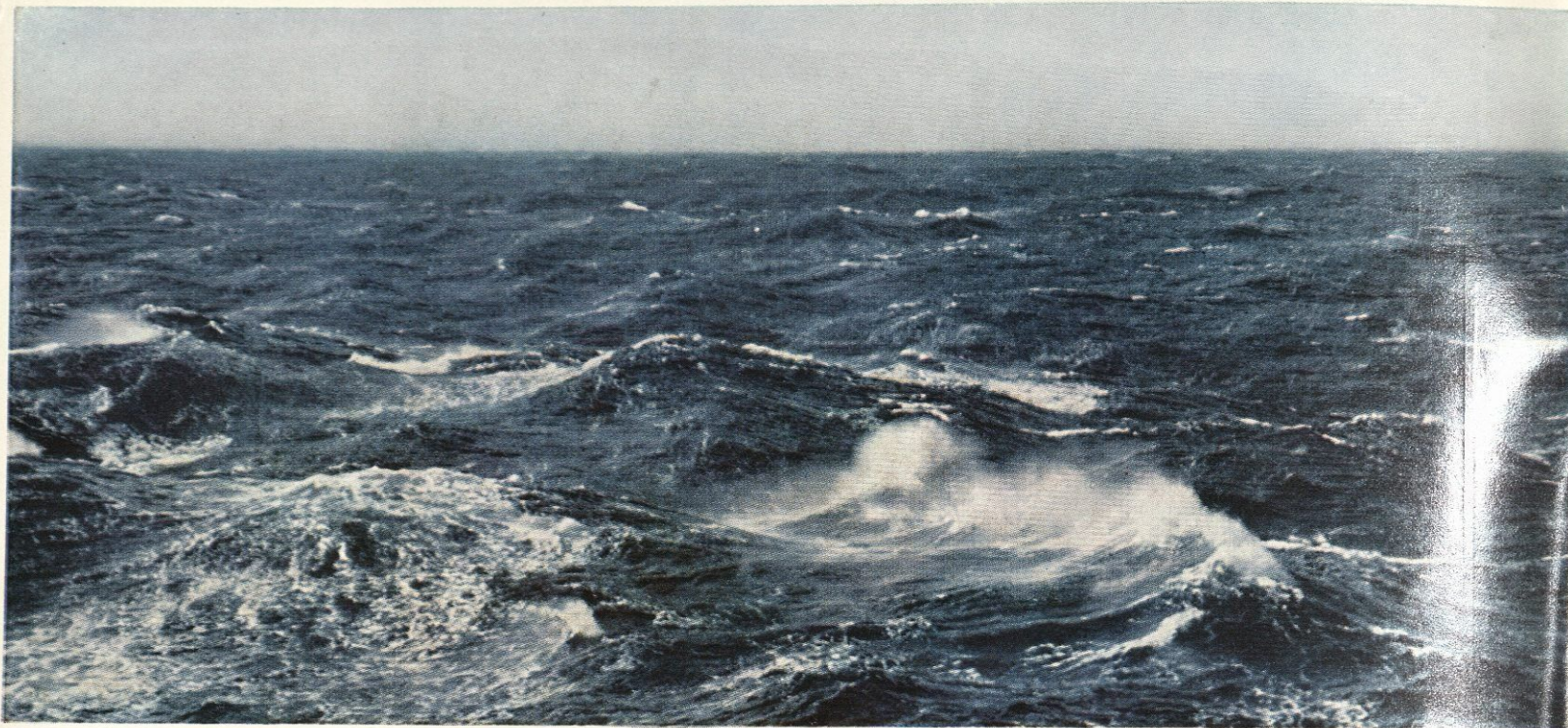


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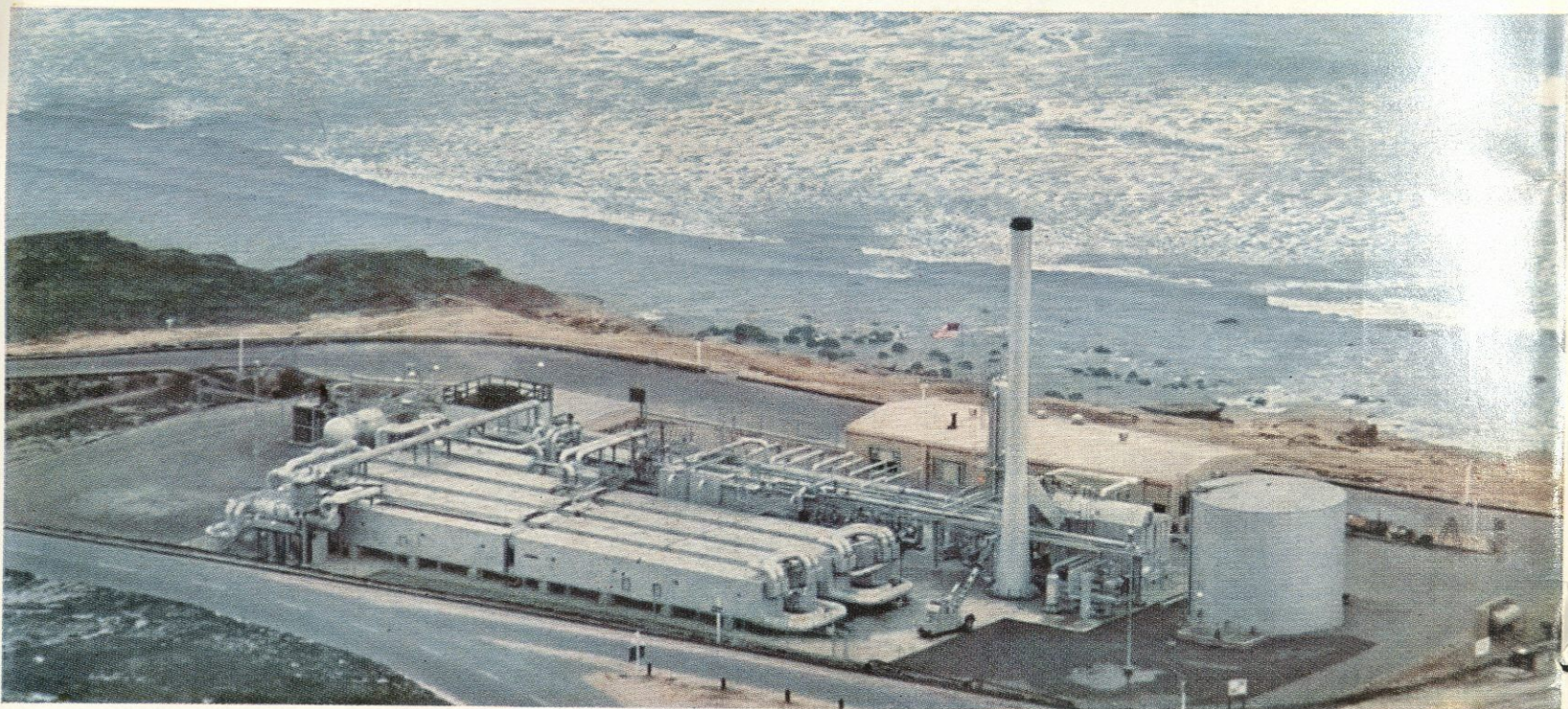


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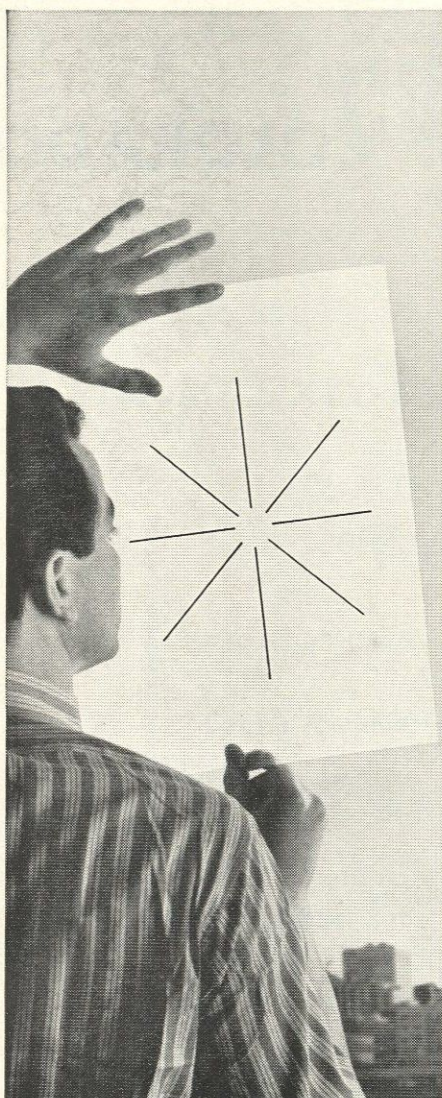
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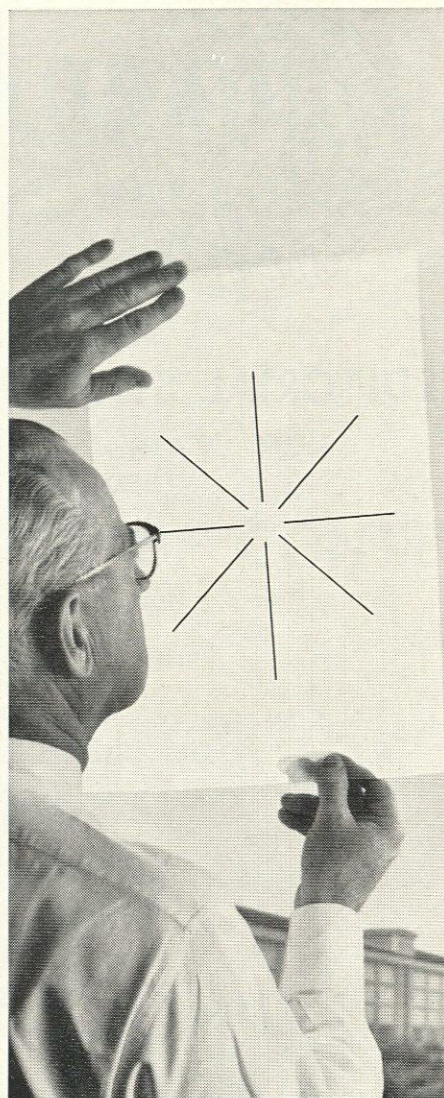
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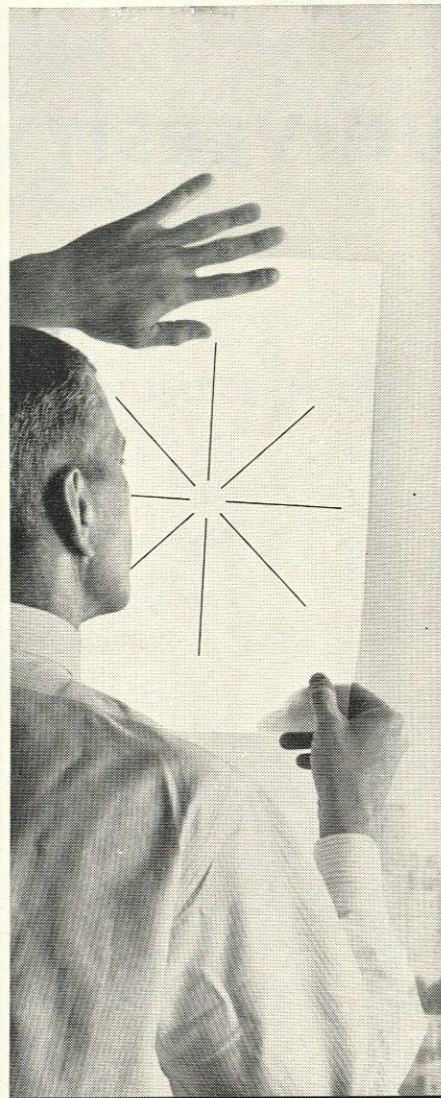
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TABLE OF CONTENTS

7	Editorial	<i>Fred Love</i>
9	Dean's Column	<i>Charles A. Hutchinson</i>
10	Proud Past, Bright Future	<i>Margaret Shipley</i>
14	Indeterminism in Physics and Robert Frost's Poetry	<i>Howard White</i>
17	Hutch	<i>Larry Davis</i>
19	E-Days	
36	Simulation	<i>Jerry Zimmerman</i>
38	Tau Beta Pi and Sigma Tau Pledges	
40	The Colorado Engineer Staff	
44	This Today	<i>Jerry Zimmerman</i>
46	The Goals of Engineering Education	<i>Klaus D. Timmerhaus</i> <i>Max S. Peters</i>
48	Index to Advertisers	
50	Puzzle Page	<i>Bruce Dunn</i>
52	Chips	<i>Fred Love</i>

COVER: This is Jerry Carroll's conception of the nine million dollar Engineering Sciences Center that was dedicated during E-Days. See the E-Days Section beginning on page 19.

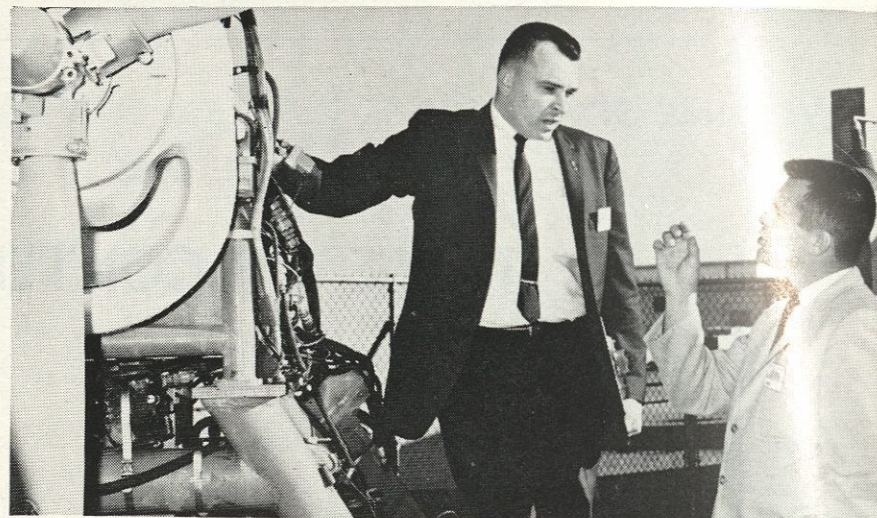
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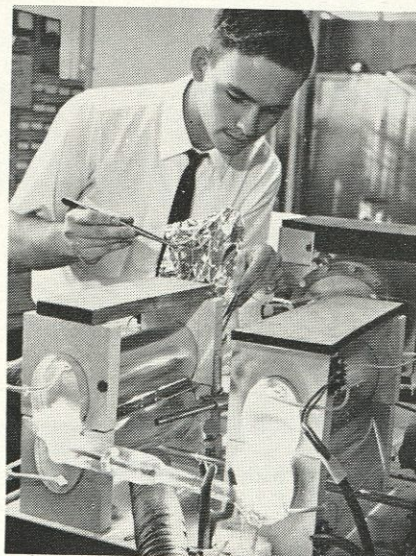
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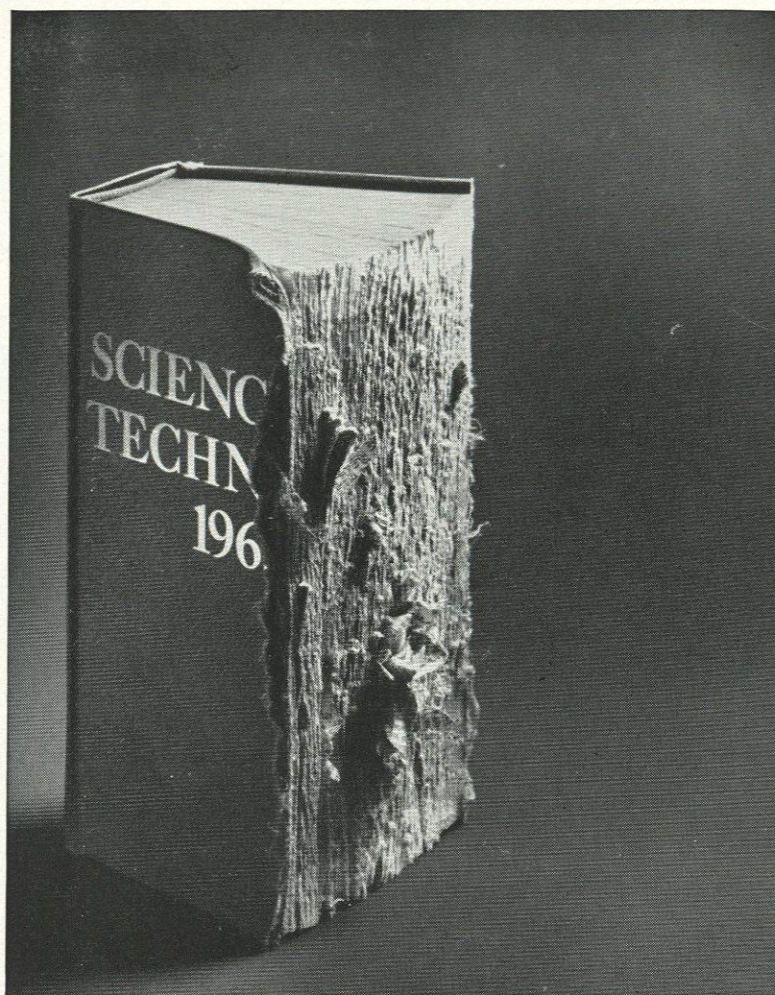
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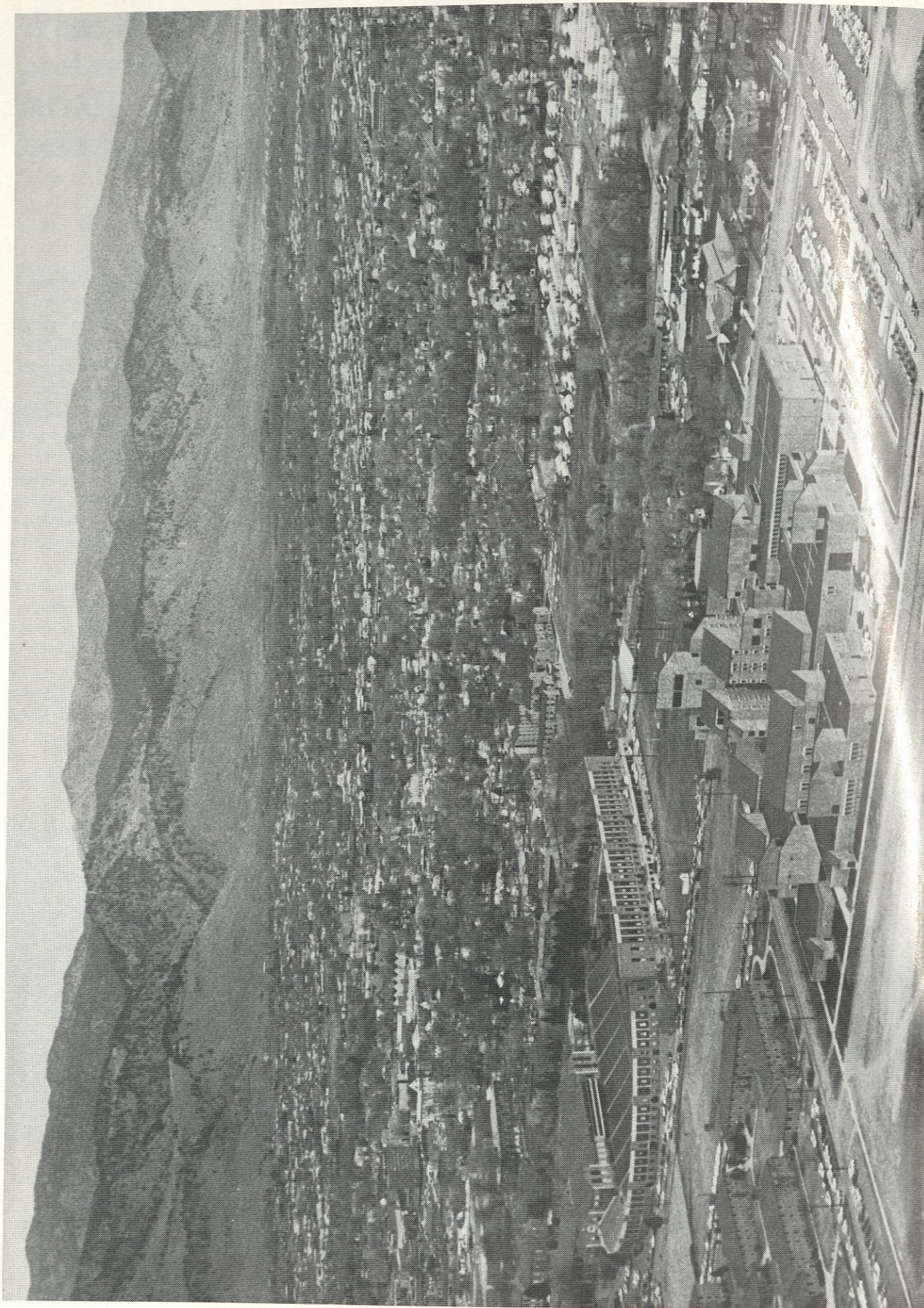
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EDITORIAL:

A PARTING SHOT

The University is presently in a dilemma. The physical facilities must be expanded rapidly to meet the growing influx of students, but the University is also rapidly running out of space. The grassy lawns are being replaced by sidewalks between buildings, and the problem still has not been solved. The solution is, of course, to build upward—elevators have become cheaper than land.

The beauty of the University of Colorado has been the harmony between the campus and the natural scenery around it. Without arguing the merits of the so-called "Italian Renaissance" architecture, let us simply say that the sandstone walls and tile roofs of this campus did nothing to mar a natural beauty unequalled in most of the world.

While the amity between man and nature is perhaps more difficult to maintain with taller, more intrusive structures, it can exist. Proof of this can be seen in the new facilities of NCAR on Table Mesa or, to some extent, in our controversial Williams Complex dormitories. Complete disregard for this harmony can be found in the new Physics building and in our own Engineering Center. Physics attempts to be too modern—a patchwork of sandstone squares between cantilevered concrete pillars while this place is simply too rough and ugly to blend with nature.

Viewed alone, the Engineering Center is, at best, tasteless. In the setting that was the University of Colorado, it is practically criminal.

—Fred E. Love

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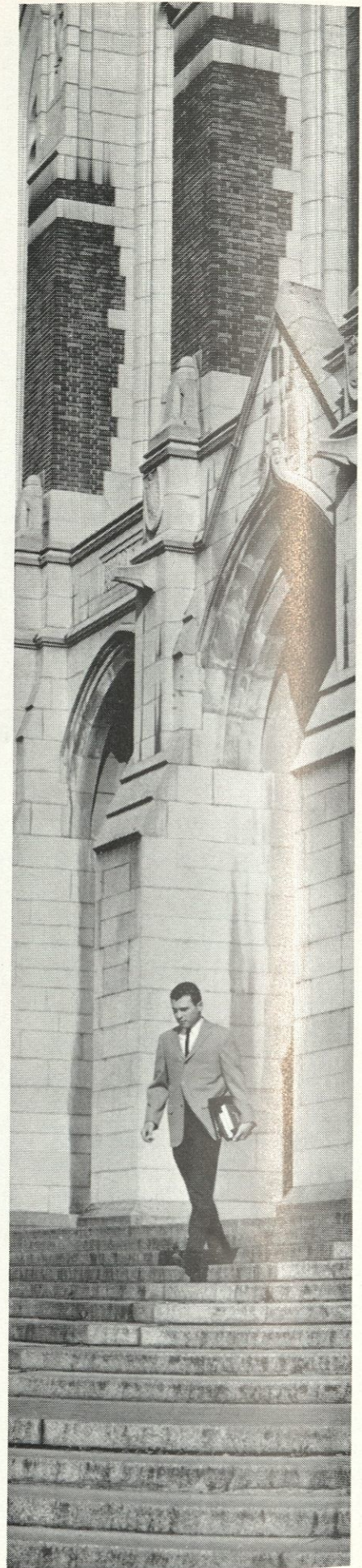
This year Boeing celebrates its 50th Anniversary. From a small shop

in 1916, it has expanded into an aggressive, eminently successful and still growing organization, with sales over \$2 billion in 1965. The power behind this remarkable growth has been a forward-striding attitude, an orientation toward the future which, over the years, has produced a steady succession of pioneering, years-ahead achievements.

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DEAN'S COLUMN:

Dean Peters has kindly offered me his space in the issue of the *Colorado Engineer* to appear before my official retirement 30 June. In so doing, he spoke of a "swan song." This I find inappropriate. In the first place, I can't sing. Next, in one capacity or another, I hope to be staying around the College for a while.

I suppose it is customary on such occasions to turn one's thoughts backward, to look with amazement on the changes that have come to pass during a tenure of forty-eight years. It seems better, to look forward. With the dedication this Spring of our new Engineering Center, I can only be happy that I have survived to see the fulfillment of dreams of long duration.

Back in the late fifties, we began to see that engineering was about to enter a new era, and we began to plan to make the necessary progress. We saw that our needs were to be both human and material. We needed more faculty, with an infusion of young blood; we desperately needed more space, with more modern equipment and facilities.

As a result of long-range planning, but not without some struggles, we eventually got the desired authorization to go ahead, and secured the necessary financing. Next, we began to receive stronger salary support, for the upgrading of present positions and the creation of new ones. We have been able to make the growth in faculty more rapid than the increase in the student body, so that the unbearably heavy teaching loads of the past are no more. The percentage of faculty members holding advanced degrees has increased strikingly, as has the number of graduate students.

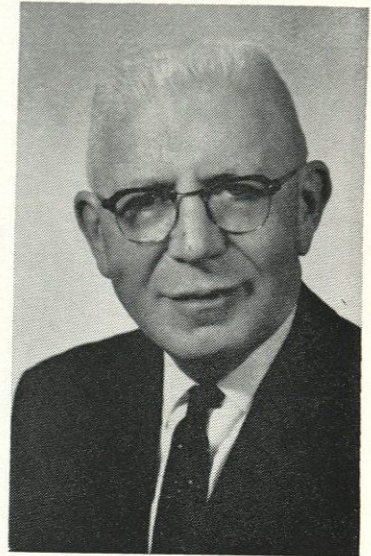
Maybe I might look back just a bit, especially since I have just mentioned graduate work. When I became Acting Head of Engineering Mathematics in 1921, we had no graduate work. I started it with Differential Equations—now a standard sophomore course. Over the years, as we developed our graduate courses, we have seen them move downward—not in quality, but in class level. Just a few years ago, for example, Laplace Transform methods were the exclusive property of a few advanced graduate students; now the sophomores are introduced to them in Circuit Analysis.

This is the most prominent memory of almost half a century—the tremendous change in engineering education from a "how to do it," largely empirical, discipline to a profession with a sound basis in mathematics and the theoretical physical sciences.

In spite of that last word, "sciences," we haven't forgotten that we are a College of Engineering, and we intend to keep it as such. We pay full tribute to the necessity of pure science on which we build our work—for the betterment and service of mankind.

Now, on the eve of retirement, I am glad that I have been privileged to have a small part in a glorious adventure to work with some of the great of a past generation. I hope I can survive long enough to see some of the developments that are sure to come in the years just ahead.

—Charles A. Hutchinson



Dean Charles A. Hutchinson

PROUD PAST BRIGHT FUTURE

One night in the fall of 1902 the streets of Boulder were the scene of an unusual parade: bringing up the rear was a forty-foot banner lettered LAST BUT NOT LEAST carried by students in greasy overalls. Behind them came three floats — a miniature building twelve feet long with windows lighted and smoke pouring from a tall chimney, a forge, lathe and anvil—with men at work on them, and last, a white dome fourteen feet high blazing with electric lights rigged to a dynamo run by a gasoline engine.

It was the Quarto-Centennial celebration of the University of Colorado. But for the College of Engineering, then called the School of Applied Science, it was the ninth year of a shaky start toward professional recognition in a largely classic-minded academic world. The replica of the engineering building, the forge and anvil, and the electric lights, represented about all there was of the college, its handful of professors, and its 125 students.

Dean of this brave start in 1893 was Civil War veteran, and veteran of the Indian war of 1864, Major Henry

MARGARET SHIPLEY

Fulton, who had enrolled in the University as a freshman at the age of 40. Graduated in 1891, he was chosen by President Baker to spend a year at the University of Michigan taking courses in civil and electrical engineering. The first offerings of the School of Applied Science, which opened to a single student named Frederick Whiteside, were patterned after those at the University of Michigan.

Whiteside was farmed out to classes and laboratories in Hale and Old Main until the Christmas holidays, when his shopwork was moved to the new engineering building. This was a one-story tin-roofed brick structure "of most doleful appearance," as described by George Rowe who arrived that fall from Michigan as professor of physics and electrical engineering. The building was added onto and dedicated in 1898, and was used until 1938, when it was razed to make room for Norlin Library.

"The Little Professor Rowe" wrote years later of that first semester: "It immediately became a problem to devise ways and means of giving all the courses we had advertised. The University had very little money . . . However, the Major got a few hundred dollars for surveying instruments and I secured a dynamo and

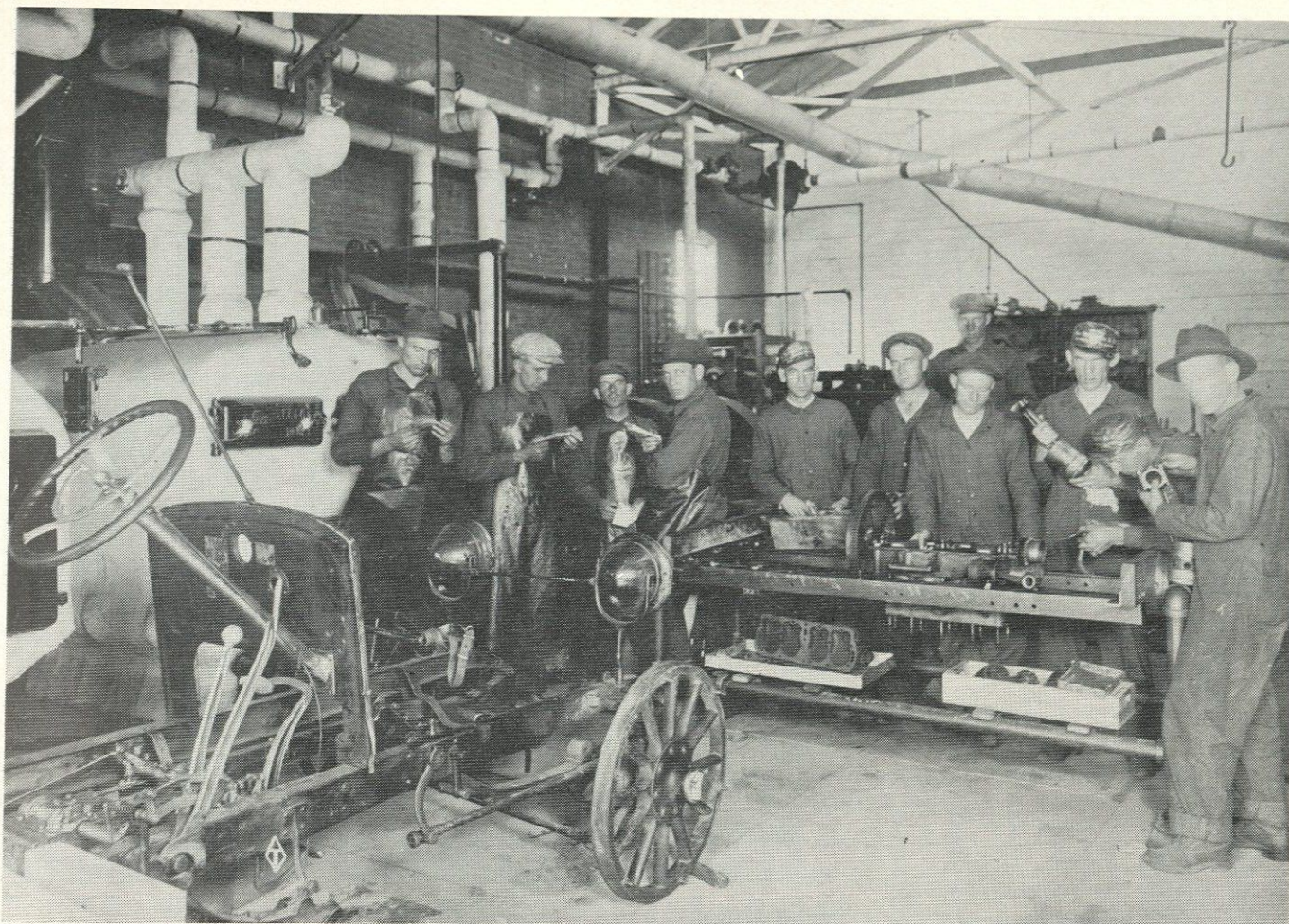
a few lathes . . . These formative years were hard at best, but with almost no money the work was disheartening."

In its second year the "Engine School" enrolled four students, the next year nine, and the success of the engineering experiment seemed assured. At the turn of the century 51 students were working for degrees in applied science. By 1906, when the school was named the College of Engineering, a department of mechanical engineering had been added which offered courses in chemical engineering as well, and there were departments of engineering drawing and applied mathematics. Two hundred and twenty students were enrolled.

Three great teachers led the civil, electrical, and mechanical engineering programs for the next fifteen years. Of Milo Ketchum, head of civil engineering and dean of the college from 1905 to 1919, a student wrote, "They don't make any better teachers than our Uncle Milo Ketchum." And of Herbert Evans, head of electrical engineering, who served as dean from 1919 to 1943, a student said, "Everybody in class swears by Shorty Evans because he gives you a yard wide, all wool, Teddy Roosevelt square deal." John Andrew Hunter,

ABOUT THE AUTHOR

Margaret Shipley is co-author with Siegfried Mandel, of *Proud Past—Bright Future: History of the College of Engineering at the University of Colorado 1893-1966*. The hard bound volume — about 400 pages and more than 200 photographs—is obtainable at \$6.50 from the University of Colorado Press.



FUTURE MECHANICAL ENGINEERS LEARN BY DISSECTION.

head of mechanical and chemical engineering, was known on campus and in Boulder as "Uncle John."

These were the years of high-spirited rivalry between the Engineers and the Laws, of such yells as *Three cheers, three beers, roughnecks, roughnecks, Engineers!*, the first Engine Ball, the first meetings of the technical societies and honoraries, the first student magazine which later became the highly rated *Colorado Engineer*.

The work of the engineers was practical: they built a bridge over the ditch at 17th Street and graded a railroad from the campus to Ford, Kansas; they tested cement and timber and soils and stone for the State of Colorado. They tested the power plant for the City of Boulder, oils and fuels for the state oil inspector, and performed efficiency tests for Colorado & Southern Railroad shops in Denver.

Junior-senior trips were taken by train to Pueblo, Georgetown, Cripple

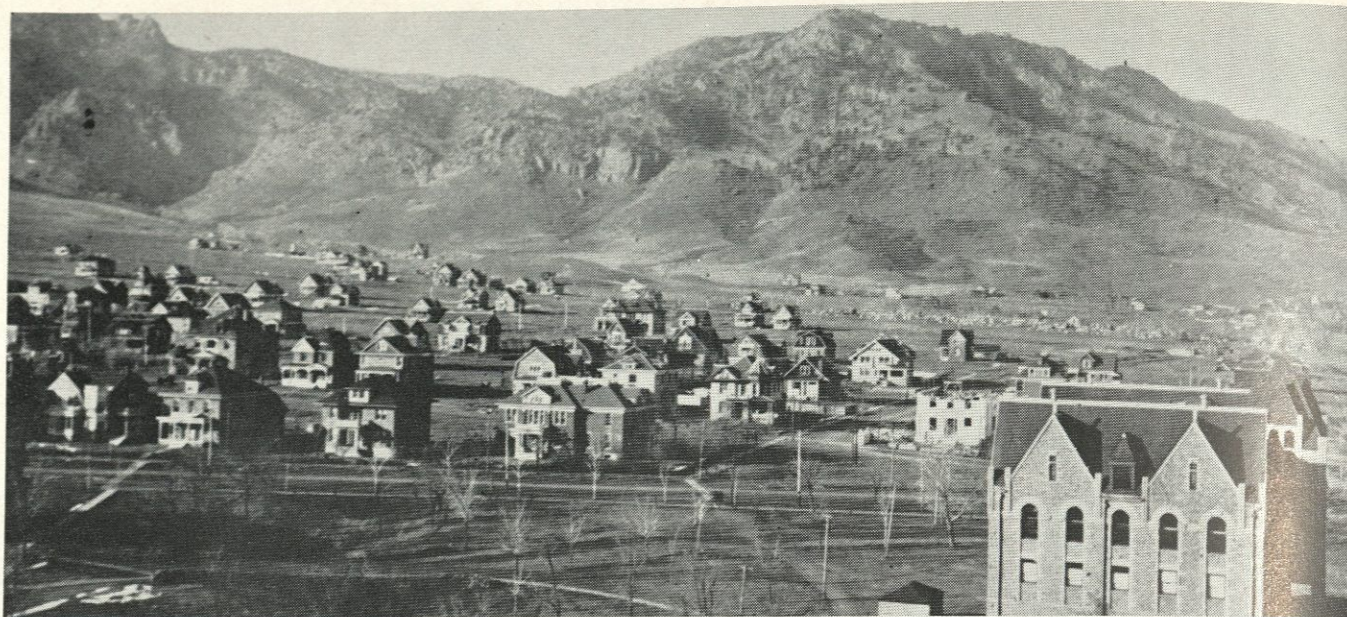
Creek, and Denver for inspection of power plants, mines, and public works. On one such trip, students who had secretly planned a wild celebration at an overnight stop in Glenwood Springs found themselves spending the night in their berths on a siding many miles beyond: Dean Ketchum, alert to rumors, had thwarted the plan.

World War I opened up new vistas to the College of Engineering. The engineer, said Dean Emeritus Milo Ketchum, must have "general training, technical training, professional experience, high moral character, knowledge of men, broad vision, administrative and business experience." The college devoted the next twenty years, with the help of University President George Norlin, to these ideals.

Dean Evans was faced with a growing post-war enrollment under crowded conditions and with little money. The shops building (Hunter), in use since 1908, was remodel-

led for mechanical engineering; electrical and civil engineering moved out of the original engineering building into Engineering I, built by Student Army Training Corps construction crews during the war. Still, enrollment increased, revenue declined. In these "boom" years the job sought the man, but in the College of Engineering valuable equipment lay idle for lack of space.

In the early Thirties the engineering departments suffered a drastic cut in appropriations. The Depression was on: hobos dropped off the trains for a warm night in the University power plant while the chief engineer looked the other way. The engineering student, who had no job waiting for him, was inclined to stay a fifth year in college. But he studied in crowded quarters; there had been no increase in floor space for twelve years. Eventually the space emergency was partially met by the legislature with passage of a second ten-year mill-levy building plan. On



SUBURBIA APPROACHES THE HILL. THAT'S HALE (BRAND NEW) IN THE BACKGROUND.

the day of the annual Applefest, November 3, 1937, the first load of stone arrived for an engineering administration building, to be named after Milo Ketchum.

Faculty who had pioneered engineering at CU weathered the Depression to go on to more years of service. Among them were Charles McCormick, Clinton LuVall, and Frank Eastom of electrical engineering; Charles A. Wagner, Wayne Beattie, and Walter Mallory of mechanical; Clarence Eckel of civil; Walter Nelson and Charles Hutchinson of mathematics; William Brubaker of drawing; Otto Birk of English; John Ekeley, Paul Dean, and Frank Germann of chemistry; and Oliver Lester and William Pietenpol of physics.

The old belt-driven machines with overhead shaft typical of the early machine shops became obsolete about 1940: machines were individually motorized for the sake of space and economy. Wood and metal shopwork was gradually phased out. In the pre-World War II laboratories new courses developed out of the innovations of the Thirties: airconditioning, refrigeration, model dam testing, vacuum tubes, radio circuits, electronics, industrial chemistry.

Bluejackets and airplanes charac-

terized the work of the College of Engineering in World War II. The Navy ROTC moved into Ketchum building and naval staff officers became members of the faculty. Naval enlisted men were instructed in radio; the Civilian Pilot Training Program devoted itself to naval trainees. The V-12 and V-5 programs were taken aboard "with a minimum of difficulty and dislocation." During the war years Dean Evans retired and Clarence Eckel became dean.

As an outcome of the war, aeronautical engineering came into its own as a department in 1946; today, as the Department of Aerospace Engineering Sciences, it offers courses in the space-age technologies. Chemical engineering undertook research in levulose and shale oil; a curriculum in architecture, delayed by the Depression and the war, was added to the architectural engineering courses offered by the civil engineering department. By 1951 work was begun in the mechanical engineering department on rocket nozzles. Computers, transistors and other solid state devices became fundamental to electrical engineering work.

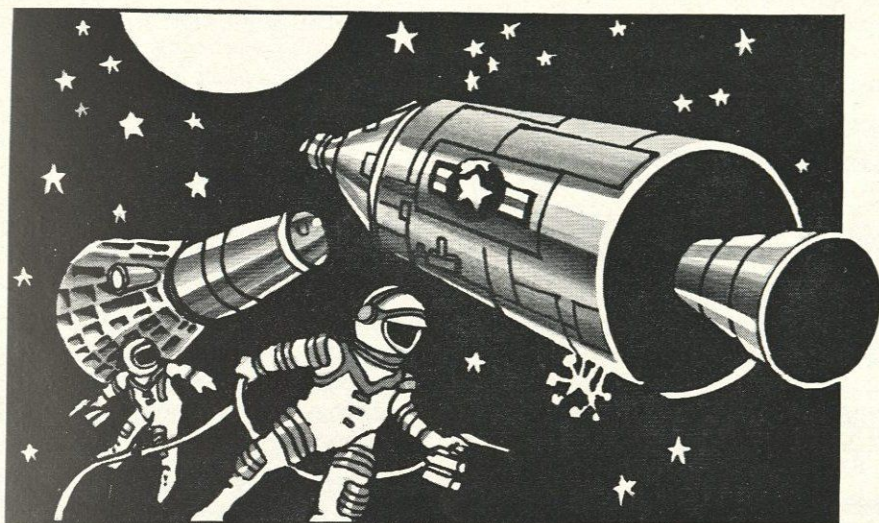
With the Sixties, a bold plan was evolved: the College of Engineering would move into a center of its own

on the east campus; other colleges of the University would be able to expand; new frontiers in undergraduate teaching and graduate laboratory research in engineering could be explored. Today the Engineering Center is a reality: around a plan of open walks and courtyards and a central office tower, aerospace, electrical, mechanical, chemical, and civil engineering laboratories and classrooms are arranged for future expansion.

The engineering student body today, seventy-three years after the first lonely student enrolled in the School of Applied Science, numbers 1552 undergraduates and 350 graduate students, including 120 Ph.D. candidates.

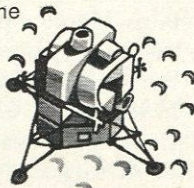
In 1892, when President Baker asked the regents for a Scientific (Technological) School, he said, "We believe this school will become an important department in the University." In 1963, a National Science Foundation grant of \$1,325,000 and an appropriation of \$7,200,000 from the people of the State of Colorado for construction of the Engineering Center spoke as a vote of confidence in the past and future of the College of Engineering.

Here are 7 knotty problems facing the Air Force: can you help us solve one?

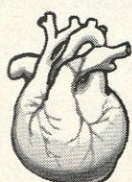


1. Repairs in space. If something goes wrong with a vehicle in orbit, how can it be fixed? Answers must be found, if large-scale space operations are to become a reality. For this and other assignments Air Force scientists and engineers will be called on to answer in the next few years, we need the best brains available.

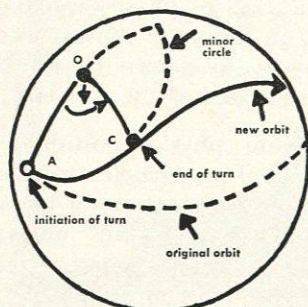
2. Lunar landing. The exact composition of the lunar surface, as well as structural and propulsion characteristics of the space vehicle, enter into this problem. Important study remains to be done—and, as an Air Force officer, you could be the one to do it!



3. Life-support biology. The filling of metabolic needs over very extended periods of time in space is one of the most fascinating subjects that Air Force scientists are investigating. The results promise to have vital ramifications for our life on earth, as well as in outer space.



4. Space orientation. The orbital problems of a spacecraft, including its ability to maneuver over selected points on the earth, are of vital importance to the military utilization of space. There are plenty of assignments for young Air Force physicists in this area.

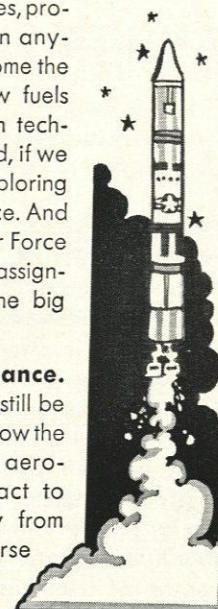


5. Synergetic plane changing. The ability of a spacecraft to change altitude can also be crucial to space operations. Where but in the Air Force could Sc.B.'s get the chance to work on such fascinating projects right at the start of their careers?

6. Space propulsion. As our space flights cover greater and greater distances, propulsion—more than anything else—will become the limiting factor. New fuels and new propulsion techniques must be found, if we are to keep on exploring the mysteries of space. And it may well be an Air Force scientist on his first assignment who makes the big breakthrough!

7. Pilot performance.

Important tests must still be made to determine how the pilots of manned aerospacecraft will react to long periods away from the earth. Of course not every new Air Force officer be-



comes involved in research and development right away. But where the most exciting advances are taking place, young Air Force scientists, administrators, pilots, and engineers are on the scene.

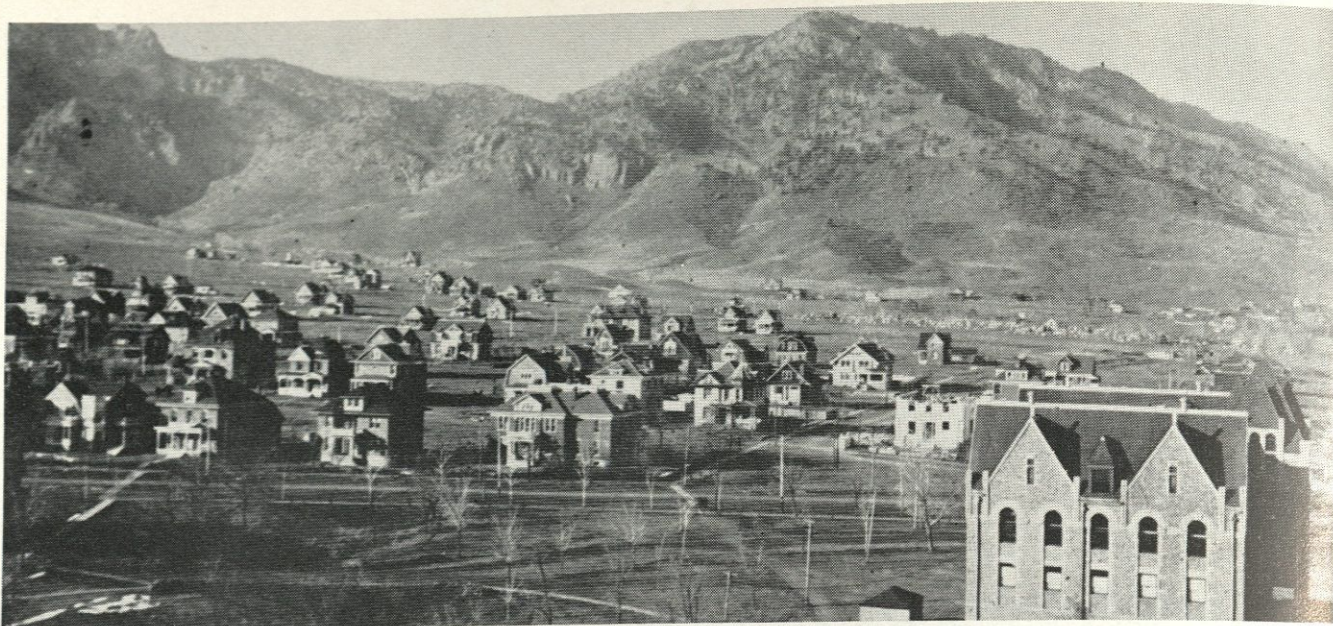
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Bluejackets and airplanes charac-

terized the work of the College of Engineering in World War II. The Navy ROTC moved into Ketchum building and naval staff officers became members of the faculty. Naval enlisted men were instructed in radio; the Civilian Pilot Training Program devoted itself to naval trainees. The V-12 and V-5 programs were taken aboard "with a minimum of difficulty and dislocation." During the war years Dean Evans retired and Clarence Eckel became dean.

As an outcome of the war, aeronautical engineering came into its own as a department in 1946; today, as the Department of Aerospace Engineering Sciences, it offers courses in the space-age technologies. Chemical engineering undertook research in levulose and shale oil; a curriculum in architecture, delayed by the Depression and the war, was added to the architectural engineering courses offered by the civil engineering department. By 1951 work was begun in the mechanical engineering department on rocket nozzles. Computers, transistors and other solid state devices became fundamental to electrical engineering work.

With the Sixties, a bold plan was evolved: the College of Engineering would move into a center of its own

on the east campus; other colleges of the University would be able to expand; new frontiers in undergraduate teaching and graduate laboratory research in engineering could be explored. Today the Engineering Center is a reality: around a plan of open walks and courtyards and a central office tower, aerospace, electrical, mechanical, chemical, and civil engineering laboratories and classrooms are arranged for future expansion.

The engineering student body today, seventy-three years after the first lonely student enrolled in the School of Applied Science, numbers 1552 undergraduates and 350 graduate students, including 120 Ph.D. candidates.

In 1892, when President Baker asked the regents for a Scientific (Technological) School, he said, "We believe this school will become an important department in the University." In 1963, a National Science Foundation grant of \$1,325,000 and an appropriation of \$7,200,000 from the people of the State of Colorado for construction of the Engineering Center spoke as a vote of confidence in the past and future of the College of Engineering.

Here are 7 knotty problems facing the Air Force: can you help us solve one?

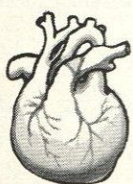


1. Repairs in space. If something goes wrong with a vehicle in orbit, how can it be fixed? Answers must be found, if large-scale space operations are to become a reality. For this and other assignments Air Force scientists and engineers will be called on to answer in the next few years, we need the best brains available.

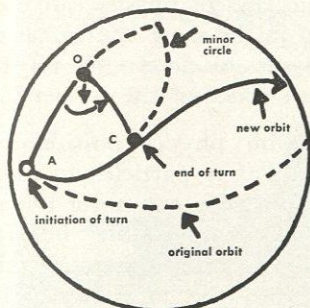
2. Lunar landing. The exact composition of the lunar surface, as well as structural and propulsion characteristics of the space vehicle, enter into this problem. Important study remains to be done—and, as an Air Force officer, you could be the one to do it!



3. Life-support biology. The filling of metabolic needs over very extended periods of time in space is one of the most fascinating subjects that Air Force scientists are investigating. The results promise to have vital ramifications for our life on earth, as well as in outer space.



4. Space orientation. The orbital problems of a spacecraft, including its ability to maneuver over selected points on the earth, are of vital importance to the military utilization of space. There are plenty of assignments for young Air Force physicists in this area.



5. Synergetic plane changing. The ability of a spacecraft to change altitude can also be crucial to space operations. Where but in the Air Force could Sc.B.'s get the chance to work on such fascinating projects right at the start of their careers?

6. Space propulsion. As our space flights cover greater and greater distances, propulsion—more than anything else—will become the limiting factor. New fuels and new propulsion techniques must be found, if we are to keep on exploring the mysteries of space. And it may well be an Air Force scientist on his first assignment who makes the big breakthrough!

7. Pilot performance. Important tests must still be made to determine how the pilots of manned aerospacecraft will react to long periods away from the earth. Of course not every new Air Force officer becomes involved in research and development right away. But where the most exciting advances are taking place, young Air Force scientists, administrators, pilots, and engineers are on the scene.



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INDETERMINISM

and

ROBERT FROST

HOWARD WHITE

One of the more interesting applications of physics has been of its implications concerning determinism and indeterminism. Newtonian physics is completely deterministic. According to Newtonian physics, with enough information any event could be exactly predicted. Likewise, the conditions necessary for an event to occur could be discovered by a sufficiently close analysis of the event. By an extension of this procedure one could then, theoretically, exactly measure the state of all the matter in the universe at some instant and by applying the classical laws of physics correctly predict or reconstruct any past or future state. This mechanistic point of view assumed that all matter, including the living, is governed by physical laws. If this hypothesis were indeed correct and the future could be exactly predicted by observing a past state, it would then in fact be determined by the past state. This past state would in turn be determined by a previous state and hence the entire universe would be deterministic. This argument was, of course, impossible to verify because of the vastness and complexity of the universe. Even the classical model of such a relatively simple system as an ideal gas had to be an inexact statistical theory because of the enormous numbers of gas molecules. However, the behavior of an individual molecule was still explained by a mechanism which was

governed by the deterministic, classical, physical laws. Thus, according to Newtonian physics, it was theoretically possible to predict the behavior of the universe by breaking it down into a series of mechanisms which obeyed classical laws.

Relativistic physics, because its laws are also exact, is still deterministic, although it redefines the concepts of time and distance. One obstacle to overcome in order to keep the theory of relativity deterministic is the concept of simultaneity. Due to simultaneity, two observers in different coordinate systems will not agree upon what the state of the universe is at a given instant or what a given instant is. This problem is, however, more one of application than of theory. Although the observers will not agree due to their different scales for measuring time and distance what the state of the universe is, they will both agree that it is exact. The relativistic laws of physics can then be applied in the same manner as classical physics to determine all future and past states of the universe.

Quantum physics postulates that the state of a particle, its position and momentum, can never be exactly measured due to the uncertainty principle. According to the relation $\Delta p \Delta x \geq h/2$, the more precisely the position or momentum (roughly the velocity; $p=mv$) of a particle is measured, the greater is the uncertainty about the other. According to one interpretation, not only can position and momentum not be simultaneously measured to any desired degree

of accuracy, but also, they are inherently inexact quantities. If this is true then the state of the universe is never exact and it is not completely governed by the deterministic laws of physics. In this view, the universe is somewhat random and therefore indeterminate.

There has been some question as to whether quantum physics is a complete physical theory or is just one whose results appear to agree with experiment. Einstein thought that quantum mechanics wasn't valid because of its indeterminism. He believed that quantum theory was just a mask which covered some hidden variables of a more exact theory. Although now physicists believe that Einstein was wrong and that there is a basic indeterminism in nature, the question is highly speculative.

Some of Robert Frost's poetry contains close parallels to physical theory. Many of his poems have in the background a dark, foreboding force against which man is constantly fighting. Possibly, one of the reasons Frost uses the pastoral scene so often is because it is closer to nature and the forces which control it. Frost begins "Mending Wall:"

Something there is that doesn't love
a wall.
That sends the frozen-ground-swell
under it,
And spills the upper boulders in the
sun,
And makes gaps even two can pass
abreast.

He later adds, "but its not elves exactly." One theme expressed in these lines is that of the unseen and destructive forces of nature which con-

ABOUT THE AUTHOR

Howard White is a sophomore in E. Physics or Chemistry. He belongs to Alpha Chi Sigma and participates in intermural.

stantly seek to destroy the ordered world which man has built. A similar idea is contained in the second law of thermodynamics. It states that entropy tends to increase or that the tendency towards disorder is a fundamental law of nature.

In "There Are Roughly Zones" a similar theme prevails. The poem is about two people who are grieving because a peach tree is dying outside in the cold winter night. It is dying because it was planted too far north where peach trees don't belong. Although this tree was definitely too far north, Frost brings in an element of uncertainty about how far north a peach tree may be grown:

Why is his nature [man's] so hard to teach
That there is no fixed line between
wrong and right,
There are roughly zones whose laws
must be obeyed.

Although Frost is concerned mainly with the moral values, the situation has a physical analogy. When photons travel through a diffraction grating it is impossible to predict where each one will go. However, by means of the Schroedinger equation one can determine the probable motion of a large number of photons. Similarly, although it can't be determined exactly how far north a peach tree will grow, one could predict the probability of a peach tree surviving at a certain latitude.

In the first stanza of "Design" Frost creates a small bit of the universe or, in more physical language, a system which he observes. His cosmos consists of a fat, dimpled spider on a white "heal-all" holding up a moth which it has just caught. This "witches brew," as he calls it, is comparable to a small segment of the universe which appears to be randomly constructed. In the second stanza he observes that there is some order in the system, for the spider has caught the moth and he asks why it occurred (what physical laws govern it).

What had that flower to do with
being white,
The wayside blue and innocent heal-
all?
What brought the kindred spider to
that height,
Then steered the white moth thither
in the night?

He answers the question with another and then wonders if such a small occurrence as a spider catching a moth could be predestined:

What but design of darkness to ap-
pall?—
If design govern a thing so small.

In such a manner Frost seems to suggest that large things might be governed by some design (such as the laws of physics) but the small occur in a random, haphazard manner. Moreover, the behavior of a baseball can be predicted with great certainty but the behavior of an electron cannot be.

In one of his later poems, "The White-Tailed Hornet," Frost observes

a hornet, which he previously thought to be infallible with his stinger, made a series of misses. He then remarks:

Won't this whole instinct matter
bear revision?
Won't almost any theory bear revision?

Just as deterministic and relativistic physics yielded to indeterministic quantum mechanics, quantum mechanics might well be revised into some new system, equally as different.

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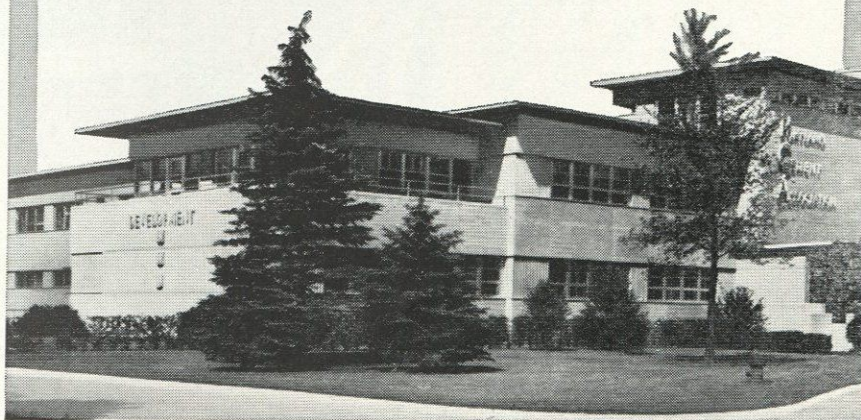
At Association headquarters, other engineers, writers and specialists prepare technical literature which is provided free to those in the building field. And daily, PCA field engineers call on project engineers, to bring them information on advances in concrete construction methods.

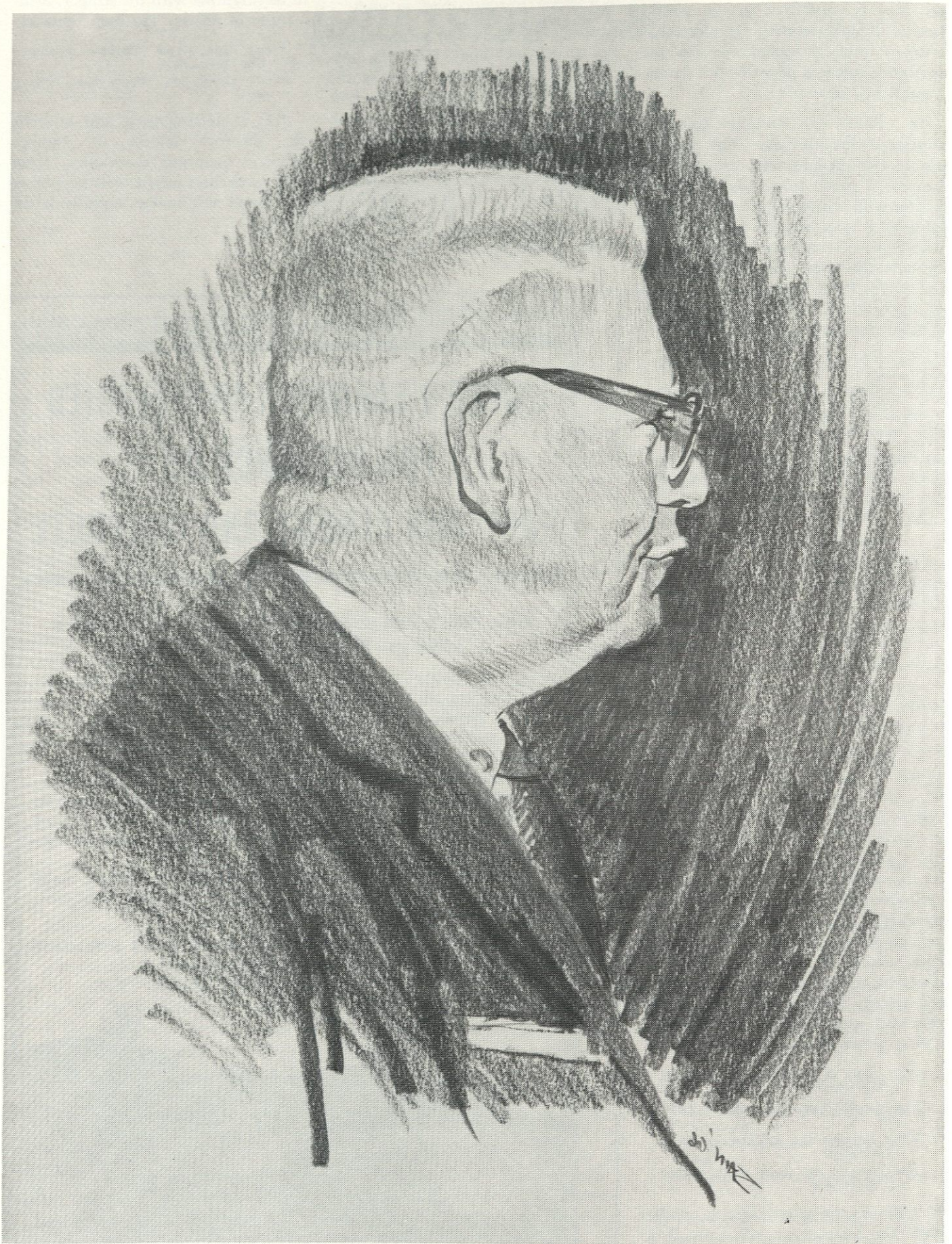
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HUTCH

LARRY DAVIS

He came to CU in the fall of 1918 from Wittenberg College in Ohio. On his first day here, he rode the trolley which ran through Boulder ("It was quite a treat.") And now, 48 years later, as the occasion of his retirement nears, he is being honored in many ways by a wide variety of people. He will retire formally on June 30; so it is with great pleasure that the *Colorado Engineer* takes this opportunity to give this account of some of his accomplishments at CU to supplement the tributes being paid him now.

Associate Dean Hutchinson began his career here in the College of Engineering's Engineering Math department. (The name was changed to "Applied Math" in 1948.) He became its head in 1921. At that time, the engineering building was situated where the north end of Norlin Library is now. There were no CU buildings to the east of it except Engineering I (opened in 1919) and Hunter. The old railroad ran nearby on its way to downtown Boulder, and twice each day the passing trains would disrupt classes for five minutes.

In 1925 (in the days when TB I was first given the name "temporary") Dean Hutchinson became the faculty director of the summer mountain recreation program. He held that position until 1933, and people still remember him leading hikes with his campaign hat set squarely on his head, and his shouts of "come and get it" at mealtimes.

In 1930, he began teaching math classes in Denver, as well as at the Denver Extension. We had no ex-

tension building then, and he held classes in the YMCA, the old Federal Center, the Westminster Law School, the primary room of the Trinity Methodist Church, the C. A. Johnson Building, the Fraternal Building, and the old Tramway Building (now the CU Extension Center). It is a tribute to his teaching ability that students always turned out in force for a course with his name listed as instructor. He taught at the extension until 1960 without a break. In 1963 he was broadcast there over closed-circuit TV as an experiment. This year, he was back in person—and his classes were as popular as ever.

When the Second World War broke out, "Hutch" served the university's V-programs as their Faculty Liaison Officer. He implemented the program whereby students accelerated their schooling and went directly into service. Since then, he has maintained close contact with the ROTC units. It is interesting to note that the parade which the ROTC students gave in his honor Thursday, May 7, was probably the first occasion on which they have all marched together.

In January of 1947, a Civil Aeronautics Administration plane went down in the mountains west of here. Dean Hutchinson was one of a group which searched for it unsuccessfully for a week. (It was found the next summer.) Later in the same year, he spent a night as a member of a group searching for a girl lost on Sugarloaf Mountain. They finally found her, frozen to death. Horrified at the lack of organization and knowledge

in CU's informal rescue group, he wrote an editorial for the paper. It was published, rimmed in black, and largely due to its impetus, he was able to organize CU's Rocky Mountain Rescue team. It had no backing or official support, but thanks to its fine leadership and achievements, it has grown to the renowned organization of today.

In a sense, Dean Hutchinson started our computer program. In 1958, the university president phoned him and told him to get busy. He complied, and our present Numerical Analysis Center and other facilities are the outgrowth of his policy.

In June of 1960, Dean Eckel retired, and "Hutch" became interim Dean of the College of Engineering. Members of the teaching staff have noted that his faculty meetings were always (wonderfully) short and to the point. Being disinclined to waste time, he had most of the business prepared beforehand. And he was on the committee which selected Max S. Peters as our present Dean.

In more than fifty years of teaching, "Hutch" has always been popular with students. There are many reasons for this. He presented mathematics well (A colleague says that he did the most thorough job of preparing for classes of anyone he knew.) He presented mathematics interestingly (example: being ambidextrous, he would hold chalk in each hand in order to begin a line with one hand and finish it with the other, or write with both hands at the same time.) But most of all, he presented mathe-

matics as a live subject instead of a routine chore. He often hears from old, appreciative students who benefited from his instruction.

Dean Hutchinson has received numerous honors and awards. An *Engineer* editorial from November, 1964, says:

All this has not gone unrecognized. In 1959, Dean Hutchinson received the Robert L. Stearns Award for Exceptional Service. He received an Award of Appreciation from the faculty of the College of Engineering in 1962. In 1963 he received a Certificate of Merit from the Commandant of the Ninth Naval District for his long service to the Navy and Naval ROTC programs. A citation from the present head of the Applied Mathematics Department stated, "Dean Hutchinson is undoubtedly the most sought-after teacher in the Rocky Mountain area by students interested in studying in the field of Applied Mathematics in Engineering."

In 1964, he received the second annual Outstanding Teacher award from the University Development Foundation. The award included an honorarium of \$1,000. And the Dean's Club was initiated in his honor.

Although it carries little official prestige, perhaps one of the most impressive testimonials to his years of service is a book given him by the Bell Telephone Company. It consists entirely of testimonial letters from his friends there. It is very thick. In the process of becoming the faculty member who has been at CU the longest, he has made many friends. (And it should be noted, too, that the world owes him a debt for reviving the old meaning of "symposium." At his Symposiums on Ideal Fluids, friends learned that "symposium" once meant "drinking together.")

Whether in the students he taught, the math department he helped develop, the university committees in which he contributed a good deal or any of his other activities you might care to mention, he has felt an indelible mark on the university. And we have noted a few of his accomplishments at CU in this article. But his achievements outside are numerous beyond belief. The *Engineer* editorial of 1964 summarized them like this.

Dean Hutchinson is a member of the American Mathematical Society, the Mathematical Society of America, the Society for Industrial and Applied Mathematics, the American Association for the Advancement of Science, and many others. He has been an associate editor of the *American Mathematics Monthly*. He is an editor of *Harper's Mathematical Series*, of which, to date, twenty-seven books have been published, and he has written and had published four widely used text books.

Dean Hutchinson has been active in industry. He has done consulting and research work for private industry and various government agencies. He has done a great deal of work for the Navy and for various Naval agencies. He has been active in the various professional societies, attending many of the meetings, seminars, and conventions, and on several occasions he has been the University's representative to important meetings.

We are fortunate that his retirement will be official only. We will lose him as Associate Dean, but he will continue teaching here. Each student owes him an enormous debt. A man of his stature and dedication is rare, and if he had not come here in 1918, the university would be a poorer place.

STRENGTH

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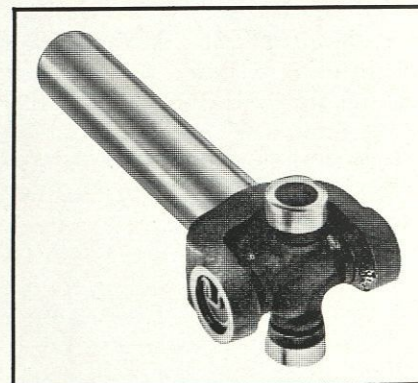
Yield strength represents the point at

which materials exceed the elastic limit. Fatigue strength is the greatest stress which can be sustained when the load is applied repeatedly. As indicated by the table below, Malleable has an advantage over steel in fatigue strength and yield strength when grades of identical tensile strength are compared.

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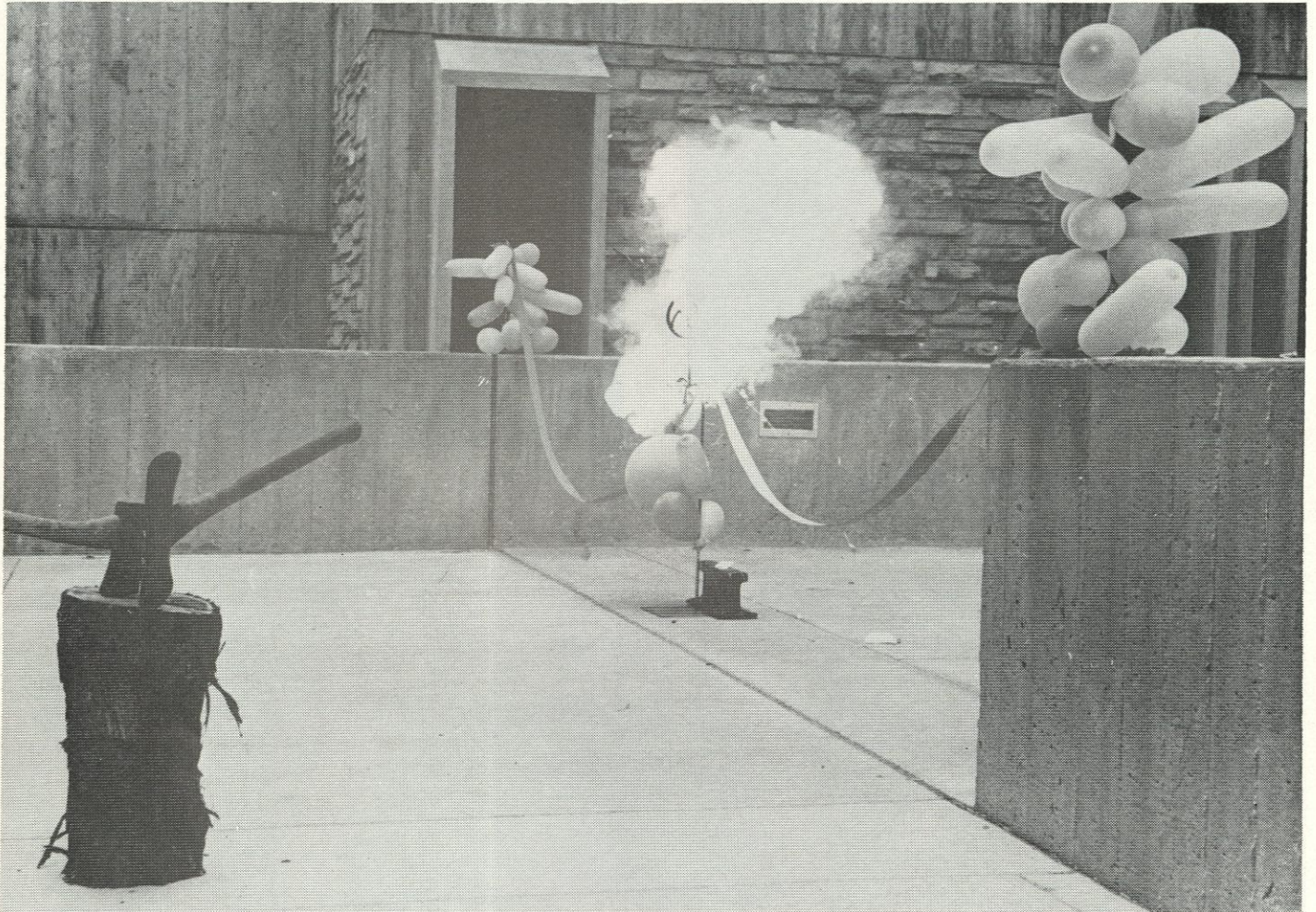


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E-DAYS



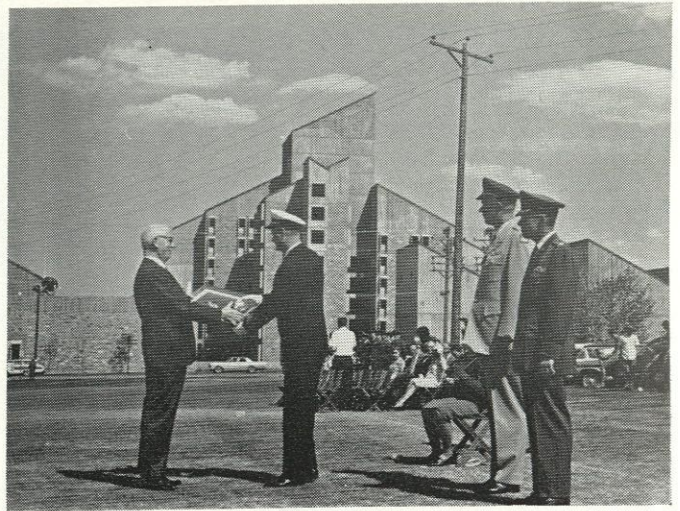
1966

THURSDAY, MAY 5

"HUTCH" DAY

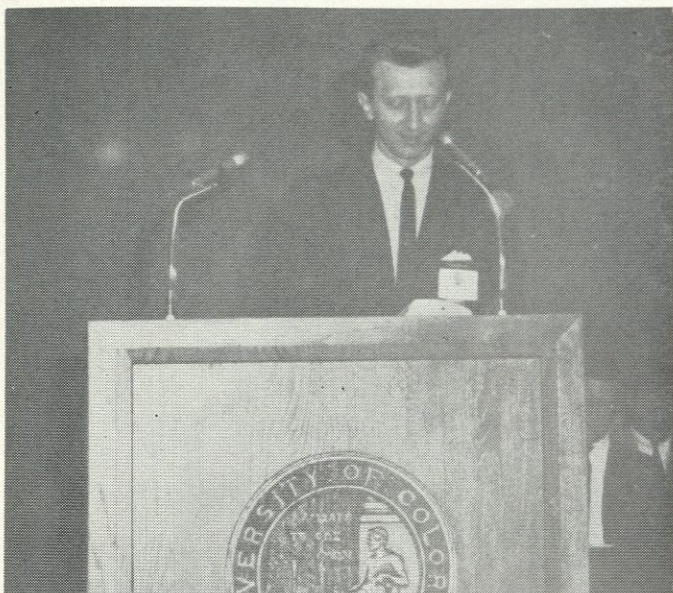


THURSDAY AFTERNOON, THE ROTC UNITS STAGED A REVIEW IN DEAN HUTCHINSON'S HONOR. NROTC ALSO PRESENTED HIM WITH A WALL PLAQUE AS AN EXPRESSION OF GRATITUDE FOR HIS WORK AS NAVY ROTC STUDENT ADVISOR.



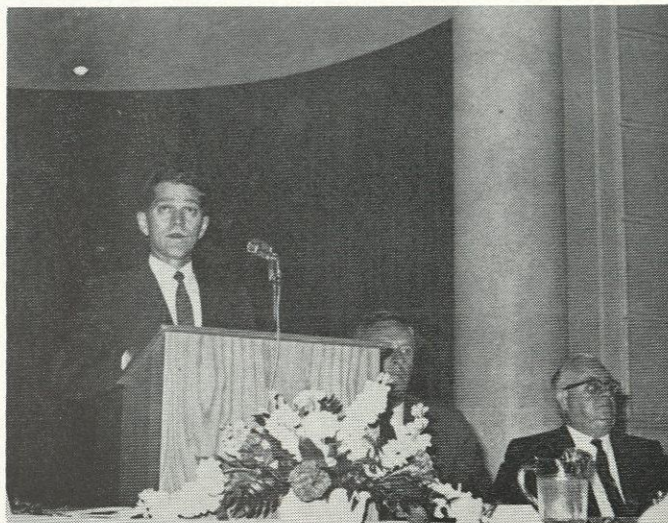
BOB GONDING, AES PRESIDENT, PRESENTS DEAN AND MRS. HUTCHINSON WITH AN ENGRAVED PUNCH BOWL — A GIFT FROM THE STUDENTS OF THE COLLEGE OF ENGINEERING.

FRIDAY, MAY 6

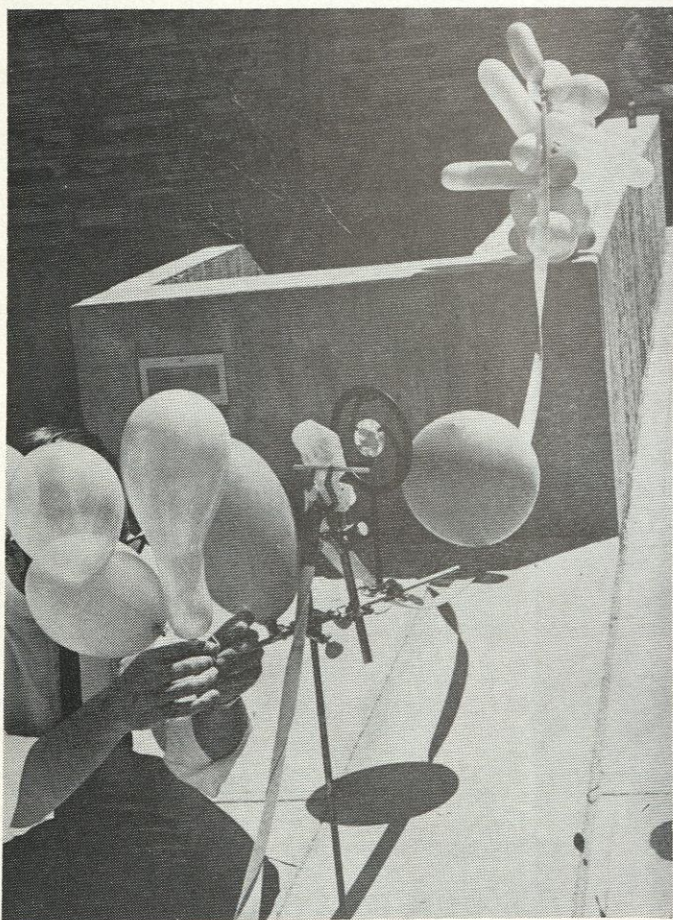


AT THE CONVOCATION, LES BESSER ACCEPTS THE COLORADO ENGINEERING COUNCIL'S AWARD FOR THE OUTSTANDING SENIOR ENGINEER.

E-DAYS



SPEAKERS AT THE LUNCHEON INCLUDED PRESIDENT SMILEY AND OUR OWN DEAN PETERS.



... MEANWHILE, BACK AT THE RANCH ...

AT THE RIBBON CUTTING



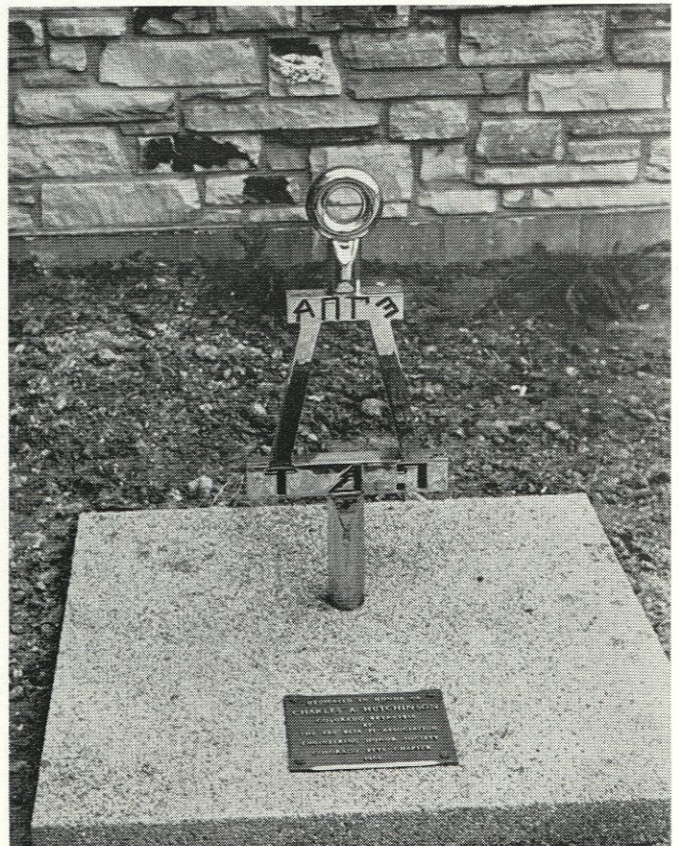
DEAN PETERS SPOKE AGAIN.



SO DID PRESIDENT SMILEY, THIS TIME TO ACCEPT THE BUILDING FOR THE UNIVERSITY OF COLORADO.

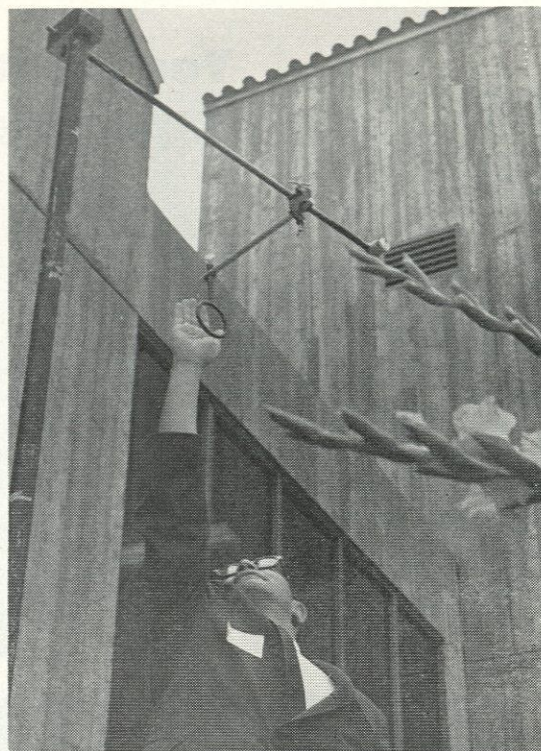


FINALLY, GORDON WOOD, TAU BETA PI CHAPTER PRESIDENT, DEDICATED THE BENT (RIGHT) IN HONOR OF DEAN HUTCHINSON, ONE OF THE CHAPTER'S MOST DISTINGUISHED MEMBERS.

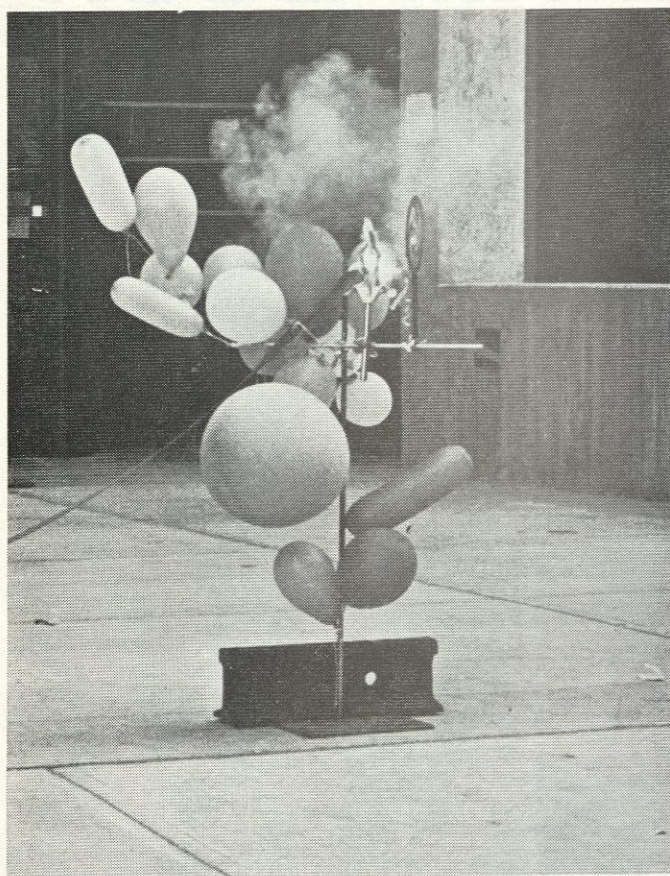




A FEW LAST-MINUTE ADJUSTMENTS.



U. S. REPRESENTATIVE WOLF BREAKS THE LASER BEAM AND STARTS THE COUNTDOWN.



... FIVE, FOUR, THREE, TWO, ONE, WHAM ...



SIGH! !

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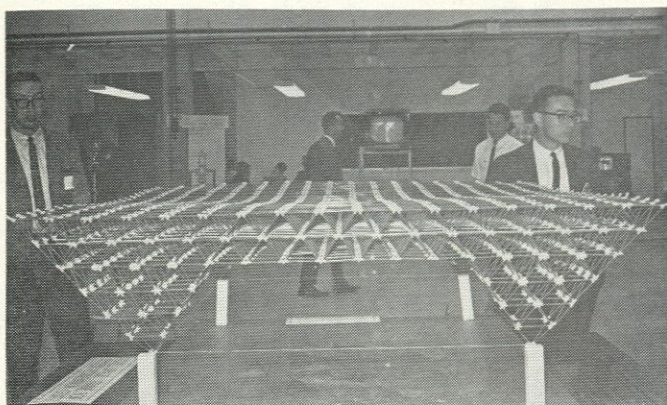
You'll be in good company at Dunham-Bush. Our main office and R&D Center is at West Hartford, Connecticut.



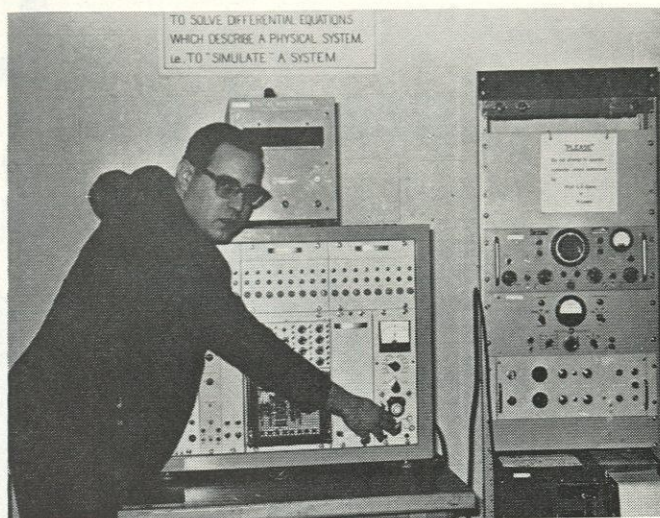
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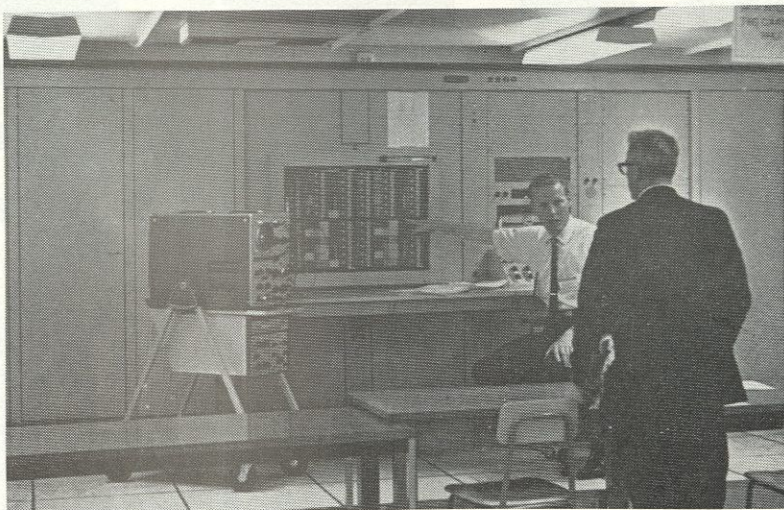
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SATURDAY, MAY 7 THE PICNIC

THE FIRST EVENT WAS THE BEARD CONTEST, WHICH, OF COURSE, REQUIRED THAT THE QUEEN AND THE PERFECT BODY CANDIDATES BE DISPLAYED.

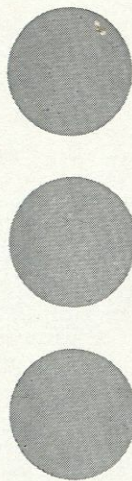


LATE NEWS

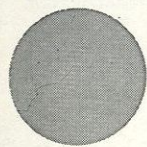
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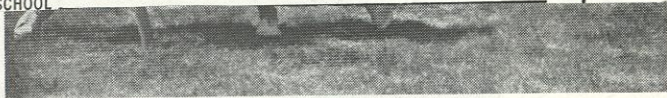
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SCHOOL _____



NOTHING LIKE A GOOD BAT RACE AFTER A FEW BEERS.

SPEC
POW
INCL
SPAC



OR JUST PUNY ENGINEERS?

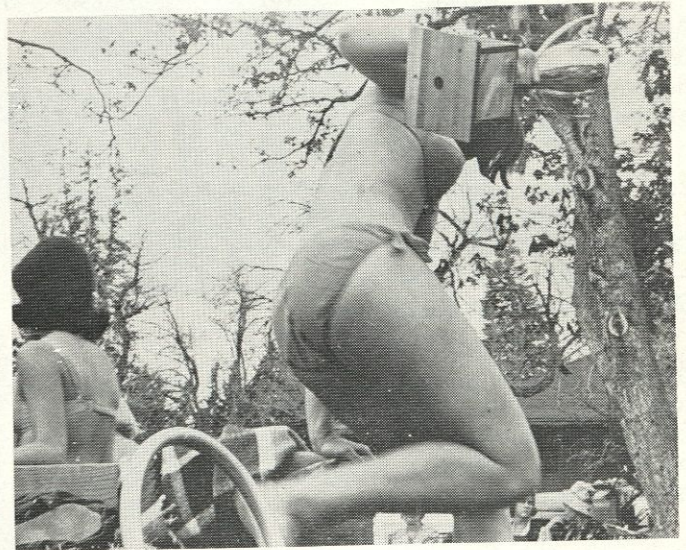


BOB ADAIR WON THE BEARD CONTEST — FRED TRIED.



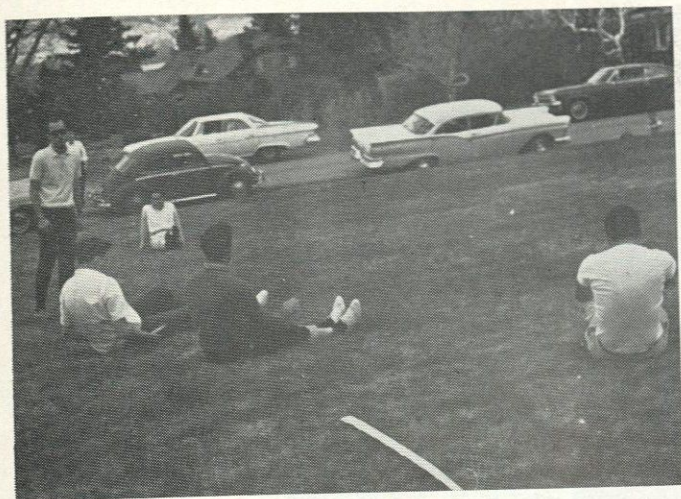
BEGIN PERFECT BODY CONTEST (FROM LEFT): LINDA ROBINSON, ALEXANDRIA ST. LOUIS, DIANE GIBSON, MARCIA DANUSER, JAN BAER AND ABBY JOHNSTON. THE DIRTY OLD MEN ON THE LEFT ARE THE MEANEST PROF. CANDIDATES.

AT LEFT: THE CONTESTANTS DISPLAY THEIR ASSETS TO THE LEERING JUDGES.



A GRACEFUL EXIT . . .

. . . AND A SEXY "SMILE." THE WINNER, ALEXANDRIA ST. LOUIS.



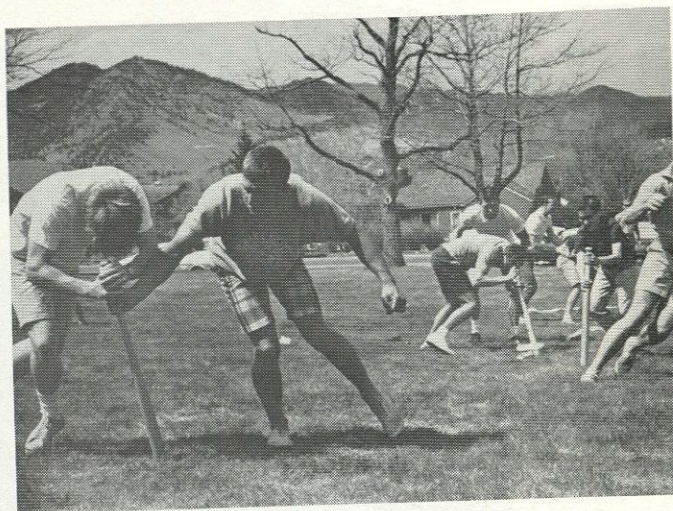
THE DEAN RIPS OFF A FEW SIT-UPS, MORE OR LESS. NOT ONLY DID HE CHEAT—HE LOST.



EGG TOSSING IS FUN—TO WATCH.



THE START OF THE WHEELBARROW RACE; EVERYBODY'S STILL UP.



NOTHING LIKE A GOOD BAT RACE AFTER A FEW BEERS.



IS IT BAD SPORTSMANSHIP — OR JUST PUNY ENGINEERS?

FIRST ROW:
(LEFT TO RIGHT)
DOLLY SHAW,
SHIRLEY NUSS,
LOIS SALTMARSH.



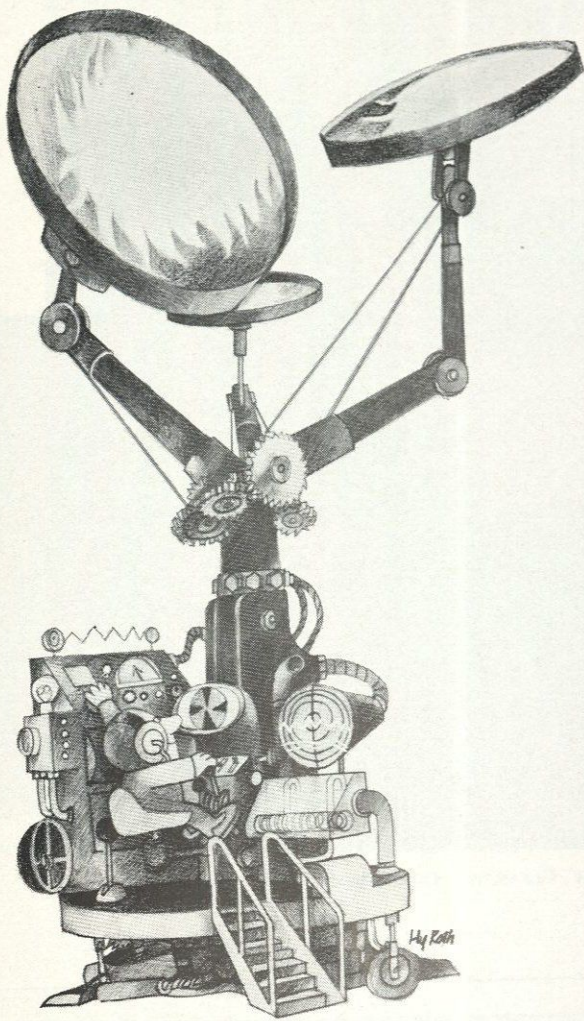
SECOND ROW:
(LEFT TO RIGHT)
SHERRY DORWARD,
SALLY HOLT,
MARY ANN BRIENZA.



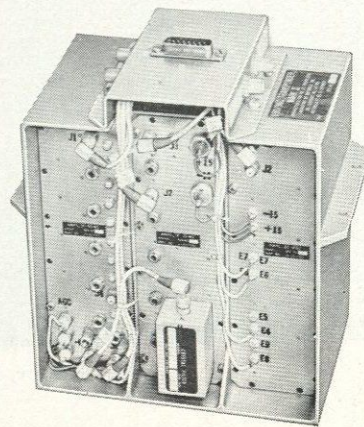
AT THE BALL SATURDAY NIGHT, DEAN HUTCH CROWNED MISS SHIRLEY
NUSS — QUEEN OF E-DAYS 1966.

E-DAYS QUEEN 1966





Flash it with a sun mirror . . .



. . . or command it through a Motorola Transponder*

THE PROBLEM: HOW DO YOU TELL

THE SPACECRAFT TO MAKE A LEFT TURN ON ITS WAY TO MARS?

Sun signals might work fine (except maybe at night) but you can count on control when you program with the aid of a Motorola transponder and flight command subsystem.

Besides, if you were skimming along millions of miles in outer space, you'd more than likely feel better with some sophisticated electronics backing you up.

Motorola's sophisticated know-how stems from years of experience in all major areas of modern electronics—from outer space, inner space, and down to earth—to a company's computer as well as your own dashboard.

In fact—how about your shirt pocket? You might just find a Motorola radio there.

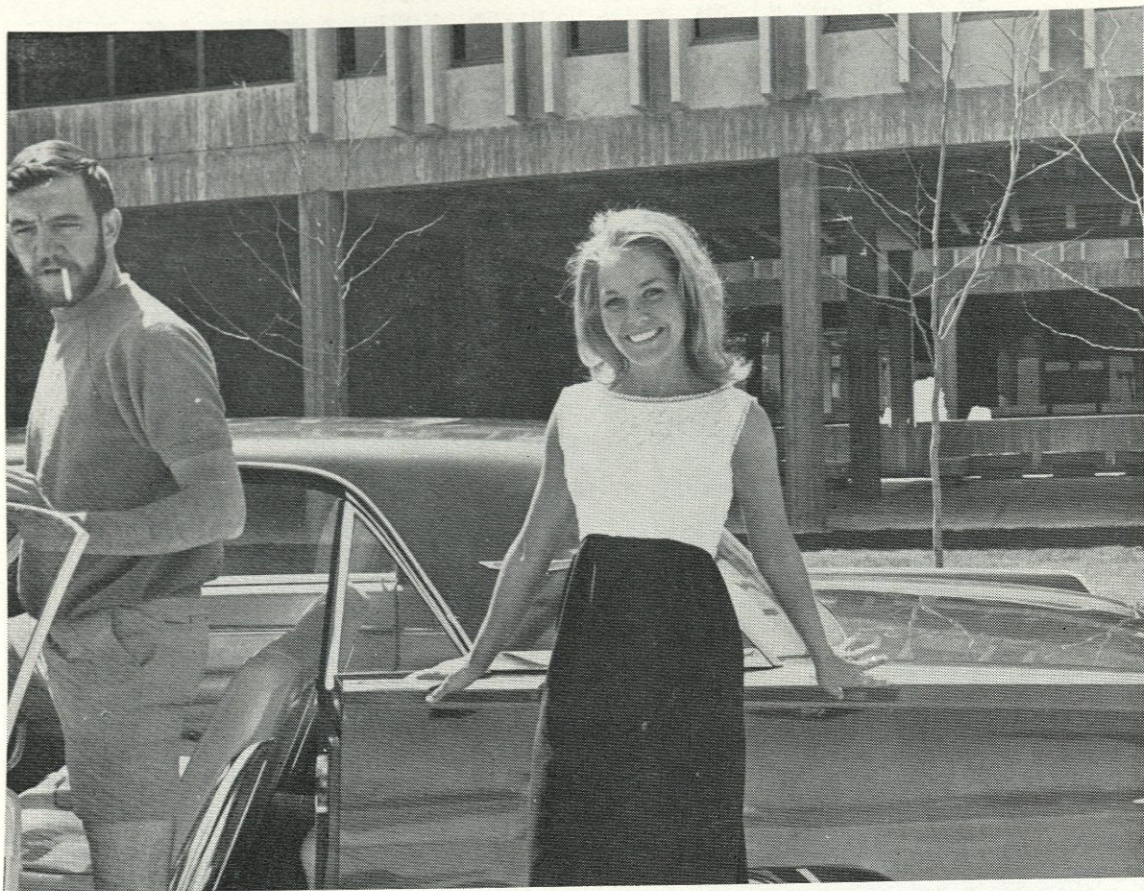
*Primary function is to receive command signals from Earth, and return critical in-flight communications information.

TRUST THIS EMSIGNIA



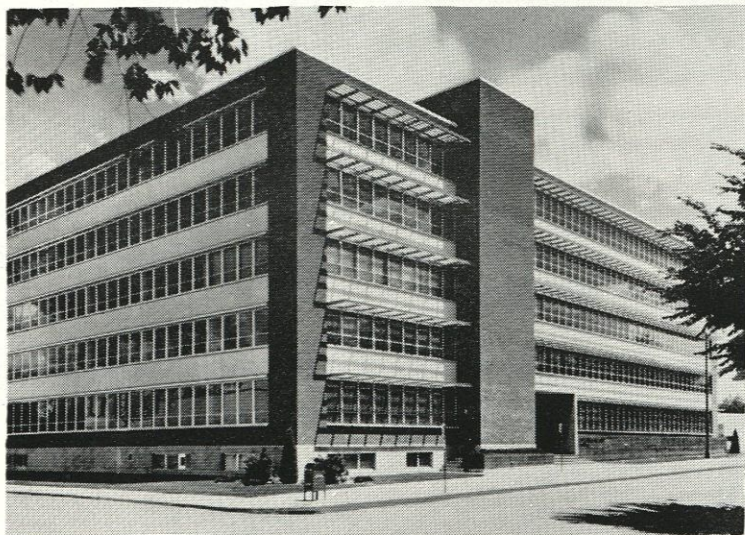
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"... AND I'M ONLY SIXTEEN!"



"THIS YEAR WE'VE DECIDED TO PRESENT FRED AND BOB WITH THESE CERTIFICATES."

SIMULATION

JERRY ZIMMERMAN

Our civilization at the present time has reached a state of such technical sophistication that normal training techniques and maintenance procedures are beginning to demand specialized equipment and training methods to instruct individuals in new skills. This new industry which concentrates on the design and manufacture of trainers and simulators will soon affect all individuals who perform technical jobs.

Simulation Techniques

Simulation is a very common practice today in large corporations. Industry is using simulation techniques to predict very accurately all types of events. However, the type of simulation to be discussed here is that used in connection with training. When discussing equipment employing this connotation of simulation, one is describing a training device which provides a realistic opportunity to "learn by doing." Utilizing actual operational equipment to "learn by doing" may not be possible for a number of reasons:

1. the equipment may be damaged or destroyed (e.g., firing a missile.)
2. the operating conditions do not exist (e.g., training in warfare tactics.)
3. the environment is unusual and

not readily attainable (e.g., training for outer space operations.)

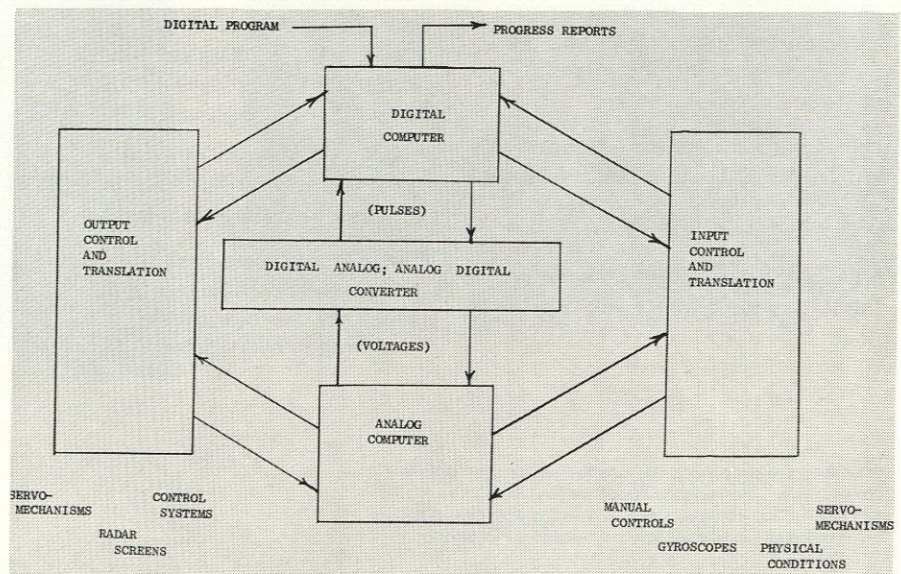
To overcome these difficulties some very highly sophisticated simulators have been developed.

The main component of all simulators is the control section (See Figure 1). This switches or changes the environment as the trainee acts. As the simulator becomes more complex, the control section takes on the

appearance of a digital or analog computer, or both, depending on the implementation. If both are employed, a digital to analog and an analog to digital converter is used to allow a transfer of information between computers.

The control section makes decisions according to various inputs. Inputs are from the trainee through manual controls, from external physical conditions (i.e., wind, temperature), or

Figure 1 – BASIC SIMULATOR BLOCK DIAGRAM



from an instructor through manual controls. The control section decisions take the form of output actions. Output can be to radar screens, to servo-mechanisms to change the attitude of the trainee to indicators (i.e., speed, position). A large advantage of these trainers is that the system can record the trainee's progress.

An example of a very simple trainer is a device used to test animal responses. Two buttons are mounted on a panel. If the animal presses one button he receives food. If he presses the other button he receives an electric shock. Counters are connected to record number of trials. A switch is connected to allow the experimenter to control the switching circuits which determine whether to shock or reward. Inputs are from the animal and experimenter; outputs are food and the shocks. The counters provide a means of measuring progress. The only difficulty is that the device does not "simulate" anything; however, it does have all the components of a simulator.

The final characteristic of a simulator is that it provides a *realistic* environment. Manual controls, layout of instruments, appearance of equipment, and equipment response to the trainee should be similar on the trainer and the actual device.

Unique Simulators

The Maryland based firm, Aircraft Armaments, Inc., (AAI), has accomplished a great deal in the implementation of simulation techniques. They have supplied the government and private industry with simulators ranging from Nike, Redstone, and Sparrow missile maintenance trainers to flight trainers and a submarine trainer which simulates an entire submarine for the training of a crew.

Space Crew Trainer

AAI recently installed an Apollo Space trainer at NASA's Manned Spacecraft Center in Houston. The Gondola duplicates the three-man crew compartment of the Apollo Command Module and is designed to be used in training astronauts in planned flight routines and emergency operations. It contains computer-operated flight instruments and controls in a realistically simulated cockpit which will be mounted on a

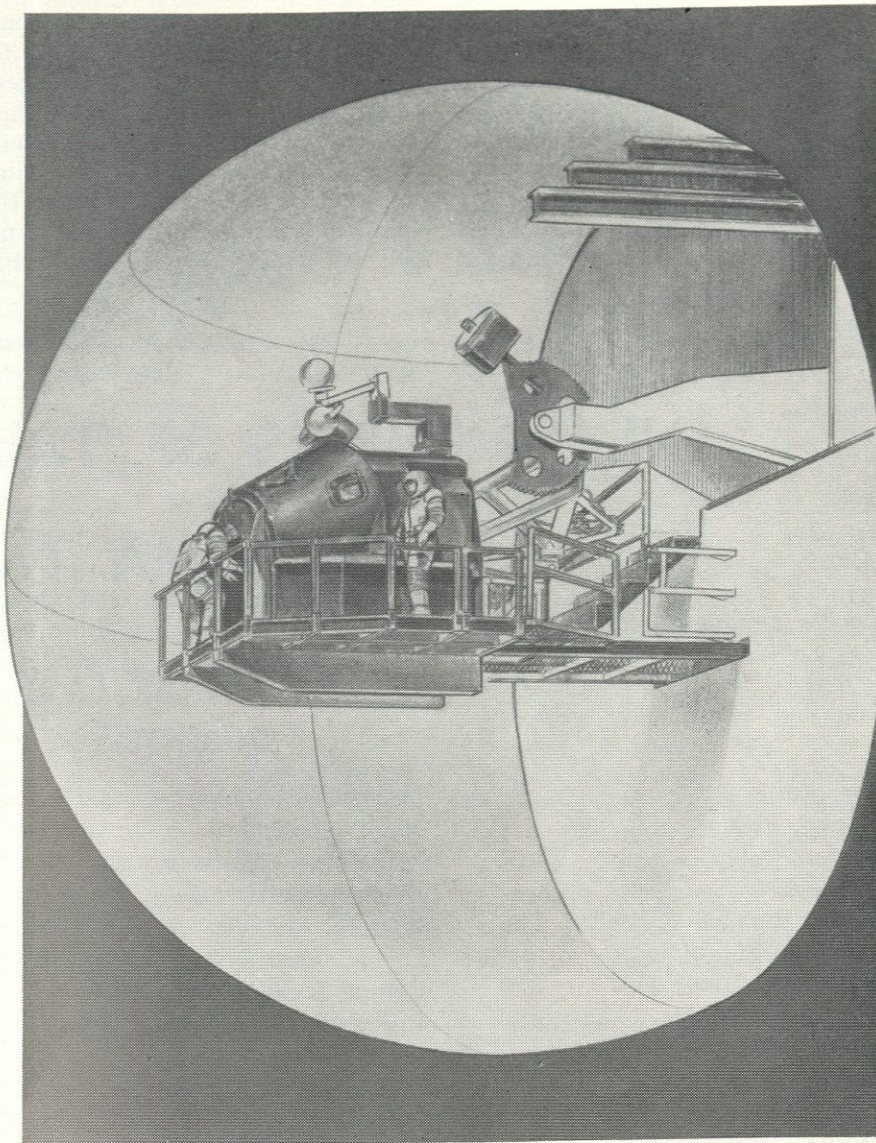


FIGURE TWO: THE APOLLO CREW STATION GONDOLA.

hydraulically powered moving base in the Dynamic Crew Procedures Simulator. (See Figure 2)

Submarines

One of the most unique, complex and costly simulators now in use is the Anti-Submarine Warfare Attack Teacher (ASW). Housed in a special complex at Pearl Harbor, this shore-based facility provides a realistic environment for crews of the latest types of operational submarines to work simulated war games and practice techniques of submarine anti-submarine warfare. The action, developed by specialized electronic equipment in conjunction with a digital computer, is displayed on a giant screen almost of cinerama size. The system is capable of generating twelve different realistic targets simultaneously that is, any combination of destroyers, battleships, car-

riers and other submarines, for submarine crews to hunt down and kill. The members of the crew operate in a submarine interior identical to the one they have become familiar with at sea. In addition to output to the giant screen, the simulator controls the targets on radar, sonar, and periscopic equipment which can be located, identified, tracked and fired upon just as in a real warfare situation. Such exercises at sea would require many ships, extensive periods of time, and numerous personnel. The facility also provides for the scoring and observation of proficiency not obtainable with the use of actual ships.

Flight Pattern Simulator

The training of competent individuals to man Airport Control Towers around the world requires a training
(Continued on page 38)

(Continued from page 37)
program which offers realistic "hands-on" experience; thus an Airport Traffic Control Simulator has been developed. The Federal Aviation Agency has already installed several of these systems. The simulated aircraft can be flown manually by the operators or automatically

flown from digital pulses stored on a magnetic tape. The process of "flying" the aircraft entails the generation of realistic flight patterns which are then projected to the trainees through a console which is similar to actual traffic control consoles. The simulator can "fly" up to sixty targets in an imaginary 400 square mile

area. Any one of twelve different types of aircraft can be simulated at each console. A unique feature of the system is the capability of operating two problems simultaneously: the simulated aircraft and radars can be divided between two problems. The recorded data contain information for high-speed automatic reduction of

NEW MEMBERS OF TAU BETA PI AND SIGMA TAU

TAU BETA PI

STUDENTS

Alter, Larry D.
Austgen, Paul P.
Bemelen, Johan V.
Bond, Frank C.
Branan, Richard C.
Browning, Gerald L.
Castleman, Curtis H.
Conklin, James W.
Correy, Robert M.
Dowding, Charles H.
Eitreim, Raymond J.
Gormley, William T.
Hines, William A.
Horn, Lyle W.

Hubbell, Donald E.
Jong, Harry T.
McAnally, Claude W.
Messerschmitt, David
Nelson, Alvin D.
Oliver, John R.
Peters, Sherwood
Primeaux, Paul R.
Prydz, Rolf
Reddien, Charles H.
Sastry
Schlappe, Robert D.
Serkowski, Robert J.
Shults, Bruce L.

Smolka, Frank R.
Sperry, Brian L.
Stephens, Jerry D.
Stites, Martin W.
Stoppelkamp, Fred
Sullivan, Jerry S.
Taylor, Gregory R.
Taylor, Fred J.
Terada, Kenneth K.
Waller, John H.
Wigotow, Joseph M.
Weigelt, Peter
Wise, John C.

FACULTY

Neal B. Kindig

B.S. — U.S. Military Academy (West Point); M.S.—Univ. of Colorado; Ph.D. — Stanford Univ.; Teaches undergraduate electronics and materials and graduate physical electronics; Assistant Prof. of E.E. (1965).

William J. Hanna

B.S., M.S. (E.E.)—Univ. of Colorado; Professor of E.E.; Supervises all undergraduate power labs both in Boulder and in Denver.

Paul E. Bartlett

B.S. (C.E.), B.S. (Bus.Mgt.), M.S. (C.E.)—Univ. of Colorado, Assistant Dean of the Denver Center; Associate Professor of C.E.

SIGMA TAU

Barber, John
Berman, Bob
Browning, Gerald
Burns, Jim
Chiddister, Bruce
Colt, Henry

Correy, Bob
Fritschle, Steve
Harr, Peter
Jurcheck, John
Koerner, Bill
Mitchell, Jerry

Morehead, Joe
Shults, Bruce
Smolka, Frank
Stoppelkamp, Fred
Weigelt, Peter

digital problem data, problem analysis, automatic playback and studies of voice radio communications.

Fault Detection Tester

The Fault Detection Tester, used for pre-flight checkout of fighter interceptors, tests certain functions of the auxiliaries for firing missiles or special weapons, infra-red sensors, radar, and the aircraft system to fire a missile or rocket successfully. It will be used for preflight and postflight trouble-shooting and as a maintenance tester. The tester provides a simulated radar/infrared input enclosed in a compact, mobile anechoic chamber which shields the aircraft being tested from outside interference and simulates a target for the aircraft's sensing devices. Included in the system is a computer which stores standards and tolerance information against which the various aircraft sensing devices are checked.

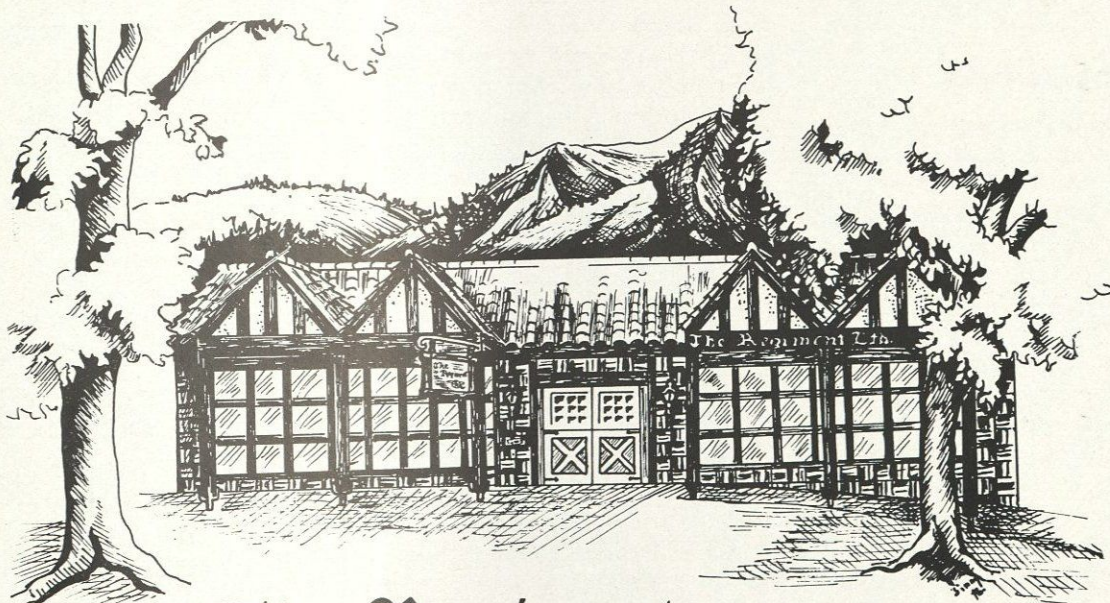
The device is mounted on a small trailer and fitted over the nose cone of the aircraft. The digital computer controls the motion of the target, the progress of the test and provides

stored conditions for periodic maintenance tests and limits to which weapons system parameters can be compared for go, no-go decisions.

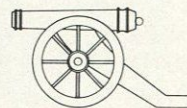
Combat experience will be acquired safely through the use of an Aircraft Attack Simulator. The pilot will be on a normal flight when suddenly an enemy jet will appear on his radar equipment. As the pilot maneuvers to intercept the target, the target on the screen maneuvers to either evade or intercept the actual fighter. If the pilot fires on the target, the "on-board" simulator housed in a bomb pod under the wing determines by use of a gyroscope and computer system, if the target was hit. Conversely, if the target is allowed to maneuver within range of the actual jet, the system informs the pilot that he has been shot down. The simulator is composed of a digital computer, gyroscopes and interconnecting circuits which tie the simulator into the jet's equipment (radar, instruments, etc.). The entire system is carried on the jet as a bomb.

Needs of the Future

All phases of engineering are being called upon for the development of simulators. As these devices become more and more complex, more highly specialized engineers will be needed. In the Aircraft Attack Simulator applied mathematicians are needed to program the computer to generate and "fly" the attacking targets. Electrical engineers are needed to design the special-purpose, light-weight, compact computers and other electrical systems. The design and development of realistic and precise simulation systems calls for the exercise of many disciplines and properly oriented implementation of a board range of technical skills, a number of which are relatively new in the engineering profession: operations research, human factors, cryogenics, electro-optics, Laser technology, programming and digital and analog circuitry, to name a few. The continuous development of reliable, effective, realistic simulators and training devices will depend upon the ingenuity in keeping abreast of the new techniques being born each day.



The Regiment
Men's Apparel



1121 13th St.

Boulder

On the Hill

THE COLORADO ENGINEER STAFF

FRED LOVE

After two illustrious years of leading the *Engineer* staff, Fred is leaving to enter the big bad world of industry—yes, he really is going to have a job. Since his arrival way back in 1961, he has probably piled up more hours in the rack than anyone else. In his limited waking hours, he has managed to get a Chem. E.—Marketing degree, belong to AIChE, Sigma Tau, Tau Beta Pi, CUAMA, and the Moonlighter Club, and teach OD to play bridge (undoubtedly his major achievement of the year). Once in a while, he has put in a few minutes on the *Engineer* and for his efforts, he was named to *Who's Whom* (objective case). Being no relation to Governor Love was unfortunate—Fred had to pay out-of-state tuition (Las Vegas is out-of-state, isn't it?) and thus, he has piled up a large IOU in Diane's coffee and donut fund. But, in several years, when he gets on his feet, he promises to make some payments.

BOB SCHWAB

Robert Schwab was this year's Business Manager, or at least that's what the sign on his desk implies. It's only of secondary interest that he had to embezzle funds from the Editor's Retirement Fund in order to buy this sign. Actually Bob has inaugurated many time-saving programs such as discarding the advertising cuts before they go to the printer, which really saves time since then the editorial staff has nothing to print. Aside from being a frustrated Business Manager he is also a frustrated Resident Advisor in one of the men's dorms on campus. This is a delightful job since it gives him an outlet to release his tensions (there is nothing more relaxing than releasing your tensions on Freshmen). After graduation this June, Bob hopes to go to work. He even has high hopes of being paid for this endeavor. It is with great sorrow that Bob releases

his reign as Business Manager—after all it's a very well paid position.

KATHY O'DONOGHUE

Kathleen O'Donoghue, our beloved assistant editor and representative of the Polish nation, is eagerly (?) looking forward to next year when she will try to fill the shoes of our Fearless Leader—Fred. Kathy used to be a Chem. E., but she didn't like Organic (or was it the other way 'round) so she changed to EDEE (Engineering Dropout Education Experiment). Her extracurricular activities are not really extensive, partly because she devotes almost every spare moment to the *Engineer* but mostly because she prefers to drink. Some of Kathy's more minor successes this past year are: her own desk, an article on LSD, proof of her masculinity(?), small gifts from the Editor (including a life-size picture of Batman and a coffee mug with her name on it from Walgreen's), a kidnapping, being served at the *Engineer* banquet, and last, but not least, the chance to write the Editor's "blurb." But he got even.

SHIRLEY NUSS

Our gal Shirley, on the *Engineer's* Staff

Can't write a line, can't draw a graph. Her one big job, as everyone knows, Is keeping Bob and Fred on their toes.

Now that's her job, but not her reason

'Cause in the new Engin' Center, beauty's not in season.

So she's here to enhance our grim office space,

by letting us all admire her. . . . face?

Chemistry and Math — in those she's a whiz.

She could probably even tell you what a function is.

In some things though, she's doomed to fail—

"Prof, I can't take this test—I broke a fingernail!"

A former 4-H'er, (farm girl you know)

She insists that Boulder is the place to go.

But she'll never change, can't you see—

She left those animals back home for the animal E's!

JOHN BROOKS

"Big John," finally a senior in Chem. E. and Business, is originally from our Beloved Boulder. He lists as some of his printable campus activities: AIChE, Rally Commission, Sophomore Class Council, Hammers, Superior Student Program, and Tau Kappa Epsilon. His remarkable business talents finally were recognized and he was put to work (?) as Finance Manager of the *Engineer*. Next year, John will be Business Manager—too bad about that.

PAUL BUGG

Paul Bugg is a pseudonym for a non-existent Features Editor. This elusive character masquerades as an Economics senior scheduled to graduate in June. It is rumored that this figment will spend the next two years teaching English as a foreign language for the Peace Corps in a French-speaking West African nation. But, then, perhaps it's only that the swamp gas is restless.

LARRY DAVIS

A doer of odd-jobs this year, Larry has written bad poetry for one joke page, a bad story on the Saint Louis Arch for another issue, and some uncomplimentary odd book reviews. Originally a sophomore in Applied Math, Larry damaged his brain seriously while studying for a physics hourly and is now seeking self-help as a psychology major in A&S. Next year, he plans to inflict the products of his diseased mind on a wider audience by writing a *Daily* column.

LARRY ALTER

My name is Larry Alter. I am the courageous, hardworking, friend-of-the-people circulation manager. Other activities this year include Eta Kappa Nu, Tau Beta Pi, and considerable goofing around. As members in good standing of the EE department, Bob Schwab and I provide a stabilizing influence on the Chem. E's presently in control.

JERRY ZIMMERMAN

Trying to get people accustomed to his techniques is Jerry's biggest problem. For instance, O'D. had difficulties becoming educated to his unique filing system; it's a system where entropy is maximized. Jerry's greatest aspiration is to be a fiction writer, and his official position on the staff as writer of "This Today" gave him much valuable experience. Jerry is majoring in the combined curriculum of Applied Math and Business. The remainder of his time is divided among Zeta Beta Tau, IFC, Freshman Camp, and filling out many odious student applications. Summer plans include a computer programming job in London or Paris, but more than likely, Boulder.

JIM HAMILTON

Jim Hamilton, whose excuse for calling himself a member of the *Engineer* staff is only that his name is listed under the heading "Colorado Industries," is a senior in EE, who, to the great relief of professors and students alike, will graduate in June, only to appear next fall at M.I.T., in order to avoid work and the draft as long as possible. He is a member of Tau Beta Pi, Sigma Tau, Eta Kappa Nu, IEEE, Men's Marching Band, Buff Ski Club, and everything else which it's possible to join without doing any work. He was selected for this year's Who's Who Among Students, (Etc.).

BRUCE DUNN

Bruce Dunn is this year's (and last's) puzzle page writer. He also fills in with an occasional drawing or diagram, and helps certain members of the editorial staff with problems in mechanics, thermo, and other such subjects which EDEE's are inclined to be deficient in. All kidding aside, he is a graduate of this University in Mechanical Engineering, and is not a record for grades (greatest number of total disappointments) in the Graduate School of Business.

Other than the little bit of writing which he does for the *ENGINEER*, he hangs around the office just enough to retain his space in Shirley's desk.

DOUG BRYAN

Uncle Doug, alias the "Big D.," is a senior in Chem Eng. A native (savage) Coloradan, he hails from Pueblo-by-the-river. His freshman and sophomore years there at S.C.S.C. were spent in relative anonymity, his only claim to fame being elected Vice-President of Phi Theta Kappa, a national Junior College honorary. Instead of studying, he fills his time with activities including AICHE, AES, Chessmen, hunting, fishing, and golf. Uncle Doug is a Resident Advisor in Kittredge, and is, therefore, a father image for many of CU's freshmen. He wants to do production management work after graduating in June, '67. We feel this is a wise decision on his part—there is less chance of his blowing the place up if he stays out of the lab.

MARK PHILLIPS

Mark was born at a very early age in Princeton, New Jersey. After one hell of a childhood, he happily (who's



ROW ONE (L. TO R.): SIEGFRIED MANDEL, BILL LLEWELLIN, KAREN MARTIN, KATHY O'DONOGHUE, MARY CHRISTIANSON, SHIRLEY NUSS, CHERYL VAN HOOSE, NORA MCKAY, PAUL BUGG, JOHN BROOKS. ROW TWO: LARRY ALTER, DENNY LEATHERMAN, BRUCE DUNN, FRED LOVE, PAT BRENNAN, BOB ECKLAND, JERRY CARROLL, LARRY DAVIS, BOB SCHWAB.

kidding whom?) attended grade school where he excelled in nothing. His four years in high school were uneventful, but he pursued such hobbies as photography and electronics. This is Mark's first year as an EE student at CU. The latter part of this year, his talents as a photographer were recognized (finally), and he spent a lovely Sunday afternoon taking pictures of the revolving doors in the Engine Center for the *Engineer* (???).

DICK BROCKWAY

Dick, a junior in EE, is currently working on messing up the mess he made in the circulation department and insuring that those who used to stop to pick up the latest issue of the *Engineer* will never see another copy—the post office will see many though. Besides holding down the *Engineer* office at night (it has a tendency to start flying at times), Dick devotes a few spare seconds to IEEE, Eta Kappa Nu and Wesley. This summer, he plans to do microwave research (if he can find them) under the NSF research program.

DENNY LEATHERMAN

Denny, Advertising Manager this year, is a senior majoring in Bridge and minoring in Chem. E. He spent

his freshman year at St. Mary's College in Dodge City, Kansas, where he was freshman class treasurer and a star football player (he doesn't believe it either!) He plans to be working in Houston this summer (gets too hot for him here) but he will be back in the fall to attempt an MBA degree. When he couldn't find a fourth, he participated in Ski Club, Senior Class Council, Intramurals (there's that football talent again) and was treasurer of Alpha Chi Sigma.

LAIRD W. STANTON

Stanton, L. W. SO5-0671 19,119-44,314 N7,876,294 AF6, 809,968 256431 KAJ8093 275-40-2449 NROTC, Dark Room Director, Skindiver, Aeromodeler, Trail Rider, Hunter, Sailor, Projectionist, Photographer (Side Lights, Knots & Fathoms, . . . *Colorado Engineer*), Spot Operator and, at times, Student in EE. Senior now . . . another year to go to catch up on credits and then on to the air-supported Navy.

CHERYL VAN HOOSE

The aim of Cheryl Van Hoose, a sophomore in Arts and Sciences, is to accumulate enough credits and gradepoint to transfer into her major—journalism. In order to retain any

practical knowledge of journalism she might have had in the first place, she has been struggling on the *Engineer* for two years to understand parameter circuits and differential equations. Even though she really never expects to be a qualified candidate for a Ph.D. in engineering, she does know exactly where to place a comma in any article in the *Engineer*. In addition to the magazine, Cheryl is a member of Alpha Gamma Delta.

ANSWERS TO THE MAY PUZZLES

1) Hold the stick at arm's length so that the top of the stick is sighted in line with the top of the tree, and your thumb is sighted at the base. Then hold the stick horizontally, with your thumb sighted at the base of the tree, and see where the tip of the stick seems to intersect the ground. The distance from this point to the base of the tree is equal to its height and can easily be measured.

2) Hint: Prove that the radius of the field is 300 feet.

3) The whole two minutes has already been used up, of course.

4) 36.

5) 12345670 spells VOLTAIRE.

Curious?

Sentimental?

Just Interested?

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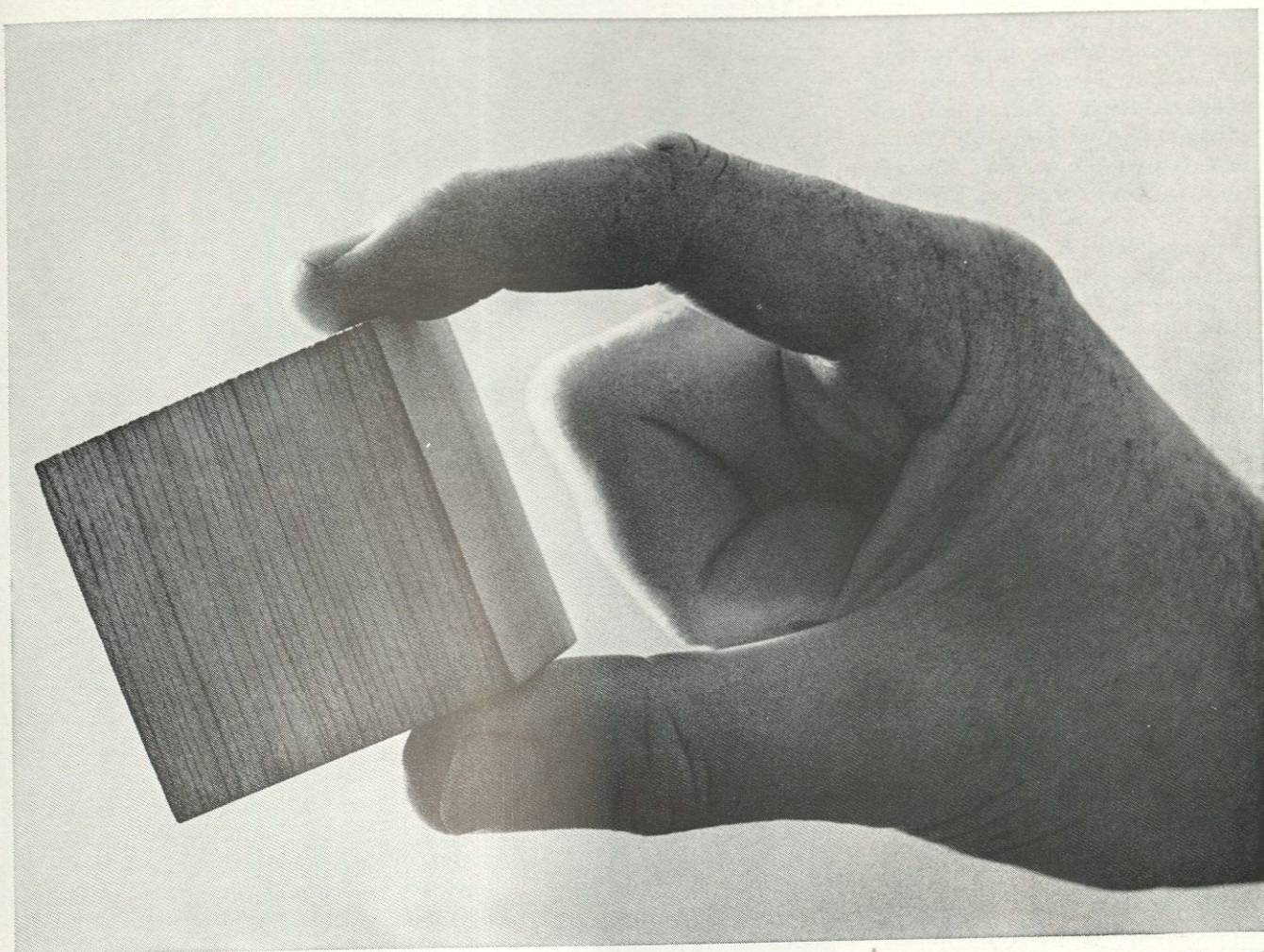
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THIS TODAY

JERRY ZIMMERMAN

FINALLY, A DC TRANSFORMER

Working with extremely thin films of tin deposited on a glass slide, a General Electric physicist has built and operated a laboratory model of a direct current (D-C) transformer—long considered an “unachievable” scientific goal.

The device is a result of research on superconducting materials—metals and alloys that have zero electrical resistance and unique magnetic properties at very low temperatures.

The D-C transformer—which can convert a direct current input into a larger or smaller direct current output—has been operated at very low voltages and currents, with an efficiency of about ten per cent.

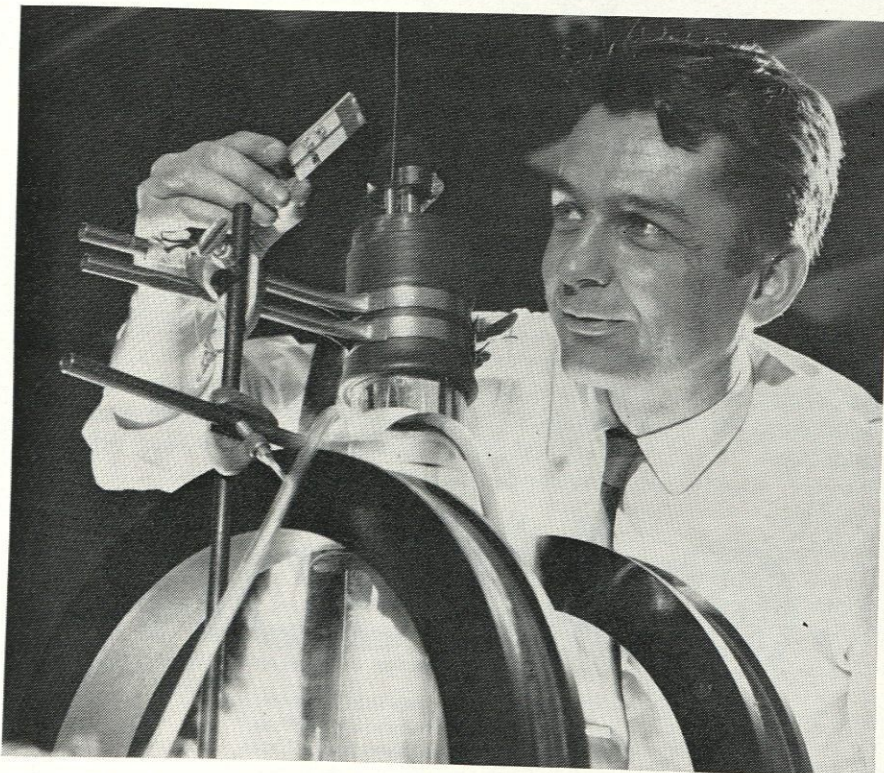
Although no immediate commercial applications are foreseen for the D-C transformer, the device marks the achievement of a goal that had eluded researchers ever since the alternating current transformer was first demonstrated nearly a century ago.

In the new D-C transformer, the primary and the secondary are made of thin tin films, which belong to a family of Type II superconductors. When an ordinary superconductor is placed in a magnetic field, the metal excludes the magnetic lines of force. Type II superconductors, on the other hand, can be penetrated by a magnetic field—but only in so-called “flux spots.”

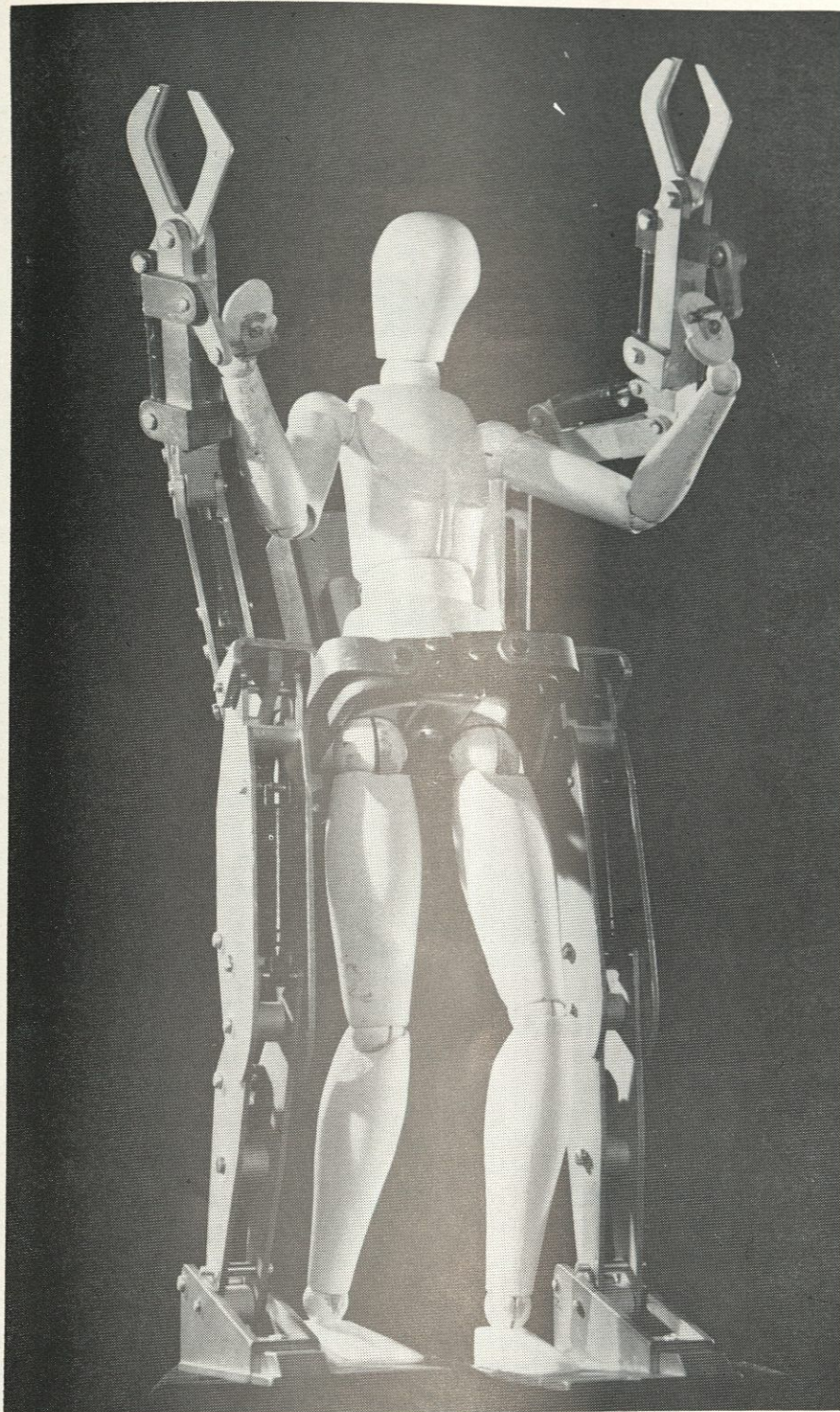
When a direct current is passed through the tin primary, the magnetic flux spots begin to move in one direction relative to the film. In the D-C transformer, these flux spots also penetrate and move through the adjacent secondary film. As a result of this moving (and hence changing) magnetic field, a direct current is induced in the secondary film.

The magnetic field fluctuations produced by the primary of the D-C transformer exist only close to the film. Thus, the secondary film must be placed no more than about .000001 inch away from the primary films—each only approximately 1000 angstroms thick—separated by an even thinner film of silicon oxide, an insulating material, only about 100 angstroms thick.

By placing a number of secondary films in series in the D-C transformer, it is possible to develop a secondary voltage many times higher than the primary voltage. Similarly, by placing a number of primary films in series, the output voltage can be “stepped down” below the input voltage.



GE'S NEW DC TRANSFORMER.



HARDIMAN, THE MAN OF THE FUTURE (?).

MR. HARDIMAN

A contract has been awarded the General Electric Company for development and construction of a set of "mechanical muscles" that will give an ordinary man the strength of a giant.

By means of an advanced system of levers, control linkages, and servo-mechanisms, this unique machine will mimic and amplify the movements

of its operator—dramatically extending his strength and endurance. This man-machine marriage will essentially combine the operator's dexterity, brain-power, and all-round versatility with a machine's strength, size, and ruggedness.

Worn like an external skeleton, the "mechanical muscles" machine—nicknamed HardiMan—will permit its operator to lift a 1500-pound load

while exerting only a fraction of this force. He will be able to perform general load-handling tasks, including walking, lifting, climbing, pushing, and pulling. The machine—technically described as a "powered exoskeleton" by its developers—will be attached to the operator at the feet, forearms, and waist.

HardiMan uses the principle of force feedback. Force feedback means that proportions of the forces generated or encountered by the machine are duplicated and reflected to the operator. If the machine's arm or leg strikes a solid object, the operator feels that identical force situation of striking a solid object with his arm or leg.

As a result, the machine simply becomes an extension of the man, and the operator is able to concern himself solely with performing the task at hand. Thus, man now has the ability to control a multi-motion machine in a natural way and to move loads at higher speed, with greater dexterity, than ever before. The control concept makes training time almost non-existent.

The HardiMan machine will be control by hydromechanical servo-valves—the mainstays of the force feedback system. The research prototype machine is scheduled for delivery in early 1968.

MORE ABOUT CHIP CIRCUITS

Sylvania Electric Products Inc. today introduced a series of multi-function integrated circuit digital subsystems on individual minute silicon chips, a technological breakthrough that could lead to the development of faster, smaller, more versatile and lower cost computers and communications systems.

The units, called Monolithic Digital Functional Arrays, contain as many as 40 conventional integrated circuit functions in a single package while providing greater reliability, lower power consumption, and less costly systems assembly.

The devices are the result of a new design technique that takes advantage of the natural semiconductor characteristics in silicon, plus the performance of high level transistor-transistor logic. The functions implemented by the Monolithic Digital Functional Arrays are common to all digital data processing systems.

The Goals of Engineering Education: A GOALS COMMITTEE DICTATE OR AN ENGINEERING PROFESSION DECISION?

M. S. PETERS

and

K. D. TIMMERHAUS

On the basis of the information requested in the various questionnaires prepared by the Goals of Engineering Education Committee, many universities and a representative group of industrial organizations attempted to present a complete and fair evaluation of their views relative to the future of engineering education. Now that the Goals Committee has presented its preliminary report, it would appear that certain specific questions should have been asked in the initial questionnaire to clarify some far-reaching recommendations rather than leaving this interpretation to the Goals Committee. Before

the final report is prepared, it is recommended, and hoped, that these questions will be asked by the Goals Committee and answered by the entire Engineering profession, so that the final report will be a more representative and realistic Goals of Engineering Education.

This presentation outlines these specific questions and indicates the answers which the authors would make to these questions, after careful consultation with their colleagues at the University of Colorado and various local industrial organizations.

In considering the over-all preli-

minary report, we wish to address ourselves primarily to the points raised in Recommendations 1, 2, 9, and 12. We are substantially in agreement with the other recommendations made in the report, although Recommendation 11 is not a real recommendation and should be deleted.

The eight specific questions and our responses follow.

(1) *Is it proper to designate engineering educational degrees as "professional" degrees? If so, should a clear indication be made at each school as to which degree it considers*

to be the first professional degree in engineering?

The designation of "professional" as applied to an engineering educational degree has a certain implication which some individuals feel should be reserved for those persons who have had considerable experience. Some organizations, such as the National Society for Professional Engineers, will certainly react unfavorably to this usage of the word "professional" as related to an educational degree. To indicate clearly that an engineering educational degree does have a professional connotation, we feel that it is appropriate to designate engineering educational degrees as "professional degrees." However, we feel that this term should not be used in an official sense. It should be used merely in a description as to the meaning of the degree to distinguish it from a liberal arts type of engineering preparatory degree.

(2) *In the future, will it be possible to provide sufficient education in engineering to permit the four-year bachelor's degree to still be considered as the first degree in engineering?*

The basis of the present four-year quality degree in engineering should be retained. This would be a four-year bachelor's degree and should be considered as the first degree in engineering. To make certain that such a degree can be acceptable as the first degree in engineering, it will be extremely important for our schools to develop a highly flexible and modernized program which will be built on a strong high school foundation of mathematics. For those students coming to the universities who do not have the necessary strong background in high school, it is quite clear that it will take longer than four years to attain this degree. Nevertheless, engineers should make every effort to retain the first degree in engineering as the four-year degree which would be available to those students who have had a strong background in high school.

(3) *What are your views relative to the desirability of designating the first professional degree in engineering as the master's degree, to be awarded upon completion of an integrated program of at least five-years duration in one or another of the conventional fields of engineer-*

ing, or in new fields, or in combinations of these fields?

A large amount of experimentation and trial with various forms of engineering education should be encouraged in our country. It would be very undesirable to try to set a standard pattern in which the first degree in engineering would be the master's degree. The reasons for the undesirability of this approach have been presented in many other statements and will not be repeated here. However, it is the view of our College that the bachelor's degree should be retained as the first degree in engineering, and it is definitely not desirable to make the master's degree as the first degree in engineering on a general basis. Some schools should be encouraged to take this step, but the master's degree should not in general be considered as the first degree in engineering.

(4) *Would it be desirable to identify the first degree in engineering (in particular the integrated program leading to the Master of Engineering degree) as an engineering degree without qualifying adjectives or phrases, and to attempt to accomplish this transition for most schools within a period of 5 to 7 years?*

Engineering is a very special type of field, and as such, it is not desirable to mislead the public or the student by failing to include a qualifying adjective or phrase with the particular degree. We very definitely feel that it is not desirable to identify uniformly the first degree in engineering as a master of engineering degree or a bachelor of engineering degree on a general basis. In some schools, an integrated program may be developed which will lead to one of these degrees, and it would be perfectly satisfactory for such a school to use the designation without the qualifying adjectives or phrases. In general, we strongly support identifying the degrees in engineering with a qualifying adjective or phrase as the generally accepted procedure in our universities.

(5) *Should accreditation by ECPD be changed from specific curricula accreditation to accreditation of the over-all unit (e.g., the Engineering College), under conditions where all first designated degrees offered by that unit would be judged to be of acceptable professional quality?*

ECPD must recognize its responsibility to help the development of quality programs. We feel strongly that accreditation on the basis of the over-all unit would not be successful in improving the quality of the various programs. Accordingly, we strongly recommend that ECPD continue to accredit specific curricula as the generally accepted approach. We recognize the problems that have developed because of the excessive number of specialized curricula that have appeared. We feel that leadership and decision on the part of ECPD can handle this particular problem.

(6) *What are your views relative to the type of educational program for engineering technology most appropriate for the future?*

The training and education of technicians is a very important facet for our future development in engineering. The engineering profession should be vitally interested in the programs for engineering technology, but they should be kept as a separate entity from the engineering degrees. Neither should these programs be considered as introductory engineering programs. It is, therefore, recommended that engineering technology programs be emphasized as a two-year terminal program which results in a high-status type of certificate. We feel that a statement should be made to the effect that engineering technology programs should be considered separately from regular engineering degree programs, and the emphasis should be on a two-year terminal program.

(7) *Would it be desirable to increase industrial financial support of research in universities by forming a nation-wide private foundation to pool contributions from individual firms and award research grants to individual professors and institutions?*

It is essential for industry to recognize the need for financially supporting the activities of our universities. This should be accomplished by direct contacts with key individuals in industry, pointing out to them this particular need. A key role in this activity should be played by our various professional societies. We do not favor the formation of a nation-wide private foundation of a joint engineering council to promote this type of activity, but we definitely feel that the individual type of research

and other support for universities should come directly from the industrial concerns rather than from a nation-wide private foundation.

(8) *Because the final report will necessarily represent the consensus of a small committee, would it be desirable to make certain that other views and interpretations are presented by including a short "alternative interpretations and views" section as a part of the final report? If your answer is in the affirmative, how could such a section be prepared effectively?*

The final report will be viewed by many as the basis on which the future of engineering education will be evolved. This will be true even though the report is not accepted by many groups. Under these conditions, to make this report the most effective and to present the fairest over-all view, we feel that a section dealing with "alternative interpretations and views" should be included as an important part of the report. We feel that such a section could be prepared effectively by having the over-all committee name a special

subcommittee. This subcommittee should be composed of five to ten individuals who have strongly indicated their disagreement with the main form of the final report. These should be persons who are recognized as leaders in the engineering education field as well as in the industrial field. It would seem that the main committee would be able to name the chairman of this subcommittee and the members in such a way as to appropriately reflect the alternate interpretations and views.

SUMMARY

In considering some alternative interpretations and views, we would like to make the following four recommendations for consideration by the above subcommittee:

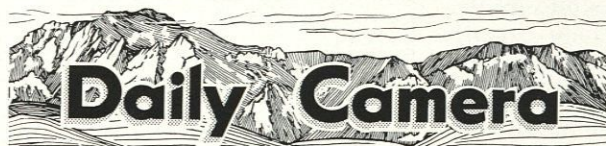
1. The Bachelor of Science Degree in engineering represents a firm educational foundation on which to build further professional activities as an engineer including graduate work and industrial functions. While some schools should be encouraged to develop programs which may represent integrated sequences leading

to a five-year Master's program, the major emphasis for the first professional degree in engineering should remain upon the Bachelor of Science Degree.

2. Although generalized engineering degrees without specific designation should be encouraged for some schools on an experimental basis, it is recommended that a specific degree designation representing an appropriate specialized area of engineering be included with the normal Bachelor curricula in engineering.

3. Accreditation by ECPD should be based on the ability of a specific engineering curriculum to meet requirements judged to be of acceptable professional quality.

4. Post-high-school college-level programs of two-years duration leading to technology certificates should be encouraged. These should be developed as high-status terminal programs on a non-professional level directed toward training technicians and should not be considered as introductory engineering programs.



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INDEX TO ADVERTISERS

Allison Div. of General Motors.....	43
American Telephone & Telegraph.....	35
The Asphalt Institute	51
Bethlehem Steel Co.	49
Boeing Co.	8
Boulder Daily Camera	48
Clearprint Paper Co.	1
Colorado Engineer	42
Dunham-Bush, Inc.	24
Eastman Kodak Co.....	Inside Back Cover
The Garrett Corp.	4
General Electric Co.	Back Cover
International Business Machines Corp.....	5
Malleable Founders	18
Motorola, Inc.	31
Portland Cement Association	15
Pratt & Whitney Aircraft	26-27
The Regiment	39
Stearns-Roger Corp.	32
U.S. Air Force	13
Westinghouse Electric Corp.....	Inside Front Cover



LARRY ARENDAS, SALESMAN
C.E., '63, Carnegie Institute of Technology

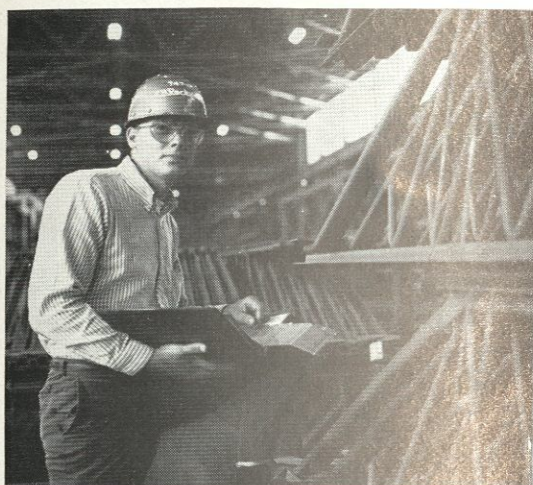


DENNY DAVIS, METALLURGICAL ENGINEER
Met.E., '64, California State Polytechnic College

Men on the move



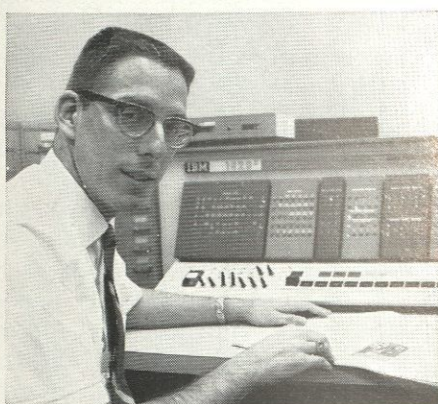
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Ch.E., '62, Villanova University

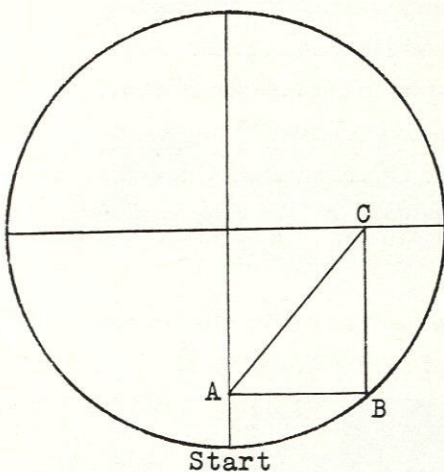


DAVE SPARKS, ASSISTANT TO SUPERINTENDENT, COAL MINE
Min.E., '60, Ohio State University

PUZZLE PAGE

BRUCE DUNN

1) How could you measure the height of a tree (approximately) using a stick of unknown length and a tape measure which you can lay along the ground? You don't start by measuring the stick, by the way.



2) Refer to Figure 1 for this one. A farmer decides to inspect a round wheat field. He starts at the edge of the field, walks 100 feet to Point A, then walks to points B and C. Here he notices that he dropped his pouch of tobacco at point A, which is 300 feet away. As he is walking back he wonders just how many acres of wheat he can grow on the field. Can you help him out? Thanks to Alan von Ahlefeldt for this puzzle and the next.

3) This is a very simple puzzle,

but one of the staff members said that he didn't think my readers were capable of solving it. Just to show him how wrong he is, solve it in your head. A touring car travels at 30 MPH to the top of a hill, a distance of one mile. How fast must he travel down the hill in order to reach the bottom (Two miles from the start) in a total elapsed time of two minutes?

4) If you can follow this one, you have gone a long way toward working it. There is a country that is ruled by a certain number of sovereigns having various names. To be exact, $1/6$ had one name, $2/9$ had another, $1/12$ still another, $1/9$ were of each of 2 others, and $1/18$ were of each of 3 others. Then there were five others on top of this. How many sovereigns were there?

5) Last comes a reconstruction problem like all the rest, with one exception, it is in octal numbers.

```

      LOTI
      RAVI
      ***TT
      L***
      ****I
      O****
      L***E*O*
  
```

Just to prevent complete nervous breakdowns before finals, and as this is the last issue of the year, I have included answers, or big hints, on page 42.

ANSWERS TO MARCH PUZZLES

1) The astronaut will have to take 15 days. This is done by getting one day's fuel at the one day's flight point and at the two day's flight point. It takes two days to accomplish the first task and eight days to accomplish the second. With this done, the trip can be made in five days with the three-day's fuel supply the ship will carry. Since the problem didn't say anything about getting the astronaut back, we can leave him at that point.

2) The equation for this problem is $a^3 + b^3 = c^4$. If we divide both sides of the equation by c^3 we get $(a/c)^3 + (b/c)^3 = c$. Now, if a/c and b/c are set equal to any two different integers (other than 1), the numbers can be found. For example, if we let a/c equal 3 and b/c equal 4, we get $3^3 + 4^3 = 91$, and the two numbers are 273 and 364.

3) This puzzle is really very simple if you start at the back and work forward. The answer is \$8.75.

4) This problem is solved in three steps. First we can determine that T must equal 1, and that W is less than or equal to 4, as the quotient starts in T and has five integers. Next we can find that E equals 4, as 44 is the only double integer, other than 11, that is made up of two squares, and 11 has been eliminated. Thus, we can now try the few possibilities available and find that TWO equals 138.

RESEARCH OPPORTUNITIES IN HIGHWAY ENGINEERING

The Asphalt Institute Suggests Projects in 5 Vital Areas



Phenomenal advances in roadbuilding techniques during the past decade have made it clear that continued highway research is a must.

Here are five important areas of highway design and construction that America's roadbuilders need to know more about.

If you or your department are planning research studies, you can make important contributions to highway technology through projects in one or more of these areas:

1 Rational Thickness Design and Materials Evaluation.

Much remains to be done in the refinement of thickness design concepts for asphalt pavement structures. Research is required in areas of asphalt rheology, behavior mechanisms of individual and combined layers of the pavement structure, stage construction and pavement strengthening by Asphalt overlays.

Traffic evaluation, essential for thickness design, requires the development of improved procedures for utilizing loadometer and other traffic data. These new procedures will more adequately permit conversion of mixed traffic loads into terms of 18,000-lb. single-axle loads as required by design guides of the American Association of State Highway Officials, The Asphalt Institute and others. Also needed are better methods for predicting future traffic volumes and characteristics.

2 Materials Specifications and Construction Quality-Control.

Needed are more scientific methods of writing specifications, particularly for determining rejection and acceptance criteria. Also urgently needed are speedier methods for quality control tests at construction sites, such as improved air- or water-permeability procedures for controlling pavement density.

3 Drainage of Pavement Structures.

Better and more positive methods are needed in this area. Suggested are experiments with two-layer systems and investigations of differing roadbed cross sections.

4 Compaction of Pavements, Traditional Lifts and Thicker Lifts.

Rolling procedures, compaction equipment and compaction testing-methods for traditional thin lifts of asphalt

pavements need further study. The recent use of much thicker lifts in asphalt pavement construction suggests the need for new studies to develop and refine techniques of compaction to obtain the densities desired.

5 Conservation and Beneficiation of Aggregates.

In light of greatly increased road and street construction, in which high-grade materials are being used in abundance, the conservation of aggregates has become a pressing requirement. A study of the use of Asphalt in membrane form to envelop low-quality base courses and soils would be helpful. Other procedures utilizing Asphalt also could be studied.

For basic background information on Asphalt construction and technology at no cost, fill in and mail the coupon.



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WOMAN: A rag, bone, a hank of hair.

MAN: A brag, a groan, a tank of air.

He was notorious for piling on homework. Finally, a student gathered up enough courage to speak to him about it. "Well," said the professor, "Why don't you do only half of the problems?" The student looked much relieved. "And then," continued the prof, "next year, when you take the course again, you can do the other half."

An engineer is a person who measures with a micrometer, marks with a piece of chalk, and cuts with a dull ax.

The inmate was being given his test to determine whether or not he was well enough to release from the asylum. So far his answers had been the proper ones, and he had only one more to go.

"John, what are you going to do when you leave here," one of the psychiatrists asked.

"Well," said John after a moment's thought. "I might finish my studies at the university, or perhaps I will go into my father's business, but then on the other hand I might like to be a teapot."

In "Show and Tell" that week, the Kindergarten teacher had her charges draw on the blackboard something that had been a source of excitement in their homes recently. Johnny, the class cut-up, confidently made two small dots on the blackboard. Suspecting his usual pranks, the teacher asked him to explain their significance.

"Well, those are periods, right?" asked Johnny.

"Yes," replied his teacher, "But what is so exciting about two periods?"

"I really don't know," answered Johnny, "But that's how many my sister in high school has missed, and that sure is causing a lot of excitement around our house."

"Gee, I've never been propositioned by a deaf-mute before."

We finally psyched them out—professors are people who tell students how to solve all the involved problems of life which they avoided by becoming professors.

"Where have you been?"

"In the phone booth talking to my girl, but someone wanted to use the phone, so we had to go somewhere else."

The priest and the rabbi were sitting next to each other on the train, and as the trip continued, they struck up a conversation. As the friendship developed, the priest asked the rabbi if he would object to answering a rather personal question. The rabbi replied, "No."

"Well," the priest continued, "as part of your religion, you are forbidden to eat ham. True?"

"Yes, that's correct," replied the rabbi.

"Well, Sir," asked the priest, "Have you ever eaten any ham?"

"Yes, I have, Father," answered the rabbi, "and would you mind if I asked YOU a personal question?"

"No, go ahead."

"As a priest, you are required to take a vow of celibacy. Have you ever broken that vow, Father?"

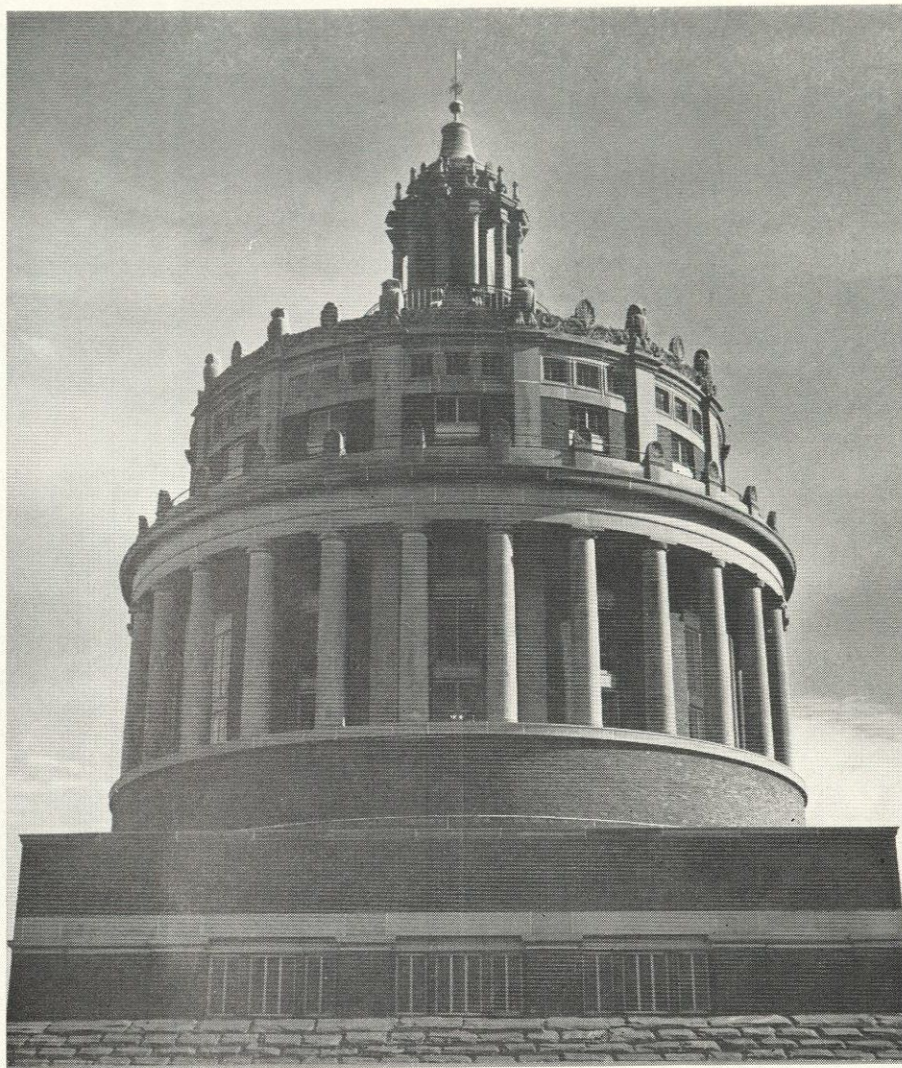
The priest hesitated for a moment and then replied, "Yes, once when I was much younger I did."

The rabbi thought for a moment and then commented, "Sure beats ham, doesn't it."

Engineer, upon being asked to a sorority dance: "Is it formal, or do I wear my own clothes?"

Remember, you hold the future of the world in your hands—sometimes.

—Fred Love



University of Rochester Library Tower as seen by the famed photographer Ansel Adams

Have your cake and eat it

Suggestion to Ch.E.s, M.E.s, and other engineers:

The University of Rochester has long committed itself to the pursuit of academic excellence and long ago attained success in that quest. Likewise, with a somewhat different conception of higher education, has the Rochester Institute of Technology earned high regard. The two institutions are quite unrelated to each other or to us, except that their fortunate presence in Rochester provides opportunity for those who join us with fresh baccalaureates to proceed right on course with the next formal stage of professional or business preparation. In Kingsport arrangements are offered by the University of Tennessee Graduate School and East Tennessee State University.

Two big factors make such plans attractive:

1. Money. It can be a great comfort when supplied regularly by a prosperous firm well aware that its fate depends on the intelligence and devotion of the people it can lure into its fold.
2. Direct personal involvement in the *realities*. The realities encountered in a company that leans as heavily as we do on engineering, science, and scholarship can be nothing but helpful to one whose motivation toward education is genuine and deep.

There is also a rough side:

You have to drive yourself pretty hard when you work and study at the same time. This shows you up as a candidate for tough assignments.

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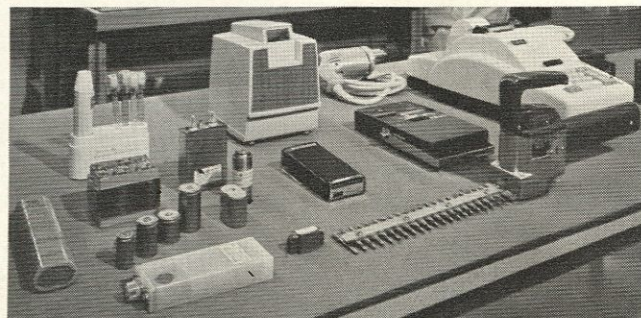
A PREVIEW OF YOUR CAREER AT GENERAL ELECTRIC



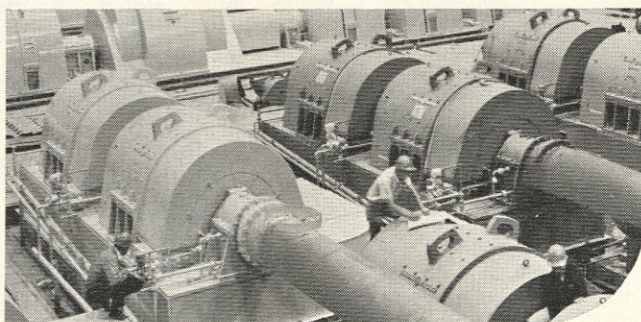
DEFENSE—G-E engineers designed and produced six J93 engines to push USAF XB-70 to Mach 3.



ELECTRIC UTILITY—Built by G.E., the Dresden Station produces commercial electric power from the atom.



CONSUMER—Nickel-cadmium batteries for cordless products were created by G.E. for new business demands.



INDUSTRIAL—G-E knowledge and skills contributed to automation of new Bethlehem Steel mill.

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