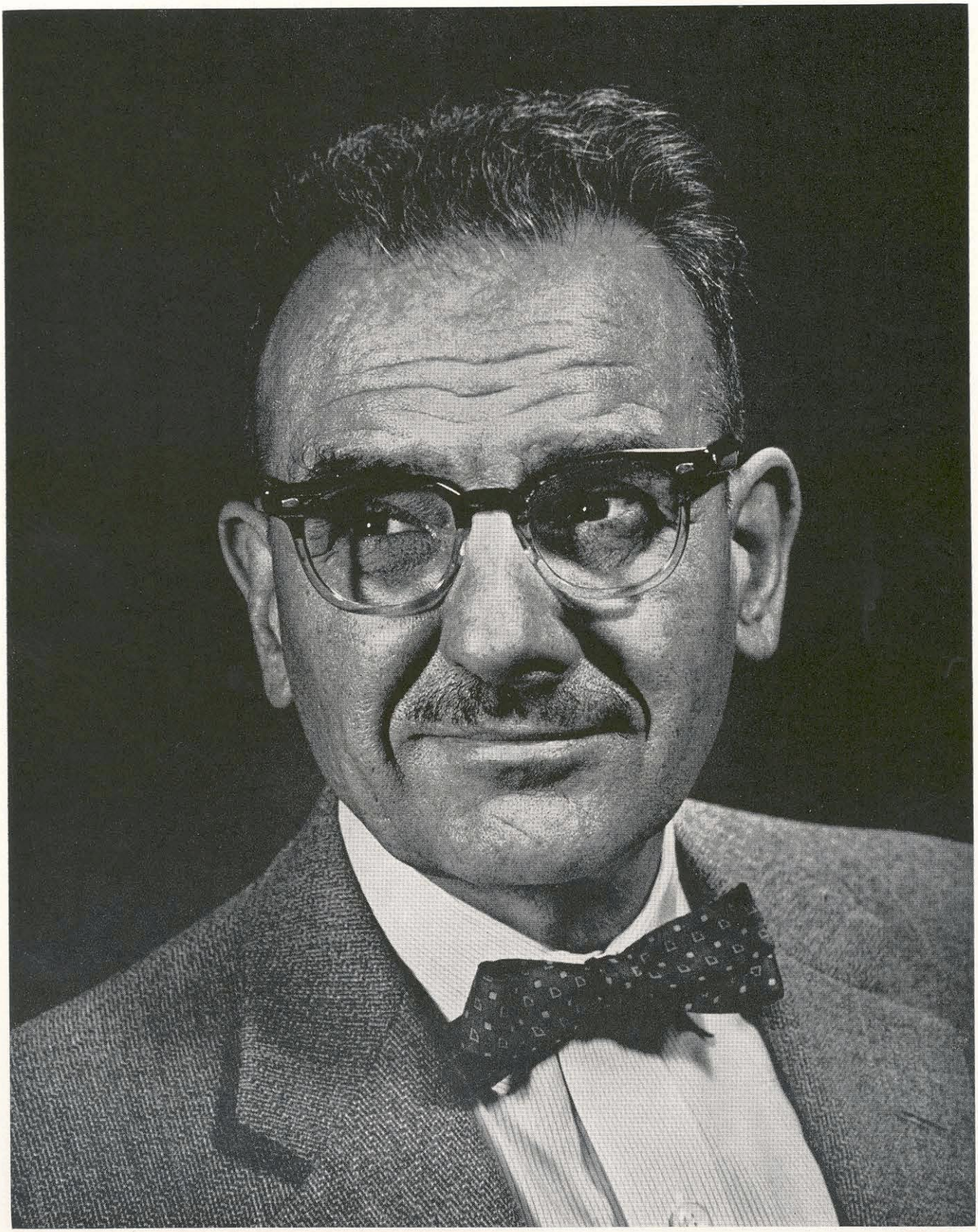
"I always thought they were fabulous monsters!" says the Unicorn. "Is it alive?"

> Alice could not help her lips curling up into a smile as she began: "Do you know, I always thought Unicorns were fabulous monsters, too?"
> ..."Well, now that we *have* seen each other," said the Unicorn, "if you'll believe in me, I'll believe in you. Is that a bargain?"

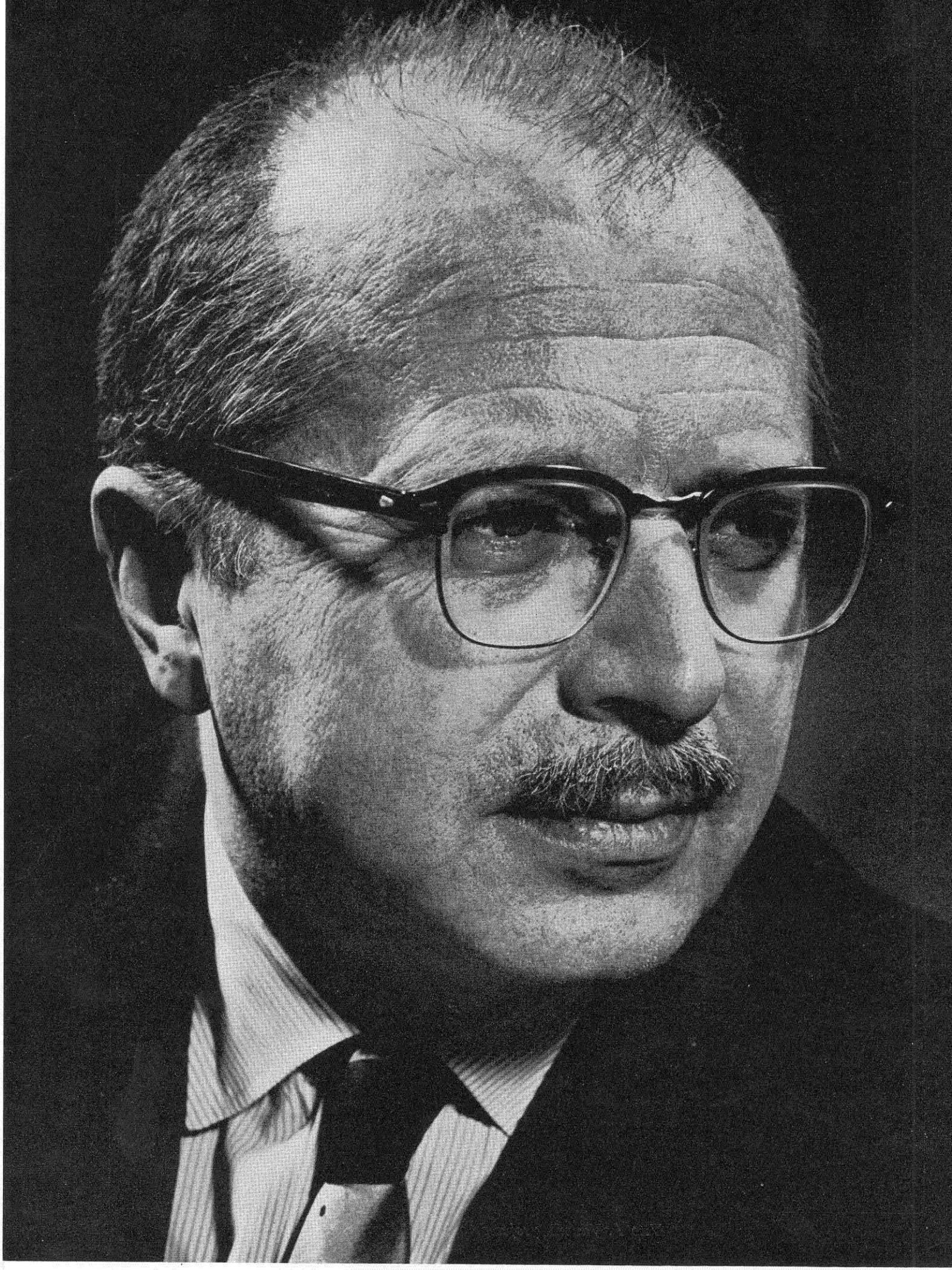
Observe the terms of the bargain: Alice was not asked to believe in what the Unicorn *said*, nor vice versa. No, the bargain was simply that each was to believe in the fact of the existence of the other. It is that elementary bargain which we of the rest of the world would ask you two super powers to make. For, upon that basis alone can we even begin to think of going forward towards the next stage, which could be nothing less than a bargain designed to secure the minimal degree of cooperation necessary to keep some sort of law and order in the world. Without that, what hope is there for any of us?

VII. Faculty Portraits

by Harvey



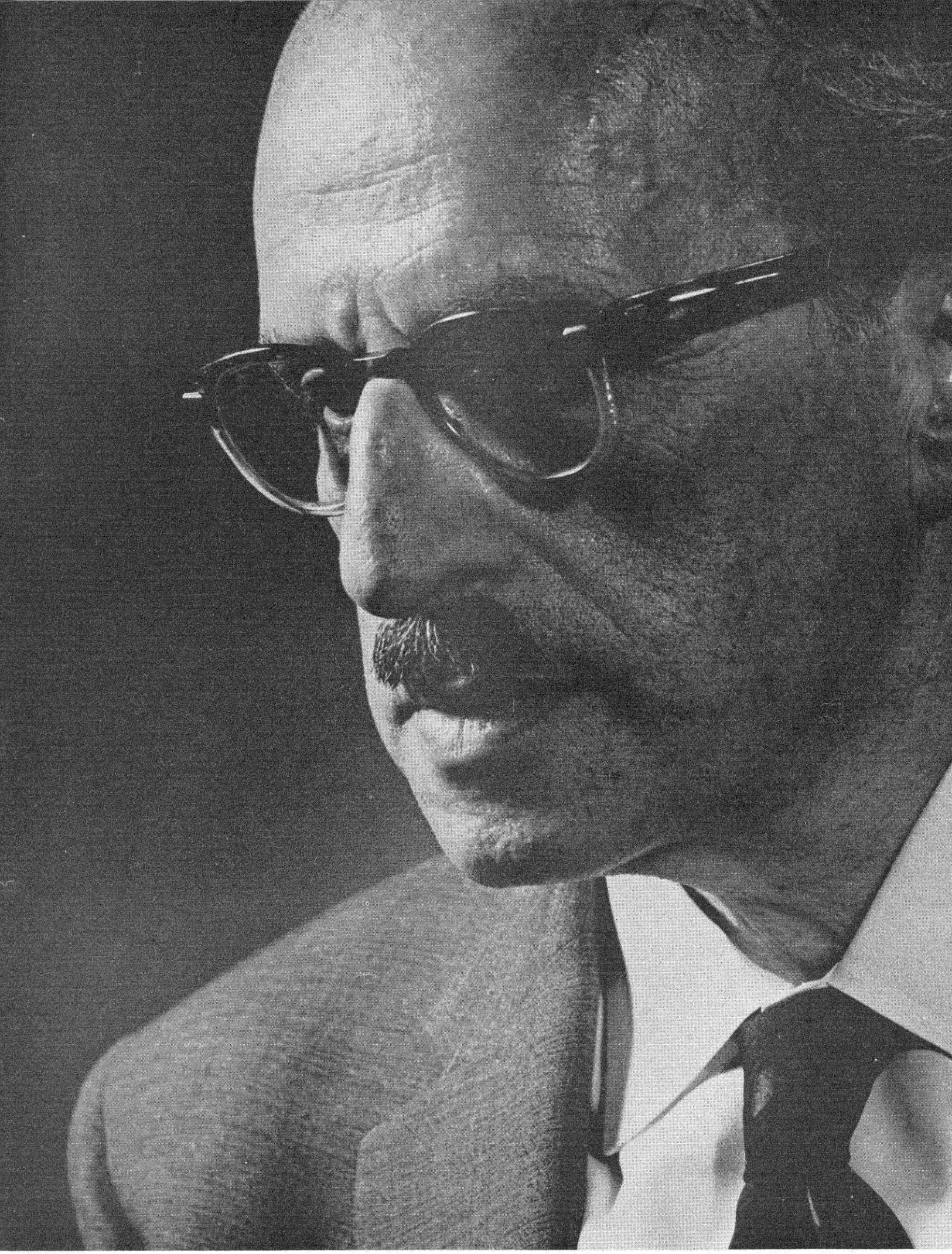
Vito A. Vanoni, professor of hydraulics.



Jesse L. Greenstein, professor of astrophysics, staff member Mt. Wilson and Palomar Observatories.

Robert P. Sharp, chairman of the division of geological sciences.

Hugo Benioff, professor of seismology.



Alfred Stern, professor of philosophy and languages.

What would YOU do as an engineer at

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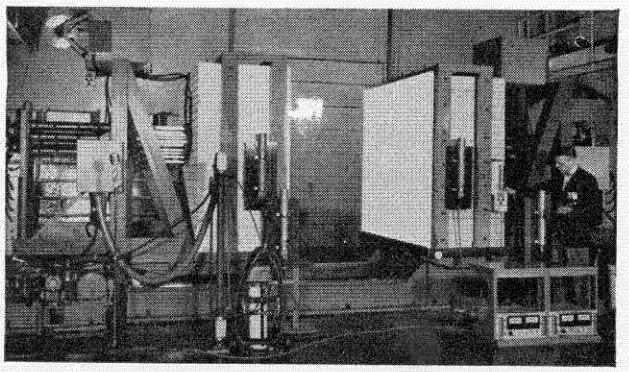
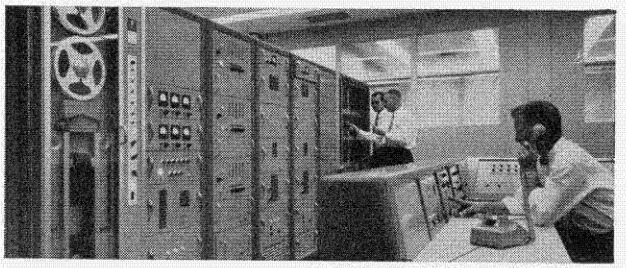
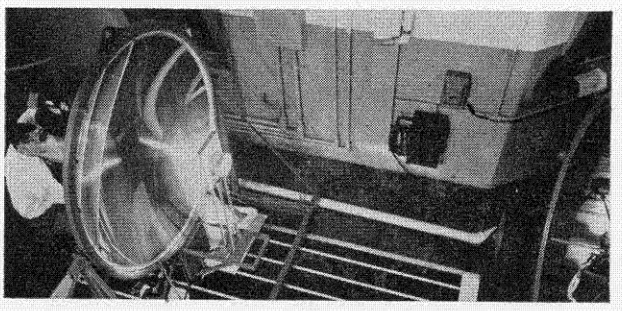


At P&WA's Connecticut Aircraft Nuclear Engine Laboratory (CANEL) many technical talents are focused on the development of nuclear propulsion systems for future air and space vehicles. With this live mock-up of a reactor, nuclear scientists and engineers can determine critical mass, material reactivity coefficients, control effectiveness and other reactor parameters.



Representative of electronic aids functioning for P&WA engineers is this on-site data recording center which can provide automatically recorded and computed data simultaneously with the testing of an engine. This equipment is capable of recording 1,200 different values per second.



Studies of solar energy collection and liquid and vapor power cycles typify P&WA's research in advanced space auxiliary power systems. Analytical and Experimental Engineers work together in such programs to establish and test basic concepts.

PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation

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The Month at Caltech

Dean of the Faculty

William N. Lacey, professor of chemical engineering, has been named dean of the faculty at Caltech. He succeeds George W. Beadle, who recently accepted the chancellorship of the University of Chicago.

Dr. Lacey served as dean of graduate studies at Caltech from 1946 to 1956 and has been a member of the faculty for 45 years. He came to Caltech as an instructor in chemistry in 1916. A graduate of Stanford (1911), he received the degree of chemical engineer there in 1912. He served as an assistant in chemistry at the University of California from 1912 to 1915, when he received his PhD. He then worked for a year as a research chemist for the Giant Powder Works in San Francisco and went on to be a research associate at MIT before joining the Caltech faculty.

For many years, Dr. Lacey, with Bruce H. Sage, professor of chemical engineering, headed a hydrocarbon research program at the Institute called Project 37. In 1953 he and Dr. Sage received Certificates of Appreciation from the American Petroleum Institute for their work on the project. The award noted that "the work carried out at the Institute has been of untold value to refiners and others because it enabled them to predict accurately how hydrocarbon mixtures would react under given circumstances" and "to save tens of millions of barrels of high-grade distillate which otherwise might have been lost forever."

In 1946 Dr. Lacey received the Hanlon Award of the National Gas Association of America "for meritorious service to the natural gas industry." In 1947 he was given the Anthony F. Lucas Gold Medal of the American Institute of Metallurgical Engineers.

During the first world war Dr. Lacey served as first lieutenant in the Ordnance Department Reserve, and saw active duty from 1917 to 1919 at the Rock Island Arsenal, in Illinois, where he was assigned to a plant for loading artillery shells and fuses.

In World War II he served with the National Defense Research Council as a supervisor of research and development of artillery rocket ammunition at Caltech, and, in 1948, he received a Presidential Certificate of Merit for this work.

Dr. Lacey has been a consultant on many government and industrial research products, and is the author or co-author of 6 textbooks and nearly 150 scientific papers. He is a member of the American Chemical Society, the American Institute of Chemical Engineers, and the American Society for Engineering Education. Since June 1960 he has been a member of the California State Board of Registration for Civil and Professional Engineers.

Honors and Awards

Frank Press, director of Caltech's Seismological Laboratory, has been appointed to a four-year term on President John F. Kennedy's science advisory committee. Dr. Press has served on California Governor Brown's scientific advisory committee on atomic energy, and on the national level as a consultant to the Departments of State, Defense, and Navy.

Dr. Press received another high honor this month when the U.S. National Committee for the International Geophysical Year designated a mountain in West Antarctica as Mount Press. Caltech operates a seismographic station at Wilkes Coast in Antarctica, under the direction of Dr. Press.

Clarence R. Allen, associate professor of geology, has received the first Grove Karl Gilbert Award of $9,000 to continue his studies of fault scarps that are caused by earth movements around the Pacific Basin. The award is made possible by the Harry Oscar Wood Fund, which is administered by the Carnegie Institution of Washington. Harry Wood was in charge of the Seismological Laboratory, a joint enterprise of Caltech and the Carnegie Institution, until it was formally turned over to Caltech in 1935.

Arthur A. Klein, professor of aeronautics at Caltech, has been elected a director of the Society of Automotive Engineers. Dr. Klein, who has been active in the organizational affairs of SAE, received a plaque last year honoring him for his many contributions. He received his BS from Caltech in 1921, his MS in 1924, and his PhD in 1925.

New Caltech Trustees

Three new members were elected to Caltech's board of trustees this month: Robert S. Ingersoll, president and chief executive officer of the Borg-Warner Cor-

continued on page 28

What's it take to make the right connection?

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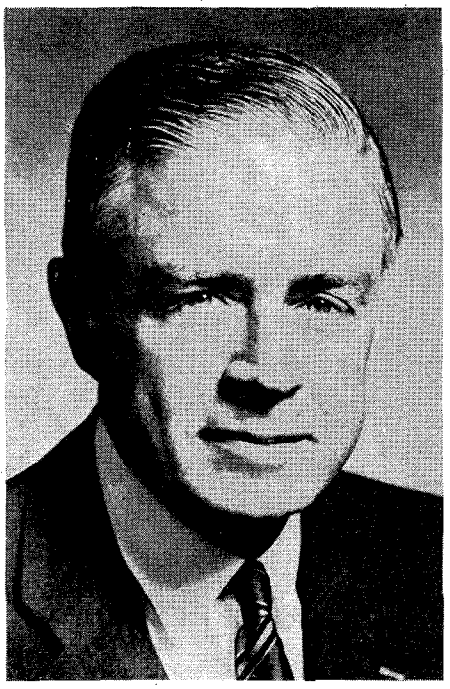
Frank Pace, Jr.



Thomas J. Watson, Jr.

Robert S. Ingersoll

poration in Chicago; Frank Pace, Jr., board chairman and chief executive officer of the General Dynamics Corporation in New York; and Thomas J. Watson, Jr., president of the International Business Machines Corporation in New York.

The three members were elected under a new policy adopted by the board to broaden the geographic base of its membership by the inclusion of a group of national trustees.

Robert S. Ingersoll has held managerial positions in several of Borg-Warner's divisions since he joined the company in 1939. He was named administrative vice president of the parent company in 1953. In 1956 he became president and in 1958, chief executive officer.

He is a director of the First National Bank of Chicago, the Container Corporation, the Chicago Association of Commerce and Industry, and the Chamber of Commerce of the United States. He is also vice president of the National Defense Transportation Association.

Mr. Ingersoll was born in 1914 in Galesburg, Ill., and is the son of Roy C. Ingersoll, chairman of the Borg-Warner Corporation. He was educated at Phillips Academy in Andover, Mass., and Yale University.

Frank Pace, Jr., joined the General Dynamics Corporation in 1952 as executive vice president. He became president in 1957, and board chairman in 1959.

He began his career in 1936 as an assistant district attorney in his native Arkansas. During World War II he served for four years with the Air Transport Command of the Army Air Corps, and after the war spent eight more years in government service as a civilian. He served as special assistant to the Attorney General, executive assistant to the Postmaster General, and assistant director of the Bureau of the Budget. In 1949 he was appointed director of the Bureau of the Budget, and in 1950 he was made Secretary of the Army. He was then only 38.

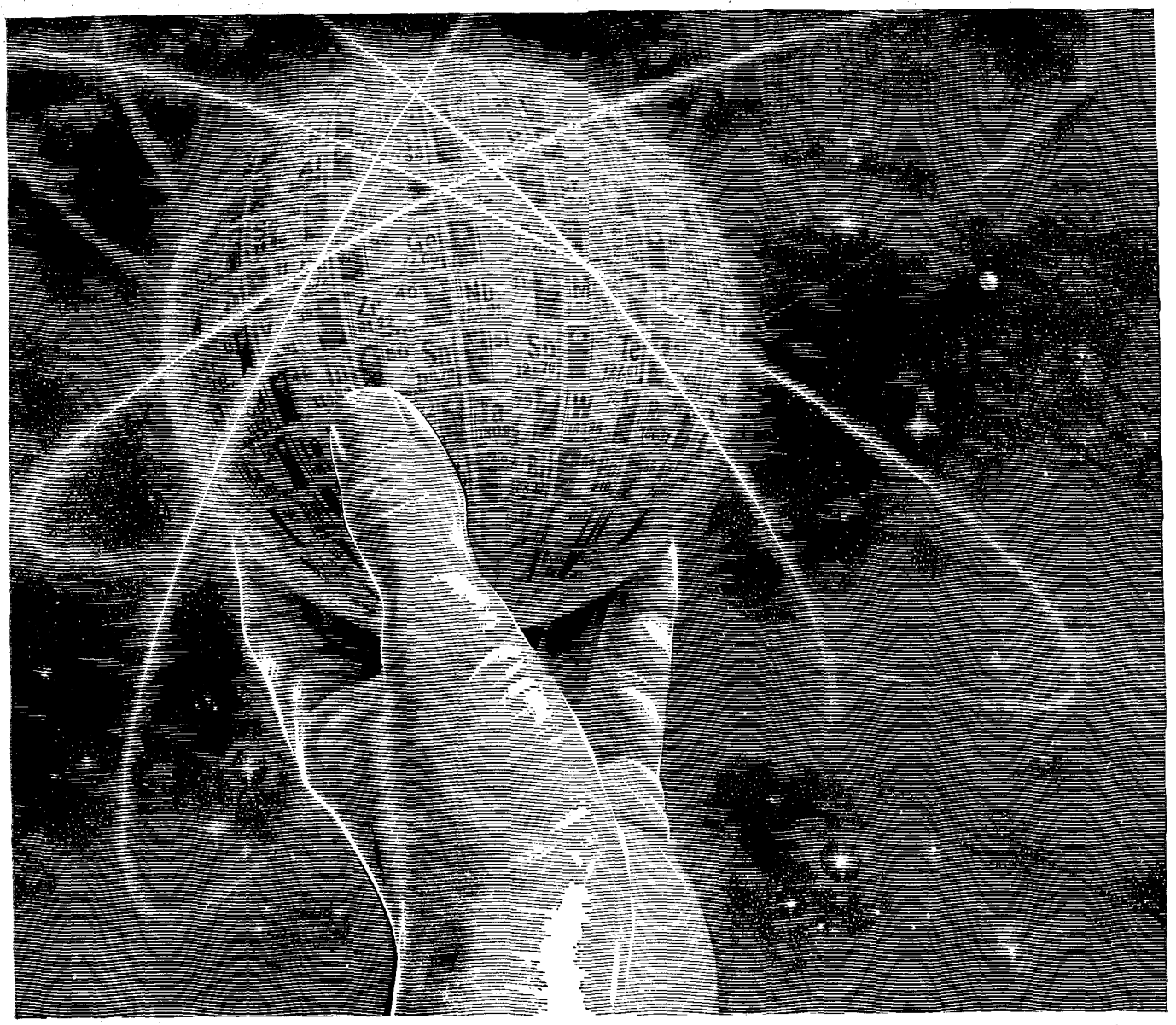
Mr. Pace is a director of many companies, among them the American Fidelity Life Insurance Company, Carriers & General Corporation, the Colgate-Palmolive Company and the Continental Oil Company. He is also a trustee of the Mutual Life Insurance Company of New York.

He was born in Little Rock, Arkansas, in 1912, and attended the Hill School in Pottstown, Pa., and Princeton University.

Thomas J. Watson, Jr., has been with IBM since 1937, except for five years, from 1940 to 1945, when he served as a bomber pilot in the Army Air Corps. He was elected president of IBM in 1952, and chief executive officer in 1956.

Mr. Watson is a director of the Bankers Trust Company of New York, and of Time, Inc., and is one of the public governors of the New York Stock Exchange.

He is also a member of the corporation of Brown University in Providence, R.I., where he received his BA in 1937, and of the Massachusetts Institute of Technology. He is a trustee of the Air Force Aid Soicety, the Eisenhower Exchange Fellowships, Inc., the Thomas Alva Edison Foundation, and the American Museum of Natural History.



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Periodic Chart ©Welch—Chicago

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Our Changing Cities

Cities still have considerable vitality but they will require increasing attention if they are to be maintained

by Robert W. Oliver

The results of the 1960 census of population should be extremely interesting. But, regardless of what the census tells us concerning the rate at which our various cities and metropolitan areas are growing, it will certainly confirm the proposition that the net population increase of the United States is taking place in cities somewhere. Less than a century ago, 60 percent of our labor force was employed on farms, but by 1950 the figure had declined to 10 percent, and it is continuing to decline. Our rural (as distinguished from our farm) population has declined from 95 percent of our total population in 1800 and 60 percent in 1900 to less than 40 percent at the present time.

Notwithstanding our pioneering traditions and our romantic recollections of the frontier, we have become a nation of city dwellers; more and more our culture reflects urban rather than rural living. And, increasingly, it reflects the way of life of large metropolitan areas – of the New York complex, for example, rather than Winesburg, Ohio. So, to know ourselves, we must know something about our cities and the ways in which they are changing. We must analyze the changing inter-relationships of urban people and urban things, for a city may be defined as *a concentration of people and the physical facilities they require in their enjoyment of life and their pursuit of income.*

Perhaps the most important manifestation of our changing cities is suburbanization – the movement of urban populations away from the centers of metropolitan areas.

In the United States there are 184 metropolitan areas – areas characterized by population concentrations around the older central cities which remain as the cores of the population concentrations. Between the censuses of 1940 and 1950, suburbs grew less rapidly than their central cities in only 25 metropolitan areas; in over 60 percent of our expanding metropolitan areas, suburbs grew at a greater absolute as well as percentage rate. And the continuation of this trend will undoubtedly be demonstrated by the results of the 1960 census. We are not only urban dwellers; we are suburban dwellers as well.

Suburbanization is probably more pronounced in southern California than in any other section of the United States. As William H. Whyte, Jr., put the matter in *The Exploding Metropolis:*

> On the fringe of the city, people are no longer drawn inward toward the center, but outward to the new shopping centers. Los Angeles, which has sometimes been called 100 suburbs in search of a city, shows the pattern at its most extreme; there is hardly any center at all, and what center there is seems useful to most citizens chiefly as a way to get from one freeway to another.

Attempts are being made to provide Los Angeles with a center: Near the Los Angeles City Hall a new, impressive public building appears every year or so; we shall soon have a downtown opera house as well as a stadium for the Dodgers; and the redevelopment of Bunker Hill is underway. But the outward population movement in southern California will continue.

Between 1930 and 1940 the population of Los Angeles County increased most rapidly in such areas as Vernon, Maywood, Bell, Huntington Park, Santa Monica, Burbank, and Glendale. Between 1940 and 1950 Long Beach, Inglewood, Encino, and Compton were added to the list. And since 1950 the impressive growth has been in such places as Whittier, Azusa, Covina, Glendora, San Fernando, Puente Hills, and Palos Verdes. If present trends continue, during the next decade the greatest absolute and percentage population increases in the Los Angeles metropolitan area will occur in the outlying sections of Los Angeles

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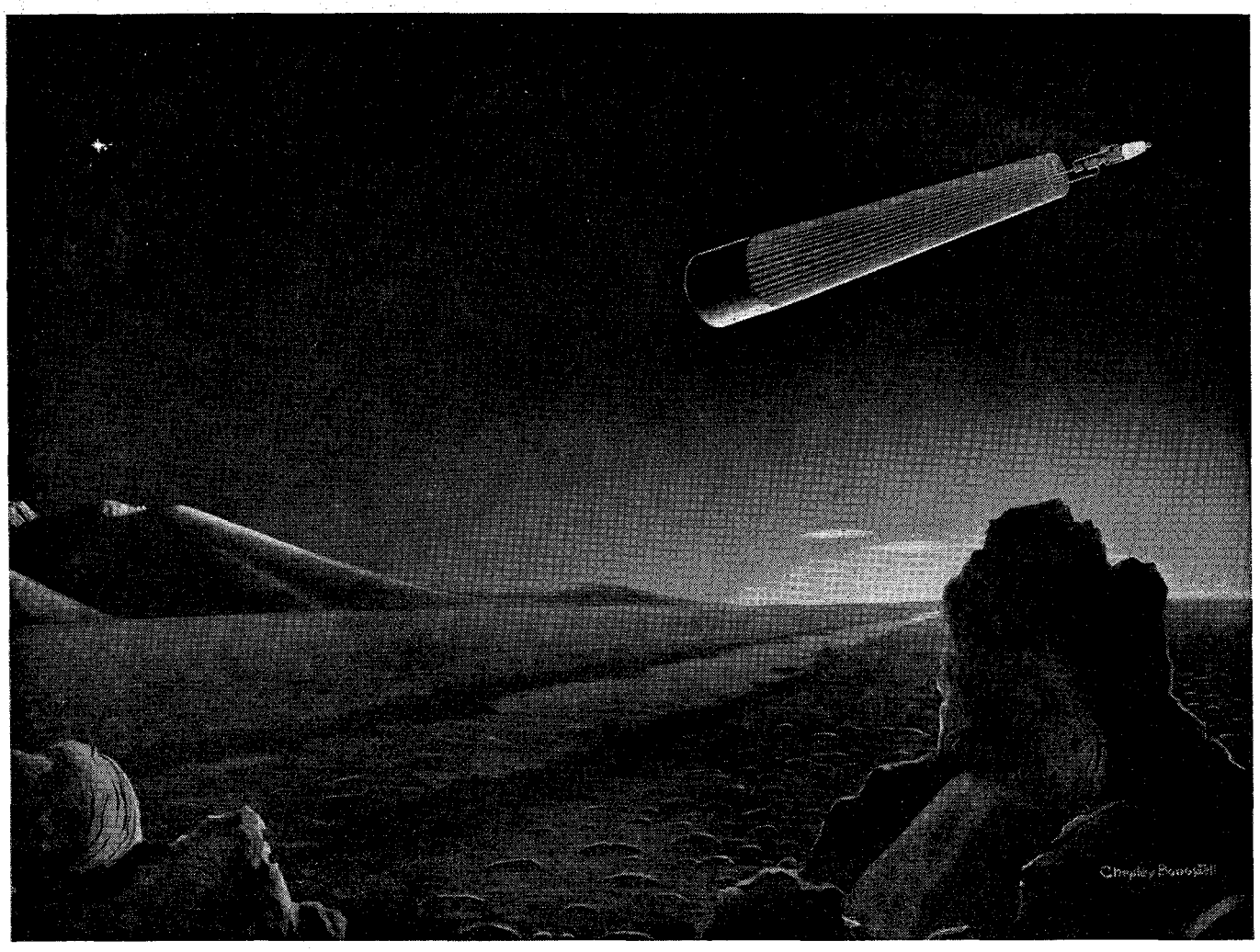

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County and in the surrounding counties of Ventura, San Bernardino, Riverside, and Orange. Indeed, it is predicted that by the year 1980 there will be one giant (should I say "monstrous"?) city – a megapolis – stretching from Santa Barbara to San Diego.

The impact of the automobile

The pattern of suburban growth has been due in large measure to the availability, farther and farther away from downtown business centers, of undeveloped, low-cost land. This has attracted manufacturing enterprises as well as residential developments, and the outward movements of business and population have reinforced each other.

It is clear that the extensive development of suburbs would have been impossible without the automobile. Together with our network of highways, the automobile has made it possible for people to live in the "country" and work in the city. And it has done a great deal more.

In the case of many of those metropolitan areas which, like Los Angeles, have developed largely since the advent of the automobile, the pattern of suburban growth has rendered public transportation unprofitable. Instead of being spread out along major rail or bus lines, population now tends to increase more or less evenly in ever-increasing concentric circles, with insufficient density in most places to support any but the most casual of public transportation systems. Thus, the automobile perpetuates itself by rendering competition obsolete.

The automobile has also had an enormous impact upon shopping habits and, consequently, shopping facilities. Successful new shopping centers are those which offer a complete selection of merchandise and are surrounded by large, readily-accessible parking lots. This means that the older shopping areas, which developed in long, thin strips along fashionable boulevards, are becoming obsolete. Certainly, if they are located near the centers of metropolitan areas, they must entice their customers through (as Victor Gruen has expressed it in A *Greater Fort Worth Tomorrow*) "a series of obstacles which each day become more and more discouraging – traffic, parking, noise, fumes . . . and (they) must consistently maintain high sales per square foot" to pay the rent the landlords must receive to justify the prices they paid for the real estate.

Changing economic functions

The growing obsolescence of many downtown shopping areas is but one manifestation of the changing functions of central cities. In general, just as the population of central cities is declining relative to the population of metropolitan areas, so is employment. But the relative decline in employment is uneven. The relative decline in manufacturing and retail trade has been greater than that in business services, finance, insurance and real estate. In other words, central downtown areas are maintaining their pre-eminence in those activities for which office space is a prerequisite, even though manufacturing and retail trade are moving to the suburbs. But the business and professional people who inhabit these downtown offices by day must travel farther and farther to the suburban homes they occupy at night.

Changing qualities of residential areas

People must also travel through what has been called a "gray belt" of older residential areas, where middle class housing is becoming lower class housing, and where slums exist or may be developing. In the case of most downtown business areas, the profit motive induces the upkeep, even the renovation for new uses, of business property. But the profit motive, the mainspring of the market system, is not so powerful a force in inducing the updating and upgrading of residential property.

According to the Welfare Planning Council of Los Angeles:

> There seems to be a specific time when a community begins to age and change its character. A family buys a home when the children are small. After twenty or twenty-five years the children have left home and frequently the house is sold. When a whole subdivision has been constructed and houses sold almost simultaneously, the transition period at the end of a generation can be fast and marked. At the end of two generations, a neighborhood may deteriorate into a blighted area.

This is particularly true in southern California, for many of our smaller, older homes are of cheap and unsightly frame construction, uncompetitive with the homes of more modern design and equipment. And in southern California, the outward movement to undeveloped, low-cost land has been particularly easy.

An older residential area need not become a slum area. A city will have a slum problem only if its buildings continue indefinitely to be neglected. It is certainly possible that the strict enforcement of health, sanitation, and building codes and zoning ordinances may prevent the development of slums. But old age and obsolescence tend to be synonymous, particularly when the rate of technological change is high. Furthermore, as property values decline, at least relatively, obsolete residential areas become attractive to lower income families and individuals. If these people are not accustomed to maintaining and improving property, the deterioration of the area will be accelerated and slum conditions may follow.

Thus, while middle and upper income families are

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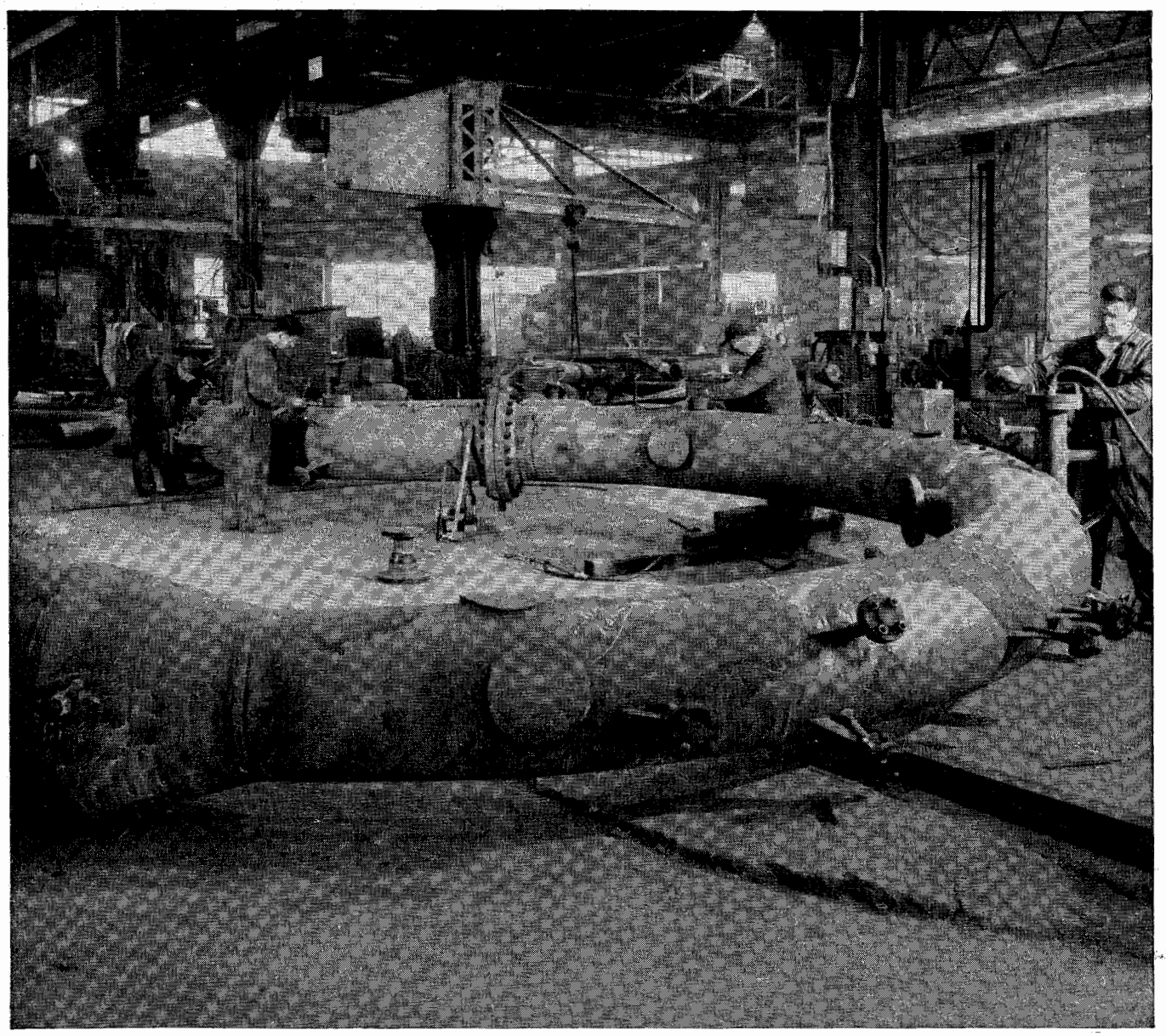

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establishing suburban residence farther and farther away from downtown business centers, and while most downtown business centers are being remodeled to meet the changing demands of the market, many of the older residential areas in between are becoming older and more obsolete. This is a problem which is attracting increasing attention all over the country. It is the problem which Congress had in mind when it passed the Housing Act of 1949.

The rationale of urban redevelopment

The federal government was interested in slum clearance during the 1930's. But by the end of World War II it was recognized that the problems of urban obsolescence were much broader than slum clearance. In 1949 Senator Robert A. Taft, along with Senators Ellender and Wagner, introduced legislation which allowed the federal government to participate actively in urban redevelopment by helping to finance local redevelopment programs.

Redevelopment planning is a strictly local matter, but federal financial assistance may be forthcoming once it has been demonstrated that redevelopment is needed, and that the spread of blight may be arrested by the redevelopment program.

The heart of federal redevelopment legislation is the provision that the federal government will pay two-thirds of the difference between the cost of acquiring and clearing the land and the amount the land can be sold for after it is cleared. The local community must pay the other one-third, though it is assumed that this cost will be more than recovered subsequently as a consequence of increased tax revenues.

The rationale of the federal redevelopment program can be summarized in three propositions:

1) The social costs of crime, disease, juvenile delinquency, illiteracy, and unsightliness can be reduced if obsolete residential areas are redeveloped before they become slums.

2) Redevelopment will seldom take place if it is left to strictly private action. An individual property owner may be wasting his money if he improves his own property while the area as a whole remains unimproved. Even a group of public-spirited citizens may be ineffective if it cannot acquire property through the power of eminent domain.

3) Federal financial assistance is needed because municipalities lack the taxing power to raise the revenue required for adequate redevelopment, and because the social gains of redevelopment on a national basis will benefit all Americans.

Actually expenditures designed to induce our middle income families to continue to live in the hearts of our cities are just as desirable as freeway and public utility expenditures (and real estate campaigns) designed to attract people farther and farther into the hinterland.

A return to the city

In any event, those who are fond of cities, and the activities which can only be supported by large concentrations of people, are anxious to see that our downtown areas are useful not only for business but also for recreation. The case has been put most graphically by William H. Whyte, Jr., in *The Exploding Metropolis*, in explaining why people who have lived in the suburbs may want to return to the city:

> Do-it-yourself no longer amuses, and all the little things that once seemed so therapeutic – weeding the driveway, pruning the roses, trimming the hedge – are now a monstrous nuisance. The grass, particularly, seems to become a Thing, and it is sometimes mentioned with such animosity as to suggest that the suburban lawn may be the salvation of the city.
>
> For the wife, the social life of suburbia can begin to pall; earlier, when there were children's problems and P.T.A. to talk about, she may have been close to people with whom she really had very little in common. Now, with the children gone, she isn't so close, and as her work load has eased up, she is drawn increasingly to the city. Often she has identified it with a certain freedom: the day in town has been a day off (as some wives put it, the "maid's day off") and she has long envied her husband his presumably exciting life in the city. Now she too wants to be close to things, and while she will be sorry, perhaps, to leave the garden, she looks forward to the museums and the theaters and symphonies.

In short, for many people, downtown city living has great appeal. Thus, people can be induced back to the city if the city has good museums and theaters and symphonies (and shops, restaurants, and nightclubs), and if these people are not repelled by widespread blight.

There is some evidence that the city is more conducive than the suburb to really splendid living. In the heart of Manhattan builders are now planning or erecting 140 apartment buildings, almost all of which will bring monthly rents in excess of $50 a room. In downtown Chicago work is under way on two luxurious 60-story circular "living towers." In downtown Boston 78 new $300-to-$675-a-month apartments will be completed this year. And this pattern is being repeated elsewhere in the country.

There is no doubt that our cities still have considerable vitality, but they will require increasing attention if they are to be maintained. When the United States was in its infancy, it was the practice of our farmers to move on to new land when the old land had been "used up." It is questionable, however, that we can afford a similar extensive approach in planning for the future of our changing cities.

Bendix answers your questions

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Some employers actually have a "talent pool" arrangement, where you will bide your time while the company "orients" you, or looks you over.

At Bendix, engineers are hired to do specific engineering jobs. We have long been devoted to the principle of "maximum skill utilization." Engineers are not placed in talent pools at Bendix.

We feel that it is wasteful to all concerned when a man works below his ability and capacity. Ask your Placement Director about Bendix—**where you can build your career to suit your talents.** Arrange for an interview with a Bendix representative; ask him about your probable first assignment. You will be surprised at how completely it can be defined. Or, write to C. A. Cleveland, The Bendix Corporation, Fisher Building, Detroit 2, Mich.. for general information.

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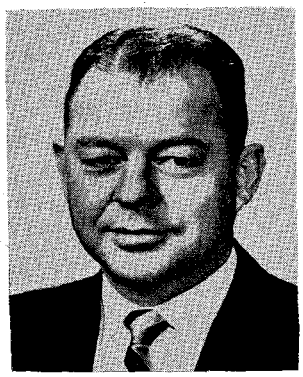
Alumni News

All-American Davis



Frank W. Davis '36, vice president and general manager of the Fort Worth Division of Convair, a division of General Dynamics Corporation, was elected recently to *Sports Illustrated's* 1960 Silver Anniversary All-America. This is an annual award by the sports magazine to 25 men on the basis of their career success and community service in the intervening years since their senior football season at college. Nomination for the honor is made by each candidate's alma mater and election is by a panel of eminent judges.

Frank Davis was active in athletics throughout his four years at Caltech, participating in football, track, swimming, tennis, and baseball. He earned varsity letters in football for three years, including his senior year. He was captain of the varsity football team during his third and fourth years, and was awarded the Wheaton Trophy for two successive years. The award is given annually to a member of the varsity football squad on the basis of sportsmanship, moral influence, and scholarship.

Frank Davis was also president of his freshman class, president of the Beavers Club, president of the Varsity Club for two years, and representative on the Board of Control for two years.

Davis lives in Fort Worth with his wife, two sons, 9 and 15, and a daughter, 18. He is an elder of the Presbyterian Church and director of the Metropolitan Branch of the YMCA, among many other civic activities.

Alumni Dinner Dance

The Annual Alumni Dinner Dance will be held in the Viennese Room of the Huntington-Sheraton Hotel in Pasadena on March 4. Cocktails at 7 and dinner at 8; dancing begins at 9. Invitations have been mailed, so send in your reservations or call the Alumni Office at Sy. 5-6841 or Mu. 1-7171, Ext. 258. Your tickets will be held at the door.

— Robert W. Lynam '54, chairman

THE ROAD TO STOCKHOLM

Dr. Linus Pauling is the man for me
He makes violent changes in my chemistry
Oh fie, when he rolls his eyes
All my atoms atomize.

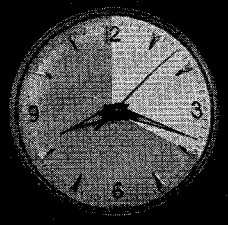
Throaty-voiced Elizabeth Lester singing this ballad brought down the house in 1954. The occasion was a dinner for the new Nobel Laureate in chemistry, given by his colleagues at the Institute. The entertainment was by randomized volunteers who endeavored by skit and song to characterize certain moments of the scientist's life.

Kent Clark, Norman Davidson, Jack Dunitz, and Ted Harrold collaborated on the book, and an enthusiastic company that included Norman Davidson, A. H. Sturtevant and Ed Hutchings provided some high moments of comedy.

The proceedings were recorded and put on 10-inch 33 1/3 LP records, under the title, "The Road to Stockholm." The records are now somewhat of a collector's item and a move is under way to have more pressings made.

If you are interested, leave an order with the Caltech Bookstore. If at least 25 orders are received, records will cost $2.00 each ($2.25 for mail orders).

IS YOUR FUTURE WORTH A 20 MINUTE INTERVIEW?



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Personals

1920

Harry P. St. Clair, consulting planning and operations engineer at the American Electric Power Service Corporation in New York, died of a heart attack on December 31. He was 65.

Harry was on the eve of retirement after 36 years with the power company. He planned 76,000 miles of power lines which serve 2,300 communities in Indiana, Michigan, Ohio, the Virginias, Kentucky, and Tennessee.

He was president of the New York chapter of the Caltech Alumni Association in 1944-45. He leaves his wife, two sons, and a daughter.

1922

Clyde R. Keith has retired from the Bell Telephone Laboratories after 38 years. For the past 10 years he has been working on the development of telephone answering and announcing machines in Murray Hill, N.J. Clyde is now assistant secretary of audio-visuals at the Presbyterian Board of National Missions in New York. He is producing filmstrips, records, and sound films for use in Presbyterian churches throughout the country.

1927

Hallam E. Mendenhall, PhD, executive assistant at Bell Labs in New York, writes that he is still in charge of university relations, as well as being ever on the alert for scientific and engineering PhD's from Caltech and elsewhere.

1935

John C. Stick, Jr., formerly chief log analyst at the Lane-Wells Company in Houston, Texas, has taken a new position after nearly 24 years with Lane-Wells. He is special assistant to the director of the instrument division at the Perkin-Elmer Company, Inc. "In my new job," writes John, "I carry out all forms of liaison with a newly-acquired affiliate, the Atomium Corporation in Waltham, Mass. Incidentally, the president of Atomium is *Hugh F. Stoddart,* '50, not only a Caltech alumnus, but from Blacker House to boot.

"We're really getting a great kick out of Connecticut — notwithstanding 12 inches of beautiful but highly impractical snow. We have a delightful contemporary house on 2½ acres of land with a small stream, cave, and all the trimmings — and only 15 minutes from work."

Frank J. Malina, MS, AE '36, PhD '40, writer and artist in Paris, is now a deputy director of the International Academy of Astronautics, founded by the International Astronautical Federation. He is also chairman of the Lunar International Laboratory Committee in Stockholm, an organization devoted to the study of technical problems related to the construction of a scientific research laboratory on the moon. Theodore von Karman, professor emeritus of aeronautics at Caltech, is the first director of the Academy of Astronautics.

Frank is known in Paris for his paintings which are luminous, mobile, and controlled by electricity — a unique combination of art and science.

1938

Roland C. Stone, partner in the Superior Honey Company in Whittier, writes from Cuernavaca, Mexico, that the company has decided to expand operations to include a wax processing plant there. "I moved to Cuernavaca last July," writes Roland, "and returned to the States in August to bring my wife, my son, Mike (15), and my daughter Kathy (10) back with me. We have rented a nice home here, and the children are in school.

"Jack (John R.) Baker, BS '38, is also in Mexico trying to start a plant for Baker Oil Well Tools in Mexico City."

1941

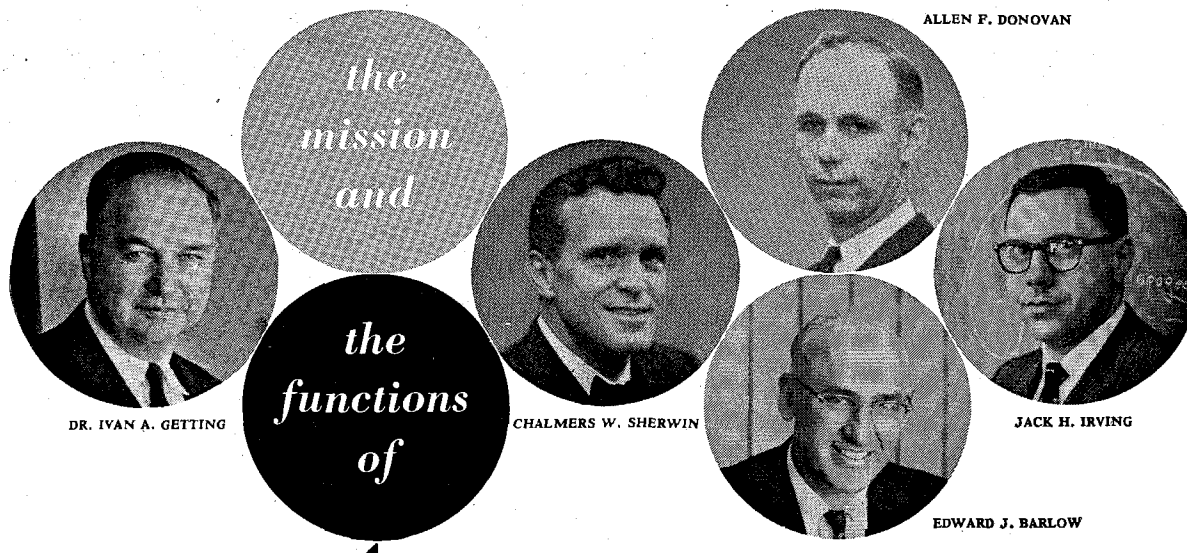
Brigadier Gen. Charles H. Terhune, Jr., AE, deputy commander for ballistic missiles of the Air Force Command and Control Development Division in Bedford, Mass., has received the Legion of Merit, second highest peacetime award, for his outstanding service as deputy commander for ballistic missiles of the Air Force Ballistic Missile Division in Inglewood, Calif., from 1954 to 1959.

1943

Fred H. Tenney is on the staff of Project Matterhorn at Princeton University. "Got a PhD in physics at the University of Rochester in 1953," he writes, "and have been in Princeton ever since. Taught physics for two years and then joined my present project. We have 3 children; Stephen, 8; David, 7; and Susan, 5. For the past two years we've been putting our spare time to use in helping found the Ethical Culture Fellowship of Princeton. It is a religious group, and a small group, so I have many titles, such as trustee, program director, and assistant director of religious education."

1945

Charles E. Lamar, manager of sales at the Southern Pipe Division of U.S. Industries in Azusa, has been named vice president of marketing. He has been with the company since 1951. In addition to his responsibilities at the home plant in Azusa, he also has charge of marketing at the Division's Hawaiian



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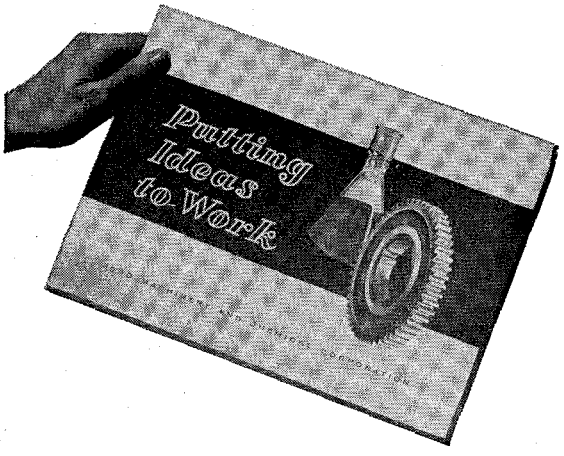
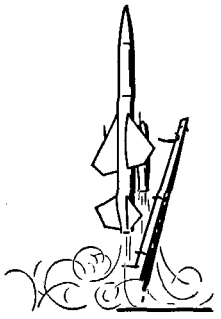


DEFENSE OPERATIONS:



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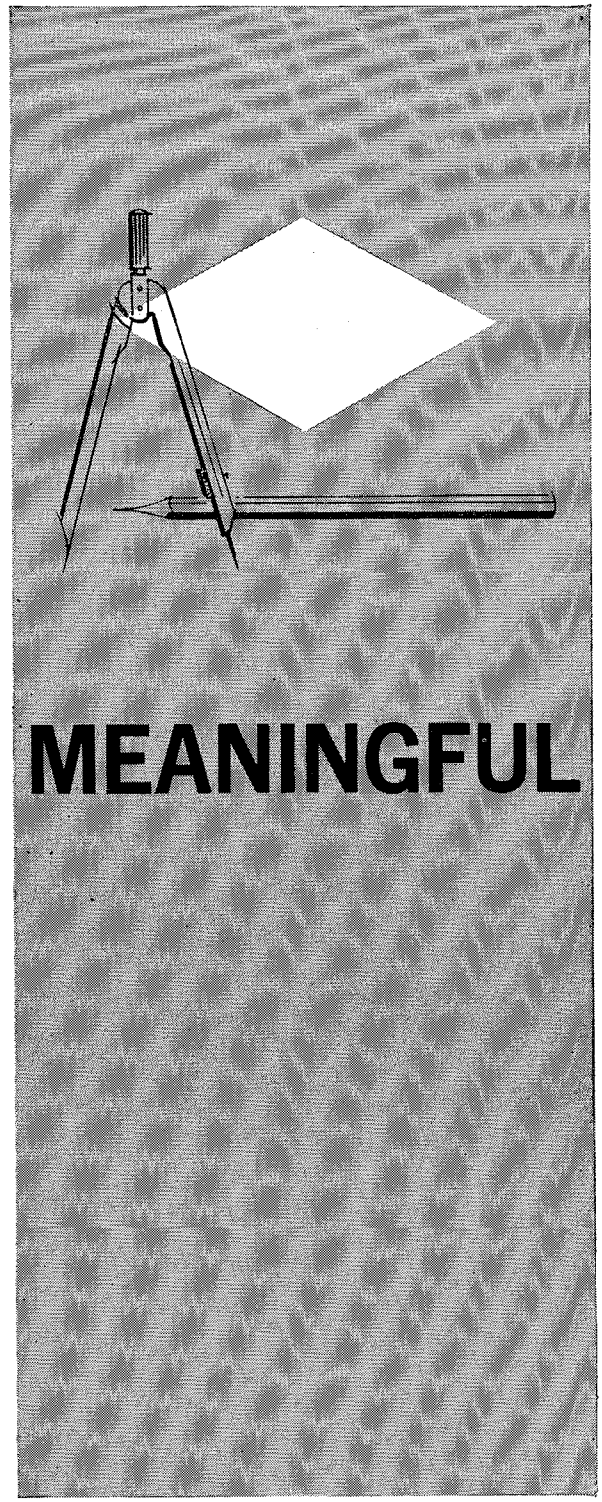

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And that is the only way we know to make a trademark *meaningful.* That will always be the Jenkins way of making valves.

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Jenkins Bros

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pipe-producing facility near Honolulu.

1947

Alfred B. Brown, Jr., MS, PhD '50, writes that he is still on the technical staff of the Bell Telephone Laboratories in Murray Hill, N.J., working on data communication system development. He has been with Bell since 1956. He has two children – Alan, 3½, and Caroline, 18 months.

David Hagelbarger, PhD, is in the systems research department of the Bell Labs. He has been with the company since 1949. The Hagelbargers have two children – John, 6, and Ann, 3.

Frank Estabrook, MS, PhD '50, has been named chief of the physics section at Caltech's Jet Propulsion Laboratory. He was formerly a research group supervisor in the same section.

1948

Thomas H. Stix, associate head of the experimental division at the Plasma Physics Laboratory (formerly Project Matterhorn) at Princeton University, is spending a year's leave at the Weizmann Institute of Science in Rehovoth, Israel. He is on an NSF postdoctoral fellowship. "Israel," he writes, "is an intriguing combination of the climate of southern California, the mysticism of the Levant, the industry of Glendale, the pioneer spirit of the early West, the sophistication of Princeton, and the archaeology of the Old Testament."

Robert Heppe, senior project engineer at the ITT Federal Laboratories in Caldwell, New Jersey, is active in the United Federalists and is a member of the N.Y. State Executive Council of UWF. The Heppes have three children.

Frank F. Scheck, attorney and counselor at law, has been named a member of the firm of Pennie, Edmonds, Morton, Barrows and Taylor in New York.

1949

Herman S. Dichter, MS, is senior project engineer at the Hughes Aircraft Engineering Division in Culver City. The Dichters have three children – two girls, 1 and 6, and a boy, 3.

Carl Price, associate professor of plant physiology at Rutgers University, writes that he now has a fourth child – Christopher. The Prices are enjoying the quiet village life of a part of New Jersey that is still rural.

1951

Thomas W. Connolly, MS '52, engineering section head for computing and data reduction in the systems engineering department (Marine) of the Sperry Gyroscope Company in Long Island, is co-author of *Analog Computation in Engineering Design*, published last year by McGraw-Hill.

1953

Frank A. Ludwig is now associate manager of the chemical research department of Electro-Optical Systems, Inc., in Pasadena. He is responsible for direction of the division's fuel cell program and for assistance in the continued development of the company's chemical research capabilities. He has been with the company since 1958.

Commander William M. Pardee, AE, is now commanding Carrier Anti-Submarine Air Group 53 in San Diego (composed of VS 21, VS 29 – both use 52 F aircraft and HS 6 – using ASW helos.) His former billet was as commanding officer of Air Anti-Submarine Squadron 37, which went on to win the Com. Nav. Air Pac E as top VS squadron, the CNO Safety Award for VS, and the Isbell Award for VS – a clean sweep of top awards.

1954

Ronald Ratney is now assistant professor of chemistry at Hood College in Maryland. After receiving his PhD from Yale in 1959, Ron worked two years as research chemist at the Trubek Laboratories in New Jersey. The Ratneys have a son and daughter.

1957

Gerd Tuchen, MS, a member of the technical staff of the Bell Telephone Laboratories, is working on the repeater for the 1-MC submarine cable system. He graduated from Bell Labs' communications development training program in 1960 which automatically gave him an "MEE" degree from N.Y.U.

Thomas W. Cooper is now working for the Bechtel Corporation as a field engineer on the construction of a chemical plant in New Castle, Delaware. He was married to Joy Oursler of Palos Verdes on November 25.

Richard W. Michie is now assistant professor of astronomy at the University of California in Berkeley. He received his PhD in astronomy from Princeton last June. The Michies have an 8-month-old son, David.

Charles W. Stephens, MS, has been appointed associate manager of the advanced power systems division of Electro-Optical Systems, Inc., in Pasadena. He has been with the company since 1958.

1959

Richard A. Baugh, MS '60, electrical engineer at Hewlett-Packard Company in Palo Alto, was married to Marcia Davidove on December 27.

Alan G. Bodine, MS, entered the Army in October and is now assigned to the Army Garrison at Fort Detrick, Maryland.

1961

Marvin Chester, who will receive his PhD from Caltech in June, is now a physicist in the solid state division at Electro-Optical Systems, Inc., in Pasadena.

Save the date

of May 6

for the

ANNUAL

ALUMNI

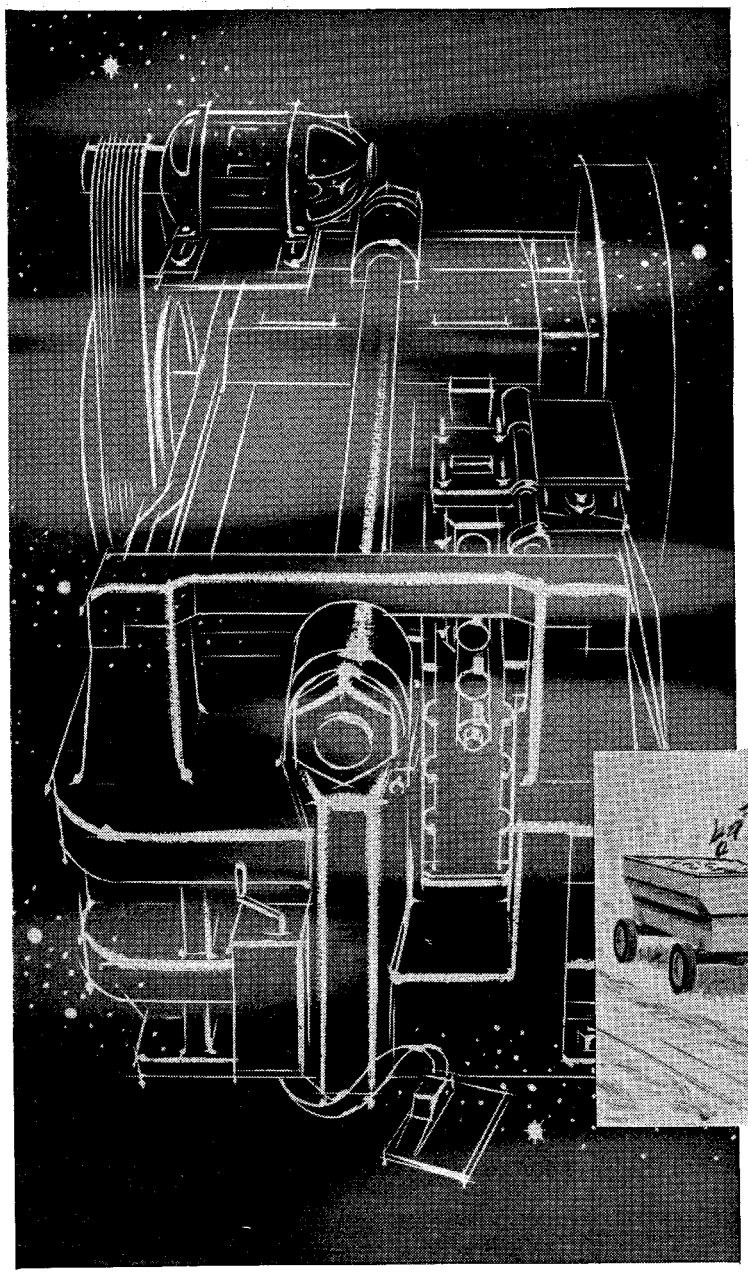
SEMINAR

beginning at 8:30 a.m.

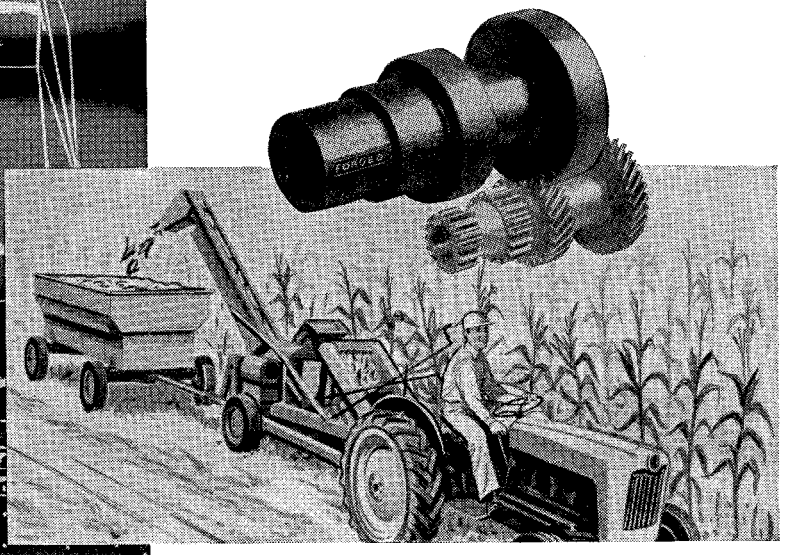
on the Caltech campus

Dinner at 6:30 at the

Huntington-Sheraton Hotel



RESISTANCE TO PUNISHMENT of any severe-service part increased by designing it to be forged



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Gear blanks for tractor and farm implement transmissions are designed to be upset-forged, usually with integral forged stub shafts. Forging gives these vital parts maximum resistance to gear-clashing shifts. Transmission life can be equal to equipment life when gears are FORGED.

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A universal constant?

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Is light affected by gravity?

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Energy conversion is our business

ALLISON

Division of General Motors, Indianapolis, Indiana

CALTECH CALENDAR

ALUMNI EVENTS

March 4	Annual Dinner Dance
May 6	Annual Seminar
June 7	Annual Meeting

ATHLETIC SCHEDULE

TRACK

February 25
Conference Relays at Redlands

March 4
Claremont-Harvey Mudd at Caltech

SWIMMING

March 2
Cal Poly (Pomona), San Fernando State at Caltech

March 4
Conference Relays at Claremont-Harvey Mudd

March 9
Redlands at Redlands

BASEBALL

March 1
La Verne at Caltech

March 4
Pasadena College at Caltech

March 8
La Verne at Caltech

FRIDAY EVENING DEMONSTRATION LECTURES

Lecture Hall, 201 Bridge, 7:30 p.m.

February 24
The Structural Problems of Missiles and Space Vehicles
—Ernest E. Sechler

March 3
Magneto Fluid Dynamics
—Hans Liepmann

March 10
Enzymes—Biological Catalysts
—Dudley Thomas

March 17
Time Measurements and Daily Rhythms in Living Organisms
—Hendrik J. Ketallapper

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Luncheon first Friday of each month
Visiting alumni cordially invited—no reservation

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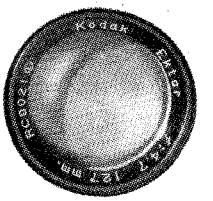
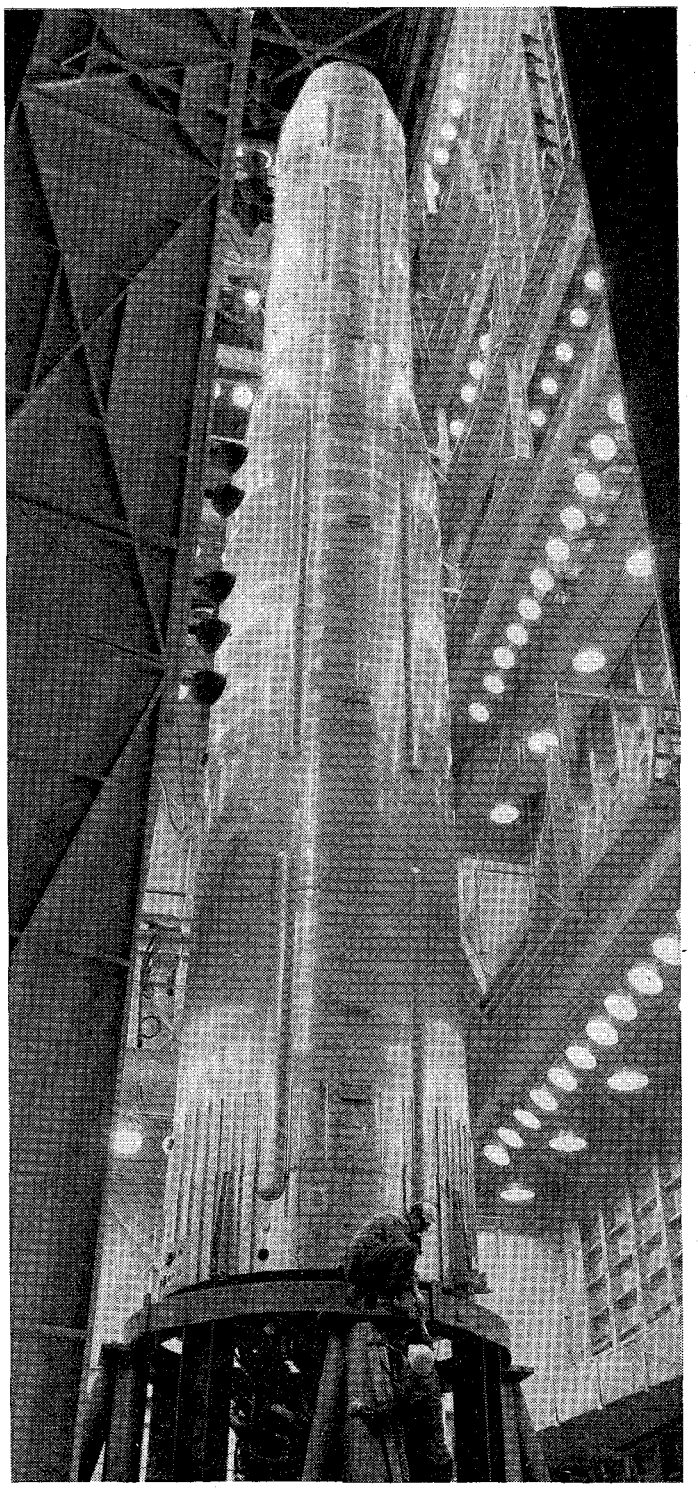
If your sights are set  on outer space–



U.S. Air Force I.C.B.M. "Titan" shown in the vertical test laboratory at the Martin Company, Denver, Colorado.

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TRADE MARK

One of a series*

Interview with General Electric's W. Scott Hill Manager—Engineering Recruiting

Qualities I Look For When Recruiting Engineers

Q. Mr. Hill, what can I do to get the most out of my job interviews?

A. You know, we have the same question. I would recommend that you have some information on what the company does and why you believe you have a contribution to make. Looking over company information in your placement office is helpful. Have in mind some of the things you would like to ask and try to anticipate questions that may refer to your specific interests.

Q. What information do you try to get during your interviews?

A. This is where we must fill in between the lines of the personnel forms. I try to find out why particular study programs have been followed, in order to learn basic motivations. I also try to find particular abilities in fields of science, or mathematics, or alternatively in the more practical courses, since these might not be apparent from personnel records. Throughout the interview we try to judge clarity of thinking since this also gives us some indication of ability and ultimate progress. One good way to judge a person, I find, is to ask myself: Would he be easy to work with and would I like to have him as my close associate?

Q. What part do first impressions play in your evaluation of people?

A. I think we all form a first impression when we meet anyone. Therefore, if a generally neat appearance is presented, I think it helps. It would indicate that you considered this important to yourself and had some pride in the way the interviewer might size you up.

Q. With only academic training as a background, how long will it be before I'll be handling responsible work?

A. Not long at all. If a man joins a training program, or is placed directly on an operating job, he gets assignments which let him work up to more responsible jobs. We are hiring people with definite consideration for their potential in either technical work or the management field, but their initial jobs will be important and responsible.

Q. How will the fact that I've had to work hard in my engineering studies, with no time for a lot of outside activities, affect my employment possibilities?

A. You're concerned, I'd guess, with all the talk of the quest for "well-rounded men." We do look for this characteristic, but being president of the student council isn't the only indication of this trait. Through talking with your professors, for example, we can determine who takes the active role in group projects and gets along well with other students in the class. This can be equally important in our judgment.

Q. How important are high scholastic grades in your decision to hire a man?

A. At G.E. we must have men who are technically competent. Your grades give us a pretty good indication of this and are also a measure of the way you have applied yourself. When we find someone whose grades are lower than might be expected from his other characteristics, we look into it to find out if there are circumstances which may have contributed.

Q. What consideration do you give work experience gained prior to graduation?

A. Often a man with summer work experience in his chosen academic field has a much better idea of what he wants to do. This helps us decide where he would be most likely to succeed or where he should start his career. Many students have had to work hard during college or summers, to support themselves. These men obviously have a motivating desire to become engineers that we find highly desirable.

Q. Do you feel that a man must know exactly what he wants to do when he is being interviewed?

A. No, I don't. It is helpful if he has thought enough about his interests to be able to discuss some general directions he is considering. For example, he might know whether he wants product engineering work, or the marketing of technical products, or the engineering associated with manufacturing. On G-E training programs, rotating assignments are designed to help men find out more about their true interests before they make their final choice.

Q. How do military commitments affect your recruiting?

A. Many young men today have military commitments when they graduate. We feel it is to their advantage and ours to accept employment after graduation and then fulfill their obligations. *We have a limited number of copies of a Department of Defense booklet describing, in detail, the many ways in which the latter can be done. Just write to Engineering Personnel, Bldg. 36, 5th Floor, General Electric Company, Schenectady 5, N. Y.* 959-8

***LOOK FOR other interviews discussing: • Advancement in Large Companies • Salary • Personal Development.**

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