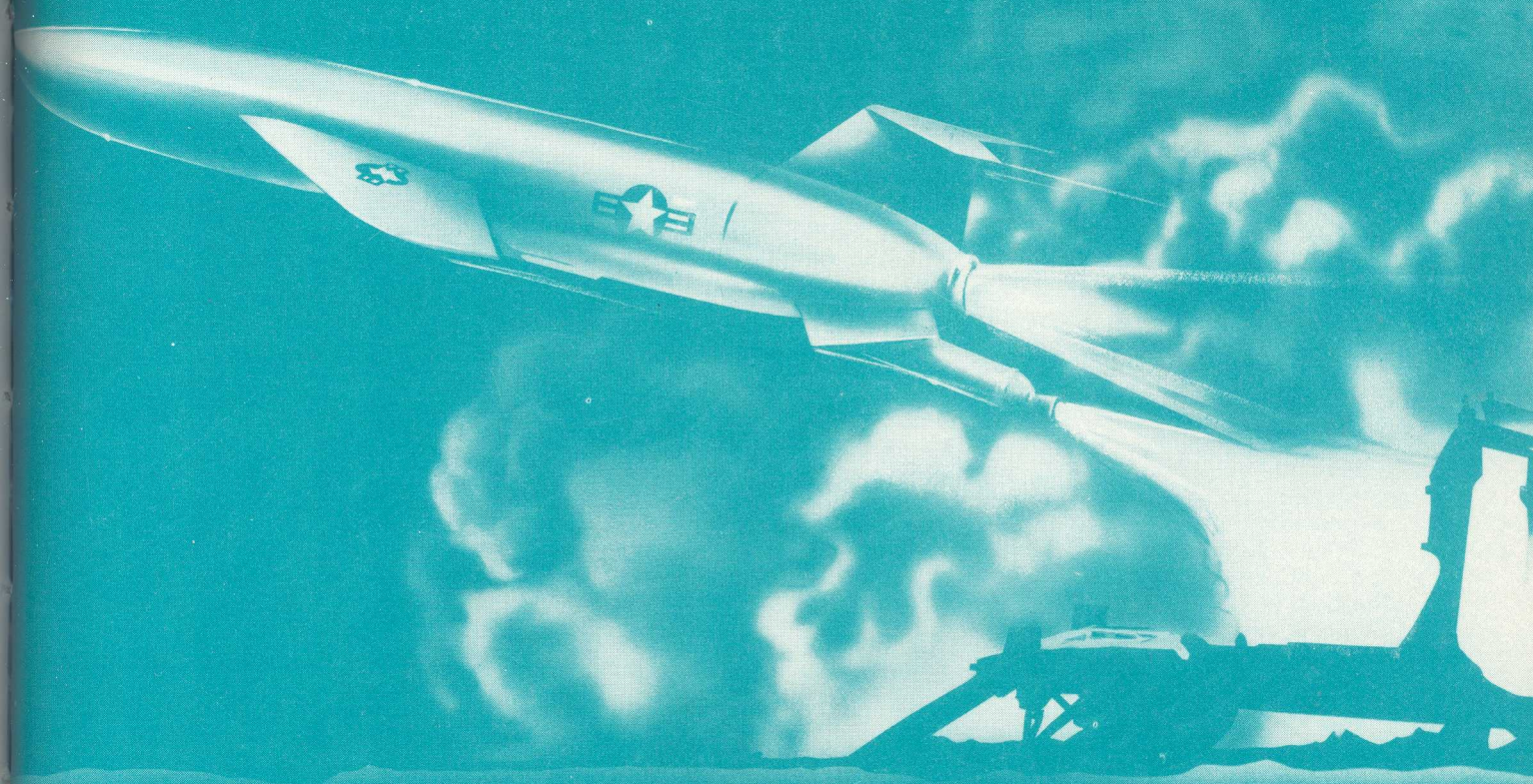
Spartan Engineer



VOLUME 9 NUMBER 2 JANUARY, 1956 PRICE 25c

Edward J. Stolic, class of '48

speaks from experience when he says . . .

"With U. S. Steel, my future holds interest, challenge and reward."

From his graduation in 1948 with a B.S. degree in Mechanical Engineering, until November of that year, Edward Stolic worked as an operating trainee in the Irvin Works of United States Steel. Following his discharge from the Army in 1950, he returned to work at U.S. Steel. In just 18 months, Mr. Stolic reached a management position as Engineer-Lubrication.

By mid-year 1953, Mr. Stolic was promoted to Foreman-Instrument Repair and Sub-Station. In a recent interview he said: "Opportunities for rapid advancement are almost limitless in U.S. Steel." At 27, Mr. Stolic is supervising a force of 30 men in mechanical and electrical tests as well as instrument repair and maintenance of gas generators, compressors and water purification units. He feels that, "The engineer finds many places to apply the knowledge he garnered in school." The men under Edward Stolic are called on to trouble shoot in any part of the mill. This calls for a wide variety of talents and leads Mr. Stolic to say: "The steel industry has expanded greatly, and with it the need for good men."

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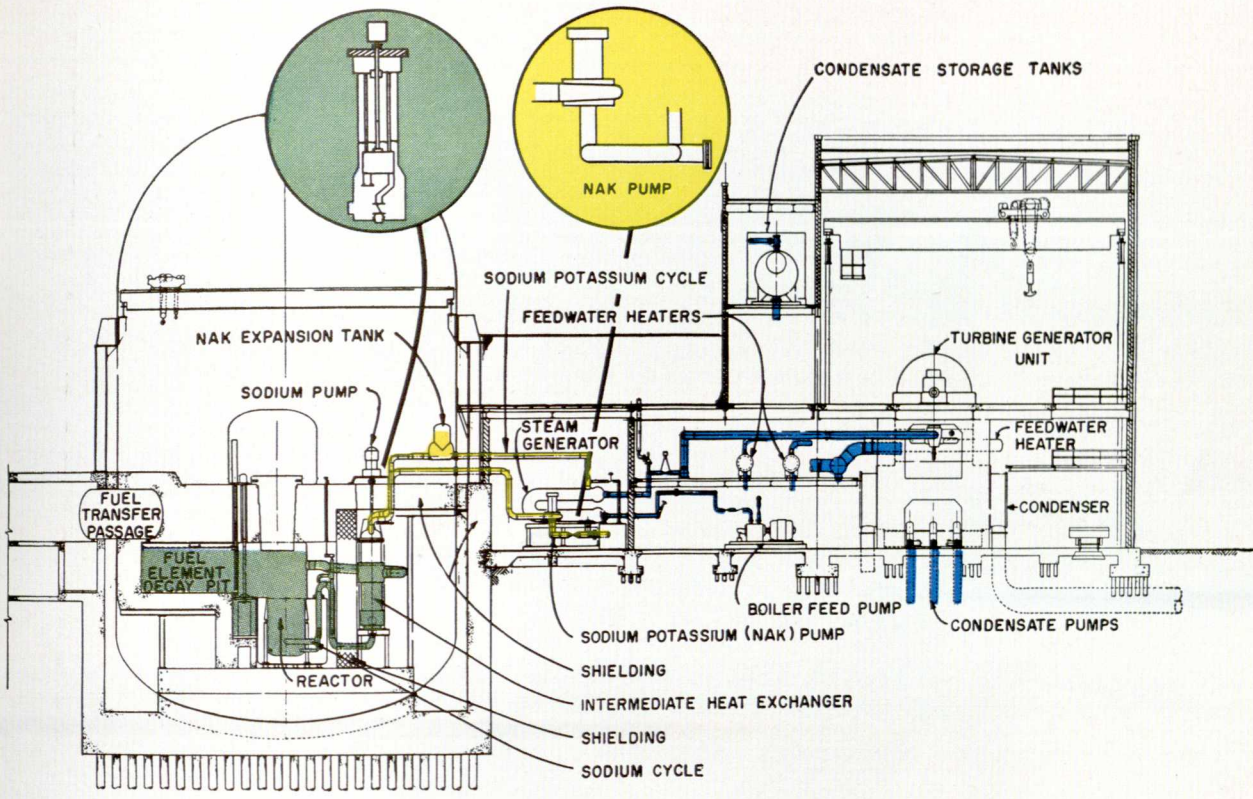

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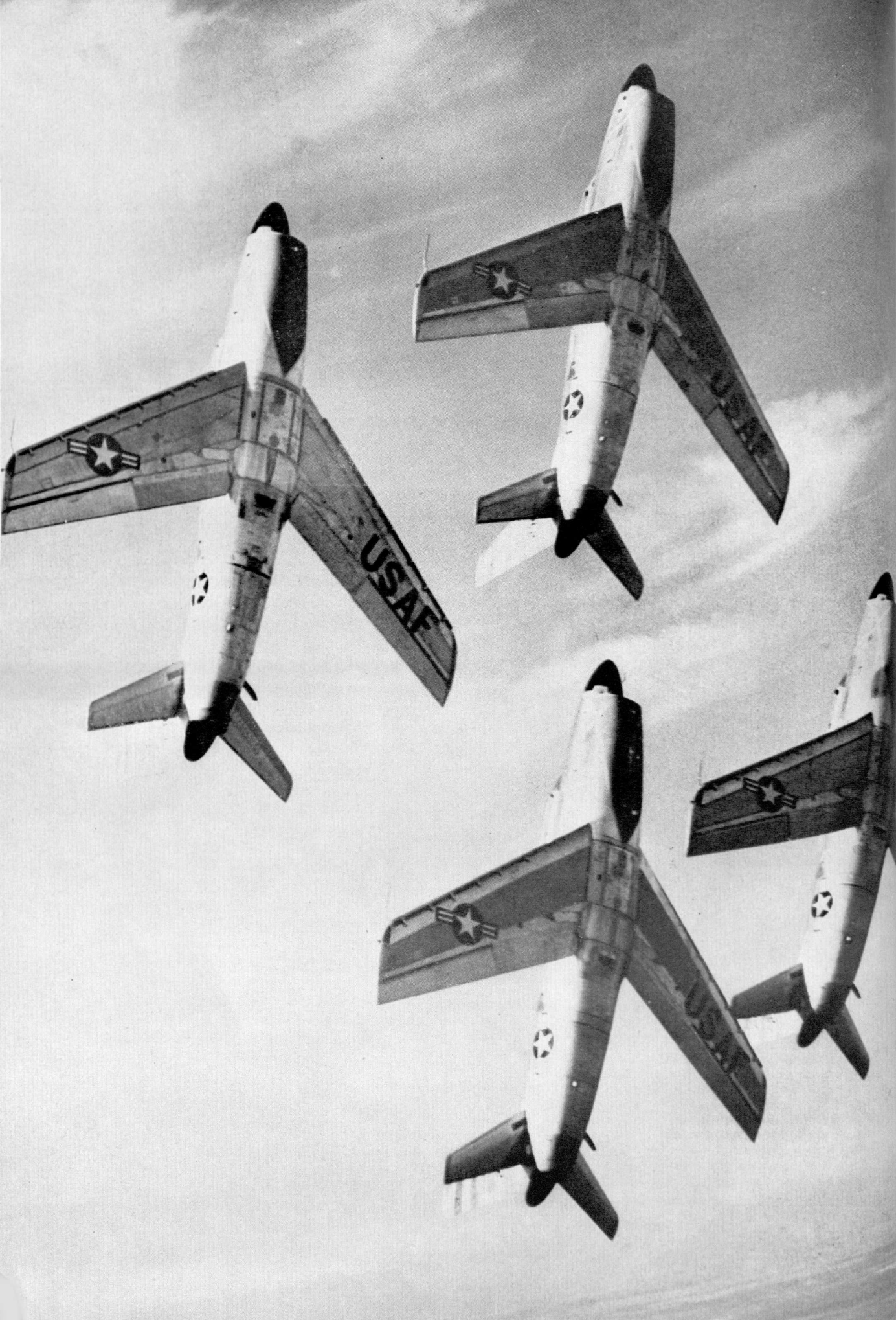
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Spartan Engineer

of michigan state university

VOLUME 9 NUMBER 2 JANUARY 1956

ARTICLES

FEATURES

Cover: THE MATADOR — NEW USAF PILOTLESS BOMBER

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Two Seconds To Live

Edited by Al Beers, from Skyline, North American Aviation, Inc., Ward Lauren

What actually started as a typical Saturday off for George Franklin Smith, a thirty-one-year-old Test pilot, turned out to become a day which changed his entire life.

Before it was over he was to become the first man to bail out of an airplane at supersonic speeds and low altitude and live! He was to suffer injuries that would put him in the hospital for six months and make him the most valuable human being in aviation.

A bachelor, Smith left his Manhattan Beach apartment to take his laundry out. On the way he suddenly decided to stop at the plant to complete a report on an airplane he had flown late Friday afternoon. Just before he left, the dispatcher hailed him with a special request:

"F-100A number 659 is ready for a first flight; why don't you take it up as long as you're here?" Since it was only one flight, he just put his parachute and life vest on over his sport shirt and slacks. Then with his helmet and oxygen mask on and fastened he was ready to go.

At the end of the runway he made the usual checks, and everything was as it should be, except for a little heaviness in the stick action. He checked the hydraulic pressure of the number one and number two systems, and since they were both normal, called the tower for take-off.

Once in the air he trimmed the fighter for a normal climb with after-burner and climbed into his familiar heading toward San Diego. At about 35,000 feet it happened.

The airplane began to nose over. It is a characteristic of airplanes going through the transonic speed to nose down slightly as they exceed Mach 1 (the speed of sound). But when Smith tried to pull ship up, he found that the control stick was stuck fast. He couldn't budge it. The plane continued to steepen its dive and gain speed. As it neared 20 degrees Smith radioed the company that he was having trouble with the hydraulic system. He grabbed the stick with both hands and pulled with all his strength. No response. By this time the dive had steepened to an 80 degree angle. His wingman gave the orders to bail out. The orders weren't needed. Smith was already making his preperations as fast as he could move: stop-cocked the engine, opened the speed brake, pulled his helmet visor down over his eyes. With his right hand he pulled up on the armrest of the seat, ejecting the canopy. From the dead silence of the closed cockpit to the open rush of air going by at more than 700 miles an hour, a tremendous noise like a long continuous explosion filled his ears.

"I don't actually remember pulling the trigger to eject the seat," Smith says. "The last thing I remember was seeing the Mach meter in front of my face, reading 1.05. The next thing, I woke up in the hospital five days later!"

Engineers calculating George's speed and rate of descent from this bit of positive information came up with what is probably one of aviations closest margins: starting at 35,000 feet, he must have been at 6,500 feet when he got out of the airplane; by this time the ship was descending at 1,140 feet per second, or 777 miles per hour! If he had hesitated two more seconds, his

Test Pilot George F. Smith looked like this, weighing 215 pounds, before the harrowing day he became the first man to survive an ejection escape flying faster than sound.

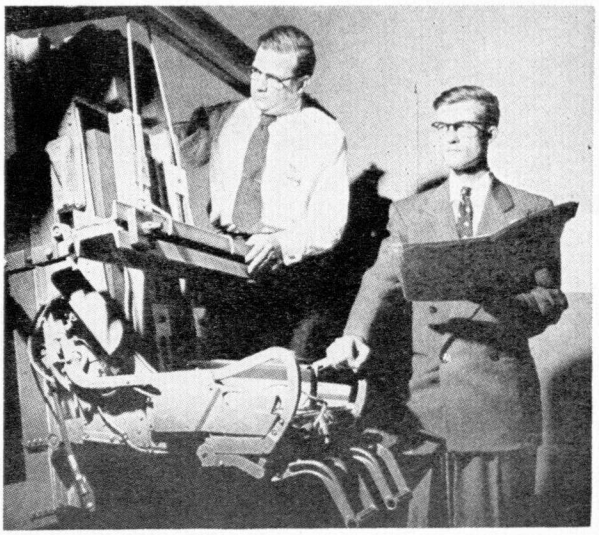
parachute would not have had time to open before he hit the water, for after ejection it takes two seconds for the seat to automatically detach itself from the pilot, and another two seconds before the automatic release opens the chute. Smith's active part in the rest of his escape was over, for he was slammed into the brick wall of supersonic air that hit him as he left the plane. But there began a series of lucky coincidences that saved his life.

Just below, a fishing boat was out in the rainy afternoon. After hearing the explosion of the plane hitting the water and seeing the limp figure of a man floating down from the cloud layer at the end of a torn parachute, the three men in the boat went over to pick the unconscious man from the water.

Although the day was pratically windless, an errant puff of breeze came up just as Smith hit the water and partially filled the parachute canopy. This and the small amount of air trapped in his clothes kept his face above the water for the 50 seconds it took for the boat to get to him. A few miles up the coast, some Coast Guard Auxiliary cruisers were practicing rescue operations that morning. They, seeing the pilot come floating down, headed immediately for the spot. The second craft soon intercepted the slower fishing craft and, transferring the inert form of the pilot to their boat, radioed ahead to have an ambulance and doctors waiting at the dock. The hospital at Newport Beach became Smith's home for the next six months.

Meanwhile Industrial Security personnel and engineers formed an immediatel investigation board, and salvage operations to regain the wreckage of the airplane began the next day. Despite many eye-witnesses, the lack of reference points on the surface of the ocean defied all efforts to pinpoint the spot where the plane went in, although it was believed to be less than a mile off shore. For twelve days the company helicopter and a dozen Navy search and salvage vessels provided diving platforms for the 57 Navy and civilian skin divers and deep sea divers. Hundreds of dives failed to locate a single piece of wreckage. Sonar, echo sounding recorders, special rakes, power clamshell dredges and an air-suction hose were used. Even TV was used in a closed circuit to look at the bottom of the ocean was useless.

Then one of the Navy divers came forward to say that he had taken a picture of the oil slick made by the plane when it dove into the ocean, taken on the day of the accident. From this picture, by the use of the triangulation process of lining up visable trees, poles and TV aerials and a transit, the exact location of the wreckage of the plane was discovered.



The human factors engineering group are among those working to better pilot's equipment.

After 321 dives and 33 days of salvage operation, 89.5% of the airplane was recovered and shipped by truck to a Los Angeles plant. As in every crash, Air Force representatives and engineers in all groups and projects concerned with the airplane studied their portions of the wreckage and reported in as much detail as possible their behavior relevant to the accident.

There was not enough wreckage salvaged in large enough pieces to be able to determine in this case just what caused this accident.

So the cause of the crash was listed officially as undetermined by both the company and the Air Force committees. There were strong suspicions by both groups, however, that the hydraulic lock caused by the inadvertant opening of a quick disconnect coupling in the hydraulic system was the cause of the trouble. Consequently the remedy of this and several other possible trouble areas, even though extremely remote, was recommended and performed on all existing F-100s and established on the line for all ships in production as a safety factor for all pilots in the future.

The role of the test pilot in aviation is shown clearly in this one action.

(Continued on Page 47)

A possible new helmet is studied by its builder, specialists and Pilot Smith.

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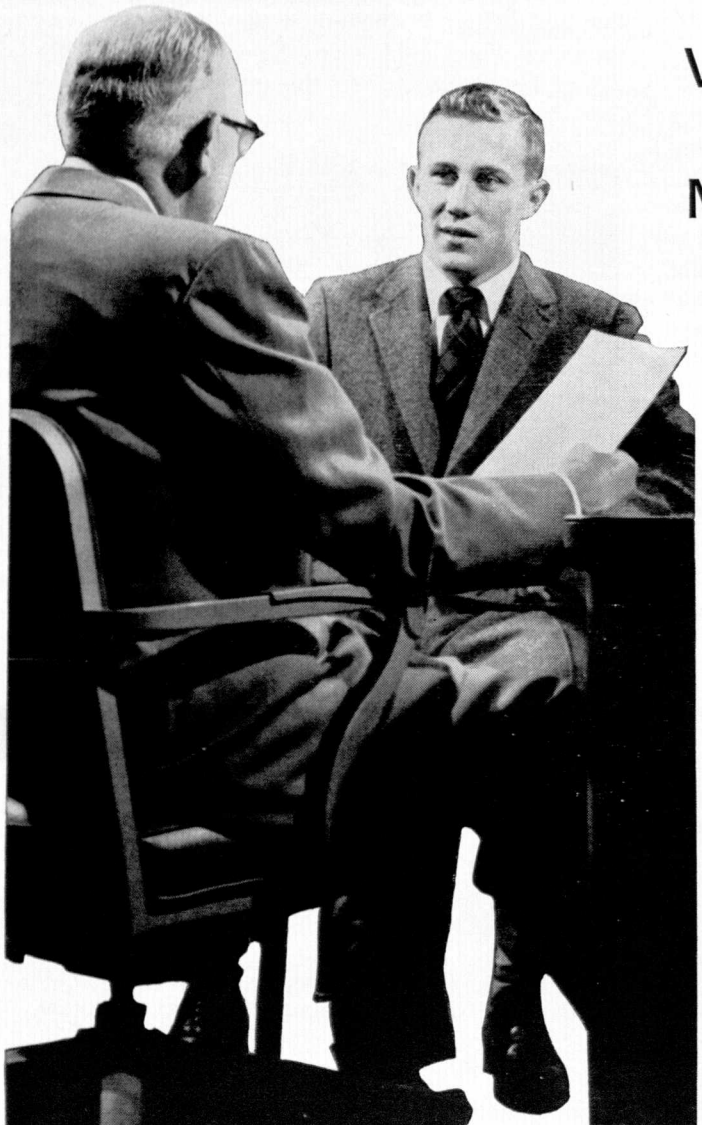

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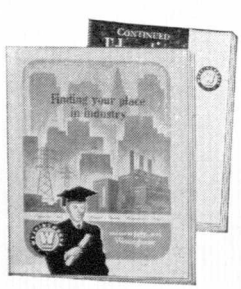

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THE VITAL LINK

by Robert E. Fredericks

Charles J. Puma

Engineering at the present time is engaged in two struggles. First, the struggle with society for recognition and understanding and, secondly, a struggle within its own ranks for a more efficient engineer.

The struggle with society has evolved from a rapid advance of science and an uninformed society. The engineer in the eyes of the layman is something good, and what he does is something great, but ask him what an engineer is or what he does and the layman has no more idea than you have about the principles of belogmetry.

Many people are familiar with the end result of engineering such as bridges, television, etc., but they have no idea of the engineers methods and problems. Until they do come familiar with these methods and problems, the engineer cannot hope to be fully recognized or understood. Seemingly, the solution to the problem is simply to familiarize the public with the scientific method. But the big problem is how do we do this.

Scientific films for schools and movie houses would not hurt the project, even science fiction if nothing better has helped make the public science conscious. These things are a step in the right direction, but they are not enough. Undoubtedly, the best and most efficient way would be educational television. Once this medium is developed to a point where it is accepted and demanded by the public, it will enrich and stimulate the minds of millions.

Some of the fault for an uninformed society lies with the engineer. There is no one who could inform society about engineering methods and problems better than the engineer himself. Instead of recognizing the value of this, the engineer has chosen to isolate himself from the unscientific groups. He goes around with an air of superiority, yet pouts because society doesn't understand him. The engineer feels he isolates himself because he belongs to a chosen group and he would be wasting his time talking with non-technical people about scientific matters. But this not so, he isolates himself because once he is taken from his scientific colleagues he is unable to communicate successfully with the non-technical individual.

Engineering is a big job and the responsibility for preparing men for this big job lies with the universities. Schooling for engineers is in two categories. First, their are educators that feel that engineering exists to convert the finding of pure research into practical things. Therefore, the best engineer is the one who has the best and most thorough understanding of science. These administrators feel that with an adequate knowledge of scientific fundamentals, the engineer is sufficiently prepared for a successful career in his field. It may be pointed out here that these principles though theoretically sound lead to often to specialization. A very high degree of specialization in the scientific and engineering fields carries with it a lack of versatility such that the individual, if taken from his immediate specialization, may become considerably less useful.

In recent years, educators and employers have begun to realize that their has been something missing in this pure scientific creature. They began to realize that the engineer must communicate with every type of individual. The engineer is the vital link between the world of pure research and the world of business. He must be equally strong on both ends of this link. The engineer must be able to communicate, not only with the pure scientist, but equally efficient with the businessman and layman. In order to do this, he must understand the non-technical man, his work, ideas and problems.

Many educators now feel that to understand the non-technical man, you must be familiar with his non-technical world, a world of business, social science and his non-cumulative world of literature.

The on the job engineer is engaged in duties sometimes quite different than you might expect. He is most often engaged in a project where he must consider cost and marketability. All too often he is presented with the decision of sacrificing efficiency and performance for the sake of space and decrease cost. There have been many times when a saving of an inch of space has saved a manufacturer thousands of dollars. The engineer must be ever cost conscience because the dollar is what rules the business world.

The engineer many times is responsible for the performance of many people. These people often consist of craftsmen, secretaries and unskilled workers. The engineer must be able to communicate intelligently with these people or else he is of no use to his employer. Also the engineer must always be familiar with the existing union contracts. He must be able to understand all phases of it because he is often engaged in a project where he must consider the daily

(Continued on Page 47)

MILITARY TELEVISION

By Bob Stocking

On August 11, 1954, an attacking force of United States Army soldiers swarmed ashore in amphibious personnel carriers after a lake crossing at Fort George G Meade, Maryland, to assault a simulated enemy stronghold. With the first wave of troops rode the herald of a new era in battlefield communication—a combat soldier equipped with a hand-carried Vidicon television camera that flashed back to regimental headquarters an instantaneous picture of the critical action on the beachhead.

The maneuver itself was divided into two distinct segments—a demonstration of the Army Signal Corps Interim Tactical Television System, on a black-and-white closed-circuit system feeding to monitors and the commander's receiver in the command post tent; and a second assault carried out under the "eyes" of color television cameras for broadcast over a national network. The color demonstration was also watched in the command post on color television sets.

The Signal Corps television unit, attached to the regiment as a part of the regimental communication system, comprised three rugged, compact Vidicon cameramen with the troops, and two larger cameras, as modified by the Signal Corps Engineering Laboratories, mounted in an L-20 reconnaissance plane. The ground cameras were linked by cable to truck-borne transmitters which relayed the pictures by microwave to a receiving unit and small preview monitors at the command post. From the airborne cameras signals were sent directly to the headquarters receiver by microwave relay and appeared on a fourth monitor.

In the command post, placed at a field table with the commander and his intelligence and operation officers, was a television technician responsible for switching images from the small monitor screens to the large viewing screen placed before the commanding officer. Thus the commander was able at any point during the action to call for a direct view on his screen of the sector covered by any of the cameras.

Radio telephone communication between the command post and the cameraman permitted the commander to direct the cameras toward any desired objective.

In this simulated command post, the role of television in ground combat took dramatic shape.

The regimental commander used the eyes of television to help him carry out his strategy. As the battle progressed, he swiftly adapted his original battle plans to new circumstances conveyed to him by Vidicon cameras in the battle area and by the larger television cameras mounted in the reconnaissance plane circling over the enemy's supply and assembly point.

A new type of enemy tank was shown on the screen and its detail rapidly noted by the staff intelligence officer. An enemy prisoner interviewed before a Vidicon camera immediately after his capture in the front line, disclosed the nature of the enemy forces opposing the assault. A map found on the prisoner and held up to the camera divulged an enemy scheme of counter-attack; the plan was confirmed by the airborne television camera, which located an assembly of hostile forces and the commander rapidly altered his plans to break up the counterattack before it could be mounted. With the help of another Vidicon camera close to the front, helicopters were directed for speedy evacuation of the wounded.

Through the entire action, the commander was able, through the eyes of television, to see and control the battle situation.

This was combat television—demonstrated publicly for the first time on the twentieth anniversary of the concept of television for military use, first proposed to the Armed Services by Brigadier General David Sarnoff. It was in 1934, when the art of television itself was in its infancy, that General Sarnoff initiated discussions with representatives of the services in Washington on applying the extended and instantaneous electronic sight of television to the subequent development of television equipment and techniques for combat use in the air and at sea—and now on land.

An audience of top ranking military and industrial leaders and representatives of the nation's press watched the Fort Meade demonstration in a "command post of the future." Observing the demonstration were General Matthew B. Ridgway, Army Chief of Staff; Major General George I. Back, Chief Signal Officer; Major General George W. Smythe, Deputy Commander of the United States Second Army, and Brigadier General David Sarnoff.

In their comments on the demonstration, Generals Ridgway, Back and Sarnoff were unanimous in emphasizing the important part that television is destined to play in future operations on the battlefield.

The combat exercise demonstrated in a highly realistic setting the tactical uses that are within the capabilities of today's experimental battlefield television

equipment. These uses explored by the Signal Corps over the past few years during its development of training technique and equipment include the following:

The location, evaluation and designation of artillery targets;

Adjustment and control of artillery fire;

Transmission of data from the combat area to headquarters;

Reconnaissance of enemy held territory to detect supply points, assembly areas and movement of forces;

Intelligence reporting, such as examination of captured personnel and equipment;

Briefing of tactical commanders before an action showing terrain, routes of approach, and enemy positions;

Observation and control of amphibious landings, river crossings and assaults, as well as the movement behind the lines of friendly troops and supplies.

In the words of General Back, speaking at the opening of the closed circuit demonstration of Signal Corps equipment, "the combat commander has been blind, insofar as he could see very little, if anything, of what was happening along the battlefront of his troops, his weapons and his machines."

The revolutionary change that is being achieved through combat television was clearly indicated in the exercises that followed, from the initial briefing with help of televised scenes of the terrain over which the assault was to take place, to the final capture of the "enemy's" stronghold—reported by a television camera with the assaulting troops.

The color cameras covered the second phase of the maneuver for the half-hour nationwide telecast. Two cameras placed in the command post showed the national audience how the future commander may employ television in directing the battle while others placed aboard an amphibious personnel carrier and in the battle area gave a constant view of the combat action.

Vidicon camera, carried in armored amphibious personnel carrier, is shown in operation at demonstration. Picture of actual landing from the amphibious vehicle was microwaved several miles to "command post of the future" where regimental officers were able to evaluate the progress of the "assault."

Each of these functions, representing knowledge that is vital to the combat commander and his staff, has been performed in the past by a variety of means ranging from written messages to radio-telephone and telegraph communications.

Whatever the system employed, the commander has been able to form his picture of an action only through the experience, judgment and interpretaation of many other people, and on the basis of information that in some instances has been hours or even days old by the time it reached him.

While demonstration of the Signal Corps black-and-white equipment underlined dramatically the capabilities of television itself in helping to direct battle action, the color telecast provided a glimpse for the distinguished audience of the ultimate goal—a combat television system that will provide the commander with a continuous view of the battle situation as it actually appears, including the color distinction between types of terrain and foliage, between natural and camouflaged objects, and between the wide

(Continued on Page 43)

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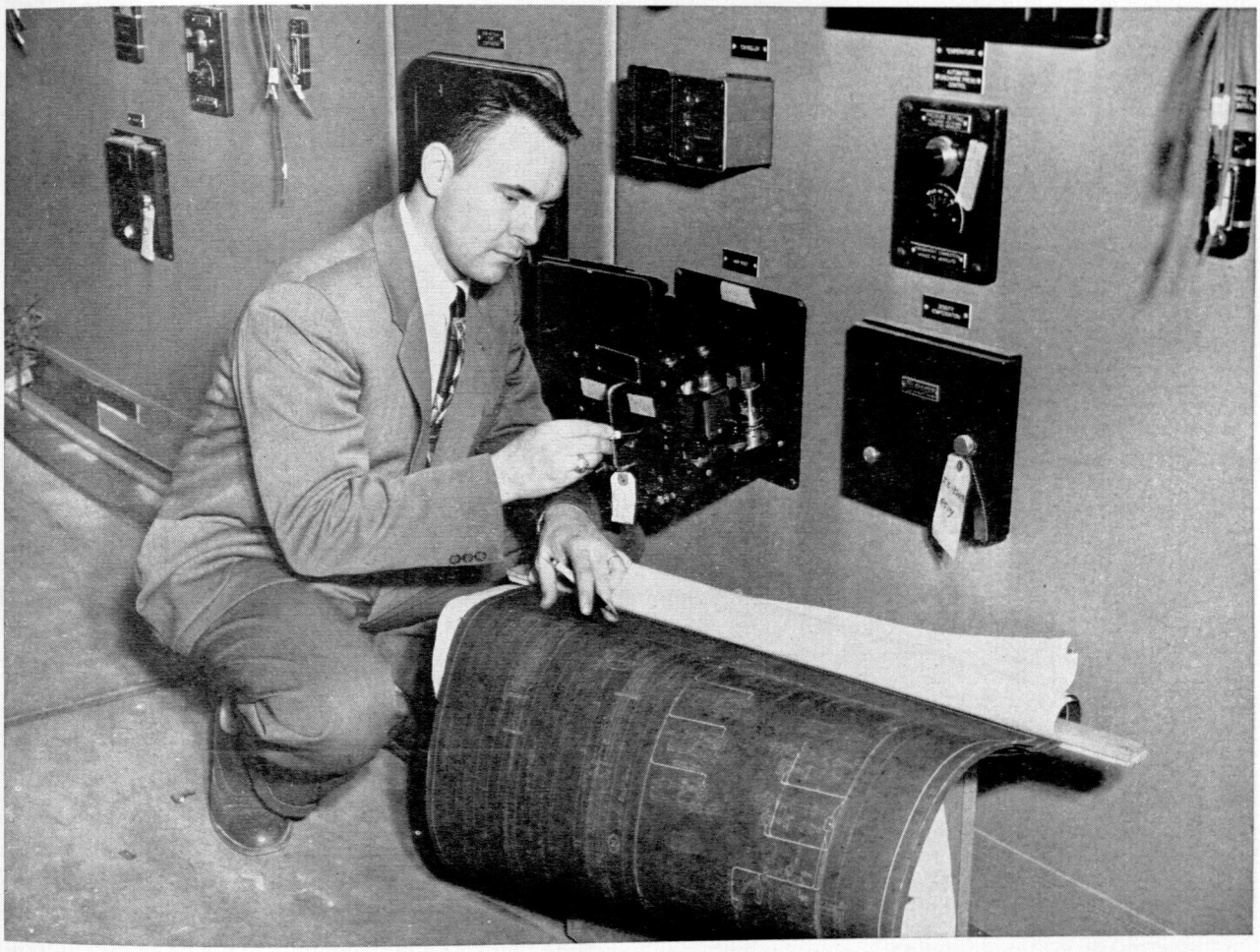


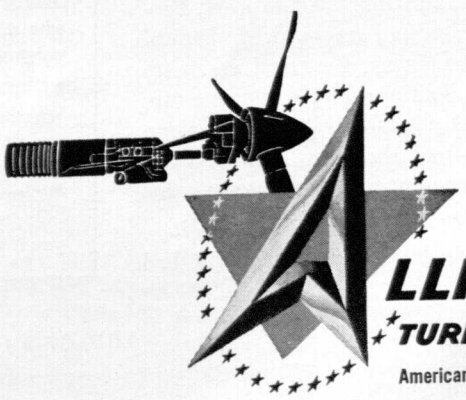
FLOYD D. (Doug) WALLACE, JR., above, is a senior project engineer at Allison.

He left Purdue in 1947 with his AE degree and came to Allison the same year. Presently, he is in charge of instrumentation and automatic process controls at Allison's new Research & Development test center.

With Allison now in the midst of a $75 million engineering expansion and building program, much of his time is spent in vendor contact work, studying and selecting equipment most adequate to do the job; observing, and helping with installation. He is shown above checking a control valve positioning amplifier on the instrument panel for controlling air pressures and temperatures of four electric motor-driven, axial flow compressors. This new facility is part of the new Research and Development test center, which—when completed—will enable testing of individual combustion components for turbo-prop and turbo-jet engines, compressor and turbine components.

Doug's work is "cut out" for him for some time to come, for only recently, Allison broke ground for the engineering building which is to be the center of expanded Research and Development facilities for advanced types of aircraft engines for commercial and military use.

With this long-range expansion program, Allison needs more engineering personnel, and opportunity for young graduate engineers is unlimited. Arrange now for an early interview with our representative on your campus, or write for information about the possibilities of YOUR engineering career at Allison: Personnel Dept., Engineering College Contact, Allison Division, General Motors Corporation, Indianapolis 6, Indiana.



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YOUTH DEVELOPEMENT PIONEERED . . .

MICHIGAN STATE'S JETS PROGRAM

by Jim Hellwarth

A Regional Organization, Jets (Junior Engineering Training for Schools) was formed at MSU to stimulate an interest in engineering among high school students. It offers all types of engineering projects and has expert assistance available for those who demonstrate initiative, enthusiasm, and interest. It is an extra-curricular club sponsored by, and operated at the high schools.

Jets was founded to encourage those students who have at least a fair aptitude for mathematical or technical subjects to prepare them for an engineering career. For these young men or women, it promotes and encourages good scholarship and proficiency in high school subjects as prerequisities for college engineering courses. Also, it enables these young people to get a preview of the engineering profession and acquaints them with men who are actively engaged in the field. This aids the student to discover and appraise his own abiilties, aptitudes, and interests in preparation for the fields of engineering.

Since mathematics is of great importance as a tool for the engineer, the student learns to develop some measure of success in algebra and other math subjects.

Who Can Join and How the Jet Clubs Are Organized?

Any young man or woman who has completed a semester or more of algebra, and is interested in comparing his talents with the requirements of the engineering profession, is eligible to join Jets. It is suggested that the clubs be made up of four or more interested students. Complete Jets kits, record forms, and steps for organizing a Jets Club are available upon request from Michigan State University. Success of any club hinges largely upon well-chosen projects and well-planned programs. Movies are a popular attraction for meetings. MSU provides a list of over 100 informative and entertaining movies. Radio programs are also available for meetings.

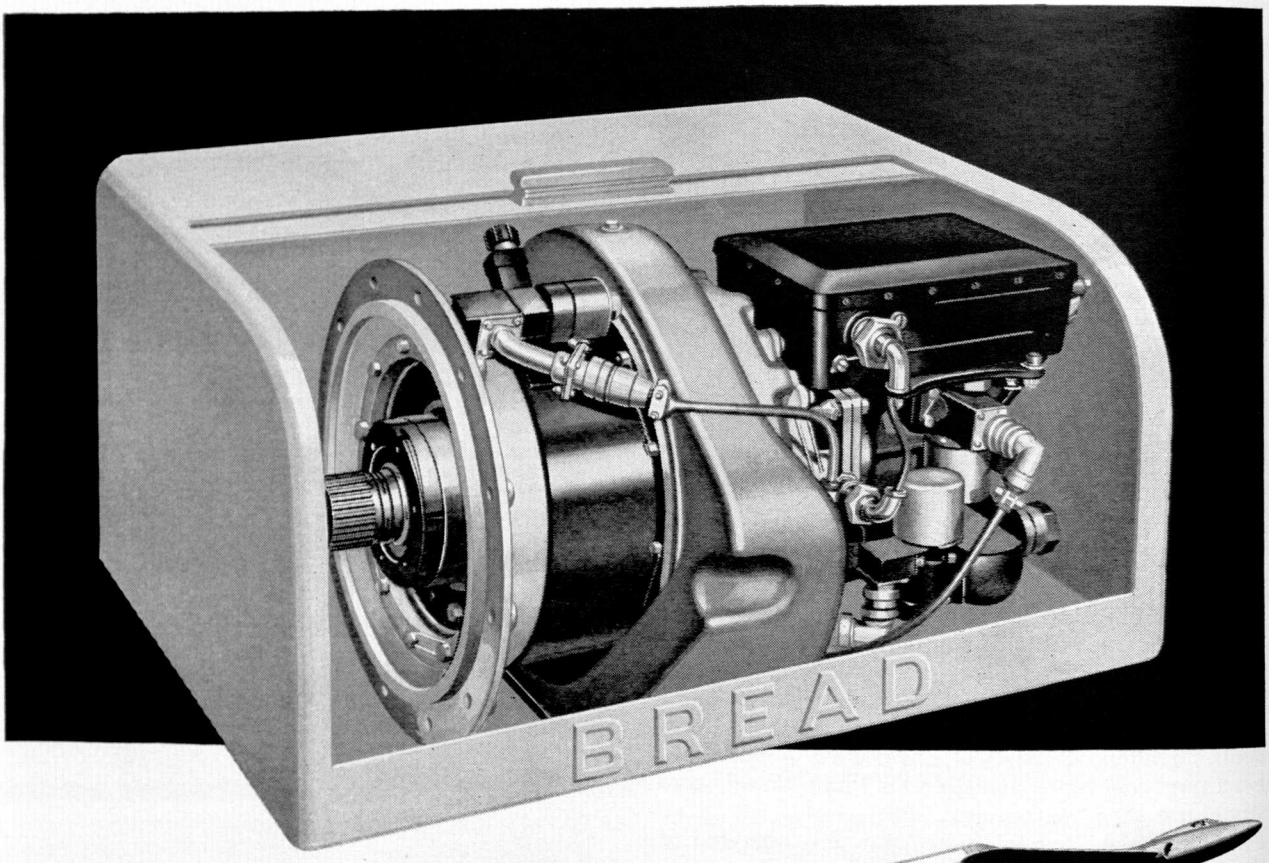
The group should select a project, either singular or collective. An engineer from MSU, or the particular locality, meets with the club periodically to check their progress and give technical advice. Projects range from designs, reports, objects and maps to almost everything one could imagine.

Member of high school JETS Club displays his electric motor and the photocell circuit which activates it.

Statewide competition is held at the annual Engineering Exposition at Michigan State University. Scholarships are offered as prizes.

Michigan State has a library with available material to Jets Clubs. This includes movies, slides, lists available speakers, general guidance literature, and many informative pamphlets.

Jets is a beneficial organization for the young engineer. As pointed out before, it aids in learning more about the profession and stimulates early interests. This experience prepares him for entrance to an engineering school and ultimately the engineering profession.



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How Bendix Engineers are Helping Lick the Aircraft Industry's No. 1 Problem

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This is but one example of how young Bendix engineers are working to solve the most severe problem plaguing the men who build today's (and tomorrow's) aircraft. Jet aircraft requirements call for more and more power in every new design. But with additional complex apparatus being jammed into every new plane that comes off the drawing board, extra power must be achieved without extra bulk. In fact, it is usually necessary to produce more power in a *smaller* package. That's when engineering skill which appreciates a real challenge comes to the fore.

Bendix is constantly seeking to increase its supply of this type of engineering skill. That's why the greatest opportunities in the world for talented young engineering graduates are found at Bendix Aviation Corporation. No matter what his field, the engineer with ability is assured of ample opportunity to demonstrate it at Bendix.

Bendix is in more businesses than aviation—many, many more. Producing over a thousand different products for just about every phase of industry, Bendix deserves your attention when you plan your engineering future. See your placement director or send for the brochure "Bendix and Your Future" for a full-scale look at what Bendix has to offer you. BENDIX AVIATION CORPORATION, FISHER BUILDING, DETROIT 2, MICHIGAN.

THE NAME Bendix AVIATION CORPORATION MILLIONS TRUST

CLUBS AND SOCIETIES

AFS

The Michigan State University Chapter of the American Foundrymen's Society is a student branch of the national organization.

The objects and purposes of the chapter are as follows:

(a) To promote interest in a foundry education at Michigan State University.

(b) To provide lecture, inspection trips, publications and instructions on subjects tending to promote the technical skill and social usefulness of students looking forward to careers in the cast metals industry or to the use of castings in their lines of business.

(c) To promote fellowship among those interested in the cast metals industry.

Each student member receives a subscription to the monthly American Foundryman magazine and he receives free admission to the national and regional conferences of the Society.

FOR FURTHER INFORMATION CALL OR VISIT THE FOUNDRY OFFICE.

AIEE-IRE

JANUARY 10 – Program for all engineering students at 8:00 p.m. in the auditorium of the Electrical Engineering Building; the subject, "Employment Opportunities for Engineers." Mr. Jack Breslin of the MSU Placement Bureau and two representatives from industry presented a program designed to acquaint engineering students with current job opportunities.

Mr. Breslin explained the procedure for arranging an interview through the representatives from industry; gave several pointers on what an interviewer looks for in a prospective employee. They then gave an overall picture of the type of jobs available and average starting salaries. A question and answer session followed.

JANUARY 24 – Program at 8:00 p.m. on "Memories for Machines," presented by Mr. Dwight S. Ashley, Chief of the Computer Engineering Branch, National Security Agency.

A.S.M.E.

This year the student chapter of A.S.M.E. has 80 members, a new record. It was encouraged at the last meeting for all members to take active part in the activities of the coming year. Of course, the big event is the coming National Speech Contest, which will be held here in the spring. Our chapter will be host to approximately 200 people, representing colleges and universities of the mid-West.

Mohindo Bedi, an engineering student from India, gave a very interesting presentation of how the educational system works in his country. He also contrasted the technological advancements of the United States to that of his country.

There were two joint meetings with the Michigan Chapter of A.S.M.E. The first included a dinner meeting, followed by a complete tour of Abram Air Survey Company. The second was a combined meeting with the S.A.E. General Motors Corporation experimental gas turbine car and bus application was talked about, supplemented by a movie about the Fire-Bird. The effectiveness of the gas turbine was demonstrated in the bus, which is a laboratory on wheels. A complete inspection of the turbine drive and its application was made.

This term, with job interviews starting, our meetings will include speakers from the Personnel Department. This will help the graduating members in particular to become better acquainted with the procedures, the listing of employers offered, and how to participate in an interview.

A.S.C.E.

The first Student Chapters of the American Society of Civil Engineers were formed in 1920, and since then have been performing a vital function on engineering college campuses by rounding out the school's professional training.

Our Student Chapter of A.S.C.E. was established to help civil engineering students to enrich their college courses by beginning those professional contacts and associations which, continued through life, are so valuable to the practicing engineer.

Faculty Advisers, a Contact Member, and a Junior Contact Member constitute the advisory personnel for the chapter.

Our chapter limits membership to Civil Engineering students in the Senior, Junior and Sophomore classes.

Our meetings are held every two weeks, usually alternating between Tuesday and Thursday nights. The meetings usually consist of a business meeting, followed by a speaker, movie or program relating to the interests of the profession. The chapter holds at least one picnic a year. An annual banquet with our local section in Detroit is also held. Our chapter is represented on the Engineering Council and participates in the annual Engineering Exposition. A North Central Conference of Student Chapters of A.S.C.E. is held each year and was hosted by our chapter last spring.

SCIENCE AND ENGINEERING

AT LOCKHEED MISSILE SYSTEMS DIVISION

THE OPERATIONAL APPROACH TO RELIABILITY

Reliability is the root of operational effectiveness, seeking out and solving failure before it occurs. The end result of Reliability is a missile system able to perform its mission successfully at a time dictated by military necessity.

To achieve that high standard, scientists and engineers at Lockheed Missile Systems Division apply an operational approach to Reliability in all phases of missile systems research, development and operation.

Under the Lockheed philosophy of Reliability, scientists and engineers combine their talents to study:

Human factors; training; design and operational safety; ground support and maintenance systems; airborne systems reliability; statistical methods; components application, including electronic, electrical, electromechanical and mechanical systems and environmental conditions.

Those possessing a high order of ability applicable to these areas of endeavor are invited to write:

Dr. Richard R. Carhart, Carl D. Lindberg, Reliability Staff Dept. Engineer, and Dr. O. B. Moan evaluate the functional and operational reliability effects of proposed revisions in the electrical power supply of a missile.

Lockheed

MISSILE SYSTEMS DIVISION

research and engineering staff

LOCKHEED AIRCRAFT CORPORATION

VAN NUYS, CALIFORNIA

Once-Over Tillage

by Gene R. White

All of our nation's past achievements and future hopes stem from one basic source, the ability of our land to produce sufficient food. Food is usually thought of in terms of human needs, but the hay, grain and sometimes even shelter for our domestic animals, must come from the land. The cost of producing food is the foremost item in the minds of our farmers. "Once-over" soil tillage methods may be the answer to many of the farmer's cost problems.

The potential of "once-over" tillage of our nation's land is increasing each year. The rising costs of farm implements, fuel and labor have all been pressing the farmer to the point of narrow profit margins and periodic losses. The farmer is always looking for faster and cheaper production practices.

Many tests seeking cheaper production practices have been conducted by farm economists and soils experts throughout the United States. The Michigan tests have been conducted by Professor R. L. Cook, Head of the Soil Science Department at Michigan State University; Professor L. M. Turk, Director of the Michigan Agriculture Experiment Station, East Lansing, Michigan, and Professor H. F. McColly of the Agricultural Engineering Department of Michigan State University. Their reports describe continuing experiments and tests with two types of "once-over" tillage implement employed in seed bed preparations. A conventional moldboard plow, with a "mulcher" (packer) attached to and pulled directly behind the plow. The other implement used consisted of a grain drill mounted on press wheels and attached to a "plow-packer" which in turn is attached to the plow. With the use of the plow and packer or mulcher only, it is necessary to employ another tractor to pull the grain drill.

The extra pounds of pull (draft) caused by the plow-packer, mulcher or press wheel drill is about one-half the draft of a 14 inch bottom plow. 1000 pounds draft was required to pull a conventional two-bottom, 14 inch plow. A 28 inch wide plow-packer required 100 pounds draft in brookston loam when moisture conditions were optimum for plowing. The plow-packer and press wheel drill required 250 pounds of draft in the same type soil. A 30 inch mulcher also required 250 pounds of draft.

Conceivably any 2-3 bottom plow tractor will be able to pull a two bottom plow and any of the extra "once-over" tillage equipment with little or no extra engine labor.

The experiments were conducted on four types of soils; Brookston Clay loam, Brookston loam, Hillsdale Sandy loam, and Fox Sandy loam soils.

When the seed bed was prepared using conventional methods (plowing, discing and harrowing) time and expense in operating costs were higher. Using "once-over" tillage, the complete seed bed preparation is accomplished in one working of the soil.

The yields of the crops were higher on some types of soils using "once-over" tillage and where yields did not exceed those of conventional tillage methods,

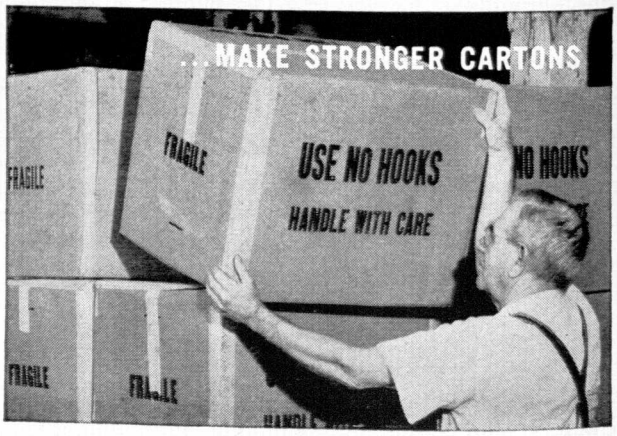
(Continued on Page 43)

Illustrated is a true once-over tillage operation. The press-wheel drill is attached to the plow-packer, which is in turn attached to the plow.

HOW HERCULES HELPS...

AN INCREASED SUPPLY of para-cresol, raw material for antioxidants used in gasoline and rubber, will become available late in 1956 with the completion of the recently announced addition to Hercules' oxychemical plant in Gibbstown, N. J. This will more than double the amount now being produced by Hercules and is the sixth product to be made commercially by the Hercules' oxidation process. Para-cresol also plays an important part in the production of essential oils and in the manufacture of dyes.

FASTEST DRYING of all protective coatings, lacquer is ideally suited to keep pace with today's mass production methods. At the Standard Box Company in Pittsburgh, for example, a single-application hot-lacquer system protects beverage boxes with no delays for drying. Hercules works closely with the coatings industry in developing and perfecting new uses for lacquer-type coatings based on its nitrocellulose, ethyl cellulose, cellulose acetate, and Parlon® (chlorinated rubber).



ACID, ALKALI, AND WATER are all repelled when paper or paperboard are sized with Hercules Aquapel®. In corrugated cartons or spiral wound fiber drums where alkaline glues are used, Aquapel sizing effectively retards penetration of the glue. Neither a resin nor a wax, Aquapel is a chemical that reacts with the cellulose fiber to form a surface that is resistant to hot and cold water, acid or alkali. That's why so many paper mills are finding ever-increasing use for this new sizing agent.

HERCULES

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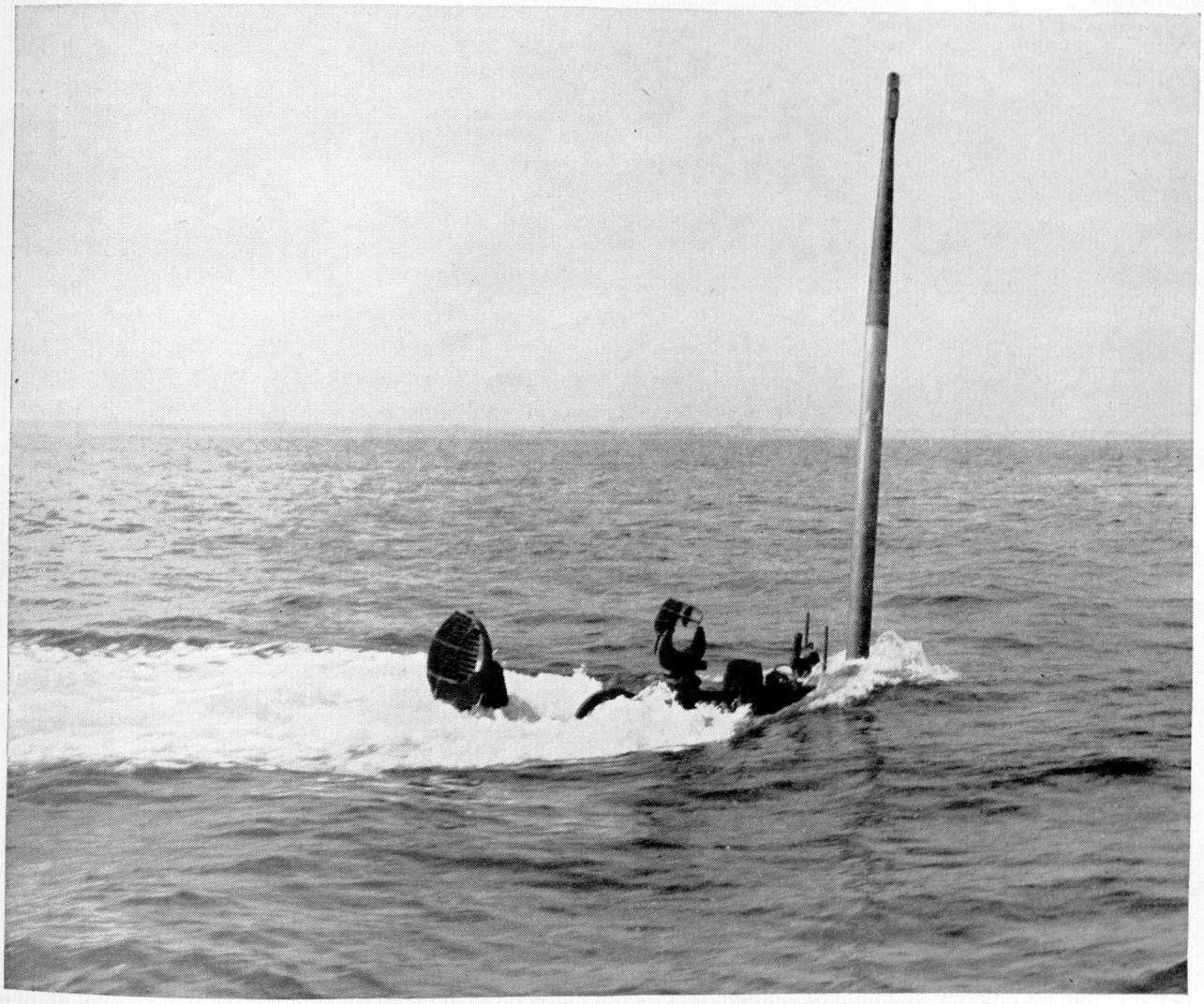
SYNTHETIC RESINS, CELLULOSE PRODUCTS, CHEMICAL COTTON, TERPENE CHEMICALS, ROSIN AND ROSIN DERIVATIVES, CHLORINATED PRODUCTS, OXYCHEMICALS, EXPLOSIVES, AND OTHER CHEMICAL PROCESSING MATERIALS.

G55-11

Here's a picture of some SPECIAL ALLOY STEEL



—and there's much more to it than appears on the surface

Only a stainless steel periscope tube, and some special navigational apparatus, shows above water. But below, a wonderfully compact mass of fighting machinery—literally packed with special steels and electrical alloys. *With* them, the ship is almost human. *Without* them, it has no eyes, ears, power . . . or usefulness. ● Allegheny Ludlum develops and produces special alloy steels of this description, *exclusively*. In your future industrial connections, when *you* have to combat corrosion, heat, wear or great stress—or require unique electrical properties —check with us. *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.*

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HIGH-ALLOY STEELS

WSW 5920

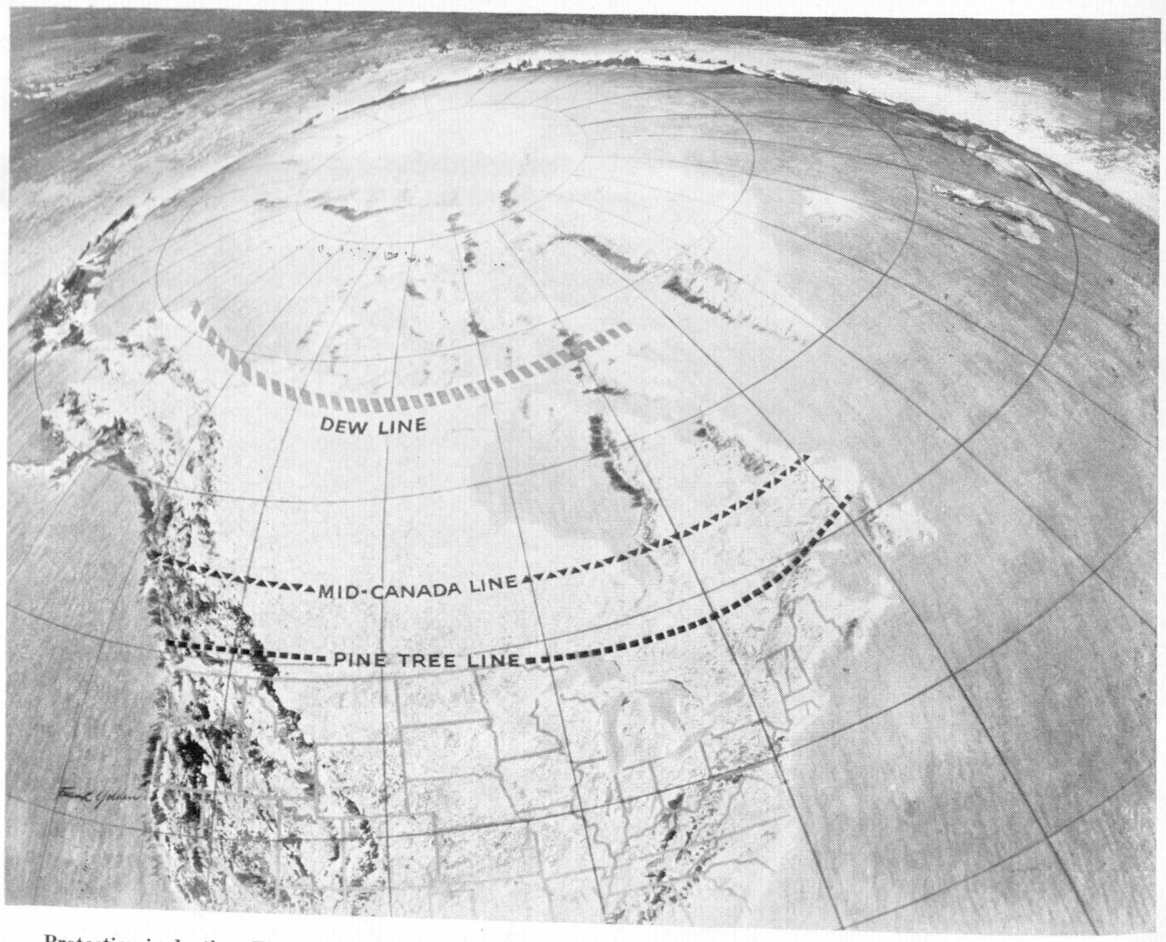
PIONEERING on the Horizons of Steel

Allegheny Ludlum

THE DEW LINE . . . .

ENGINEERING IN THE ARCTIC . . .

The Distant Early Warning system now being built across the northern rim of the western world, is a joint defense operation of two nations, the United States and Canada, and in concept, construction and execution will be a major engineering achievement. Popularity termed the DEW Line, it is a picket-fence network of radar stations designed to guard against sneak air attacks via the short and direct polar regions. Considering the industrial heart of America as a prime target of any attack, the electronic sentry system will offer several hours of warning—priceless minutes if "Condition Red" is ever sounded.



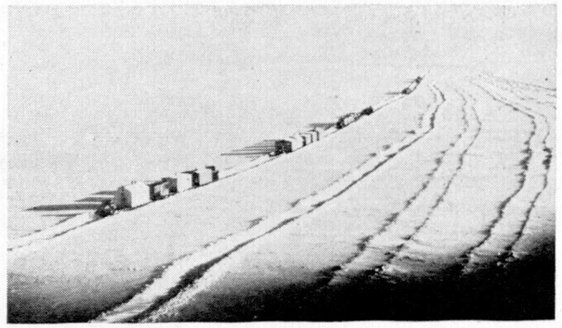
Protection in depth — The Distant Early Warning Line, now being built is shown in its relationship to the Canadian-built Mid-Canada and Pine Tree radar lines. All three will function as a protective net integrated into a vast defense communications network.

Feasibility of the DEW Line was first explored by scientists of Bell Telephone Laboratories and Massachusetts Institute of Technology. In 1953 an experimental DEW installation was designed, transported and operated within the Arctic Circle. Special buildings and construction techniques were devised to withstand severe arctic weather. Stations were exhaustively evaluated, designs were modified, equipments were changed to combat polar magnetism, effects of constant wind and cold were measured—both on men and the complex devices they would have to keep operable. Based on observations of the experimental line, American and Canadian authorities agreed that the DEW Line, although a tremendous undertaking, could be built and would work. Early in 1955, the Department of Defense named the prime contractor for the development, design, engineering, procurement, construction and installation of the full-size Arctic line—the first line of warning to be integrated into the Continental Defense network headquartered at Colorado Springs, Colorado.

When completed, the DEW Line will stretch across Canada from Alaska to Greenland with station sites located on terrains ranging from desolate flats to rugged altitudes—all virtually inaccessible except by air. So, a network of permanent settlements is being built in a frozen wilderness—a problem of logistics and engineering to the *n*th degree.

To accomplish the job, an organization had to be built, personnel recruited from colleges and the Bell System had to be trained in new techniques, and coordinating procedures with Governments, suppliers and subcontractors had to be set up. There has been no time for leisurely planning; for one of the most surprising aspects of the DEW Line project is the speed with which it was launched. Some ten days after the contract signing, construction crews of subcontractors were at work at forward bases in the far north.

Even while building sites were being selected, vast quantities of construction equipment, materials and supplies had to be procured and delivered to arctic job locations. While engineers and plants across the country were busy designing and manufacturing the equipments to become a part of this DEW Line, the



Transportation "on the rocks"—A tractor snow-train of men and material pushes its way across the wide, wide arctic wastes.

Air Force and Navy were active in getting ready to transport the heavy tonnage to where they would be needed. A major air lift of men and supplies was set in motion. In no time at all military Globemasters were moving heavy machinery, even D-8 tractors weighing over 40,000 lbs., large cranes and motor vehicles. Other aircraft, including Flying Boxcars and small ski-equipped planes flown by skillful bush pilots were hauling tools, food and men to the polar wastes. D-4 tractors were "air dropped" so that they in turn could help construct air fields where large aircraft could later land and discharge heavier cargoes. Many of these air fields were built on ice of the Arctic Sea. Meanwhile, freight was being loaded aboard ships at Canadian and American ports and rushed as far north as possible to waiting planes and snow tractor trains. Much cargo was hauled directly to beaches and sites by LST's and LCU's.

The nature of the arctic poses many new and unusual problems. There is the problem of construction on the Permafrost. Heat leakage from buildings must not be allowed to penetrate the earth's surface and destroy nature's fine balance of temperature which might cause the earth to settle badly. Seemingly little things become important. Finding a way to extract heat from the diesel-jacket water and the diesel exhausts to provide normal building heating require-

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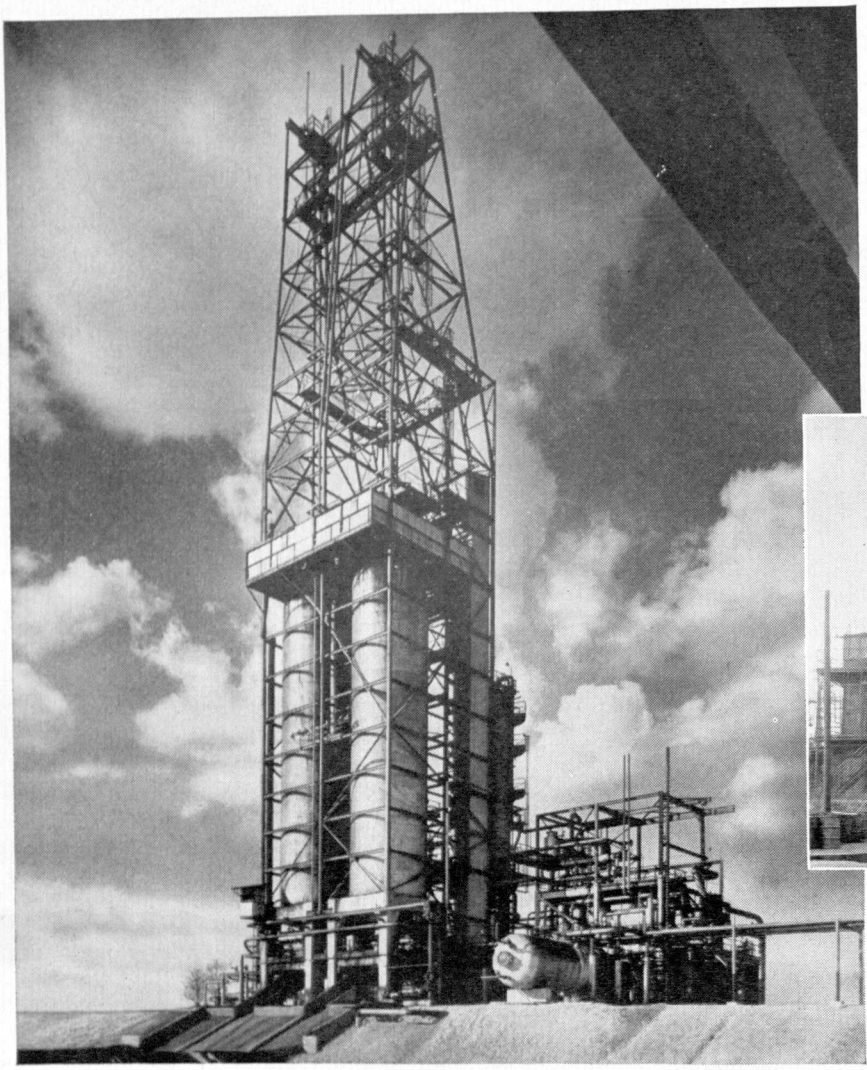
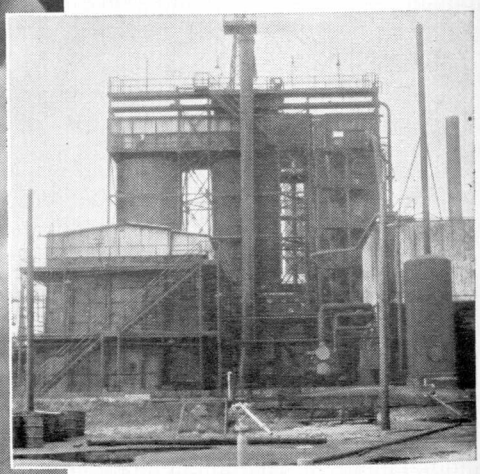


This towering modern unit at the El Dorado, Ark., refinery of Pan-Am Southern Corporation, a Standard Oil subsidiary, produces 700 tons of coke daily.



Standard's original delayed coking unit at Whiting recently celebrated its 25th birthday "on stream" and going strong.

How to make an exception prove a rule

TECHNOLOGICAL PROGRESS is rapid in the petroleum industry. Few processes have a chance to "grow old" on the job. Most are killed off through the combined efforts of thousands of scientists working constantly to improve everything we do, make or use in our business.

Every now and then, though, we experience a happy exception to this rule. That occurs when a new development not only meets the immediate need but also provides the right answer to situations yet unforeseen.

Twenty-five years ago last August a process known as "delayed coking" was invented. The new process made a quicker, cleaner job of converting heavy residual oil into gasoline, gas oil, and coke. It paid off spectacularly when catalytic cracking was invented and these giant new units began calling for feed. It paid off again when the diesel locomotive came along to put the heavy oil burning steam locomotive out of business.

Dr. Robert E. Wilson, chairman of the board of Standard Oil today, was the inventor of delayed coking. Almost all of the young scientists who worked with him in its development are still with Standard too, in responsible positions requiring their special skills.

Young scientists in research and engineering at Standard Oil today find it satisfying to see their creative efforts translated into valuable product and process improvements.

Standard Oil Company

910 South Michigan Avenue, Chicago 80, Illinois

STANDARD

RCA TV camera encased in special diving bell televises the activities of sea life in sunlit waters off the Gulf Stream.

Now RCA puts TV underwater to help the Government protect marine life

Ten fathoms down, an RCA television camera moves through darting schools of fish. On the surface, U.S. Fish and Wildlife experts hover over an RCA remote control TV monitor. From what they see will come new fishing techniques to help the government protect marine life.

The electronic and engineering skill behind underwater TV is inherent in all RCA products and services. And continually, RCA scientists at the David Sarnoff Research Center in Princeton, N. J., delve into new "Electronics for Living" that will make life fuller, easier, happier.

WHERE TO, MR. ENGINEER?

RCA offers careers in research, development, design, and manufacturing for engineers with Bachelor or advanced degrees in E.E., M.E. or Physics. For full information, write to: Mr. Robert Haklisch, Manager, College Relations, Radio Corporation of America, Camden 2, N. J.

U.S. Fish and Wildlife Service technicians study fishing methods and equipment of an RCA remote control TV monitor.

RCA®

RADIO CORPORATION OF AMERICA

ELECTRONICS FOR LIVING

NEW DEVELOPMENTS

Edited by John Boyd

New Tube for TV

A new high voltage rectifier tube that promises to cut television set manufacturing costs and give longer life has been introduced.

The new tube has been registered as the 2B3-GT, and is intended for design into television sets in place of the 1B3-GT. The 2B3-GT has a filament rating of 1.75 volts at 0.25 amperes as compared with the 1.25-volt and 0.2 ampere rating of the 1B3-GT. The 2B3-GT can be operated directly from the flyback transformer without a filament dropping resistor—thus saving the manufacturer the cost of the resistor, associated wiring and assembly expense.

The 2B3-GT has a new type of filament construction which promises to give longer life and greater dependability. Other ratings and pin connections remain the same as the 1B3-GT.

First Transoceanic Telephone Cable

The laying of the world's first transoceanic telephone cable, linking North America and Europe, will begin early this year. More than 2,000 miles in length, it will span the Atlantic Ocean between Newfoundland and Scotland. The new cable will enable people anywhere in the United States and Canada to talk to those in Europe as if they were making a local telephone call, as it will not be subjected to atmospheric disturbances, such as electrical storms and fading, that sometimes interfere with existing communications by radio circuits. Due to the fact that the human voice will not carry a great distance over wire, repeaters or "boosters" will be built into the cable every 40 miles. In these repeaters will be special amplifying tubes with oxide-coated nickel cathodes which may operate continuously on the ocean bottom for as long as forty years.

Television in Underwater Research

There is now an underwater application of closed-circuit television which is enabling the U. S. Fish and Wildlife Service, Department of the Interior, to observe and test the performance of experimental fishery methods and equipment under actual oceanic conditions.

The application represents the first practical demonstration in this country of underwater television as a research tool for experimental work in fishery operations, and gives promise of a wide range of uses in marine biology and explorations.

Currently, the Service is utilizing closed-circuit television in connection with the development of a midwater trawling net and in a remote study of shrimp in their natural habitat.

The Service's underwater TV experiments were initiated with "Operation Fisheye," conducted recently in the Gulf Stream off the east Florida coast. A standard ITV closed-circuit television system provided remote observations of experimental fishery gear towed at depths of more than 60 feet. The gear was illuminated only by natural sunlight, and the views produced on the TV monitor were sufficiently clear and sharp for photographing by both still and motion picture cameras.

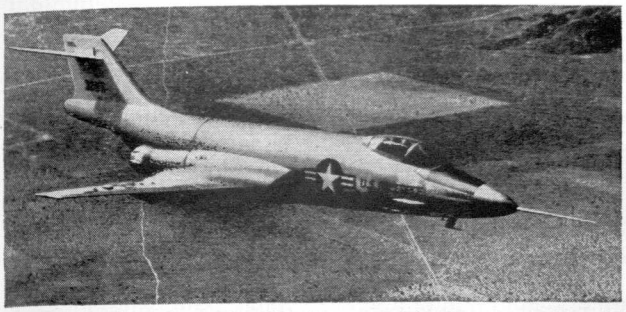
In underwater operations, the ITV camera is housed within a watertight steel cylinder, which is mounted in a submersible free-flooded, ball-type "diving bell." Atop the "diving bell," and connected to it by a gear train and yoke assembly, is a water-tight electrically driven power unit, which permits remote control of the TV camera's scan—360 degrees in azimuth and 90 degrees in elevation. What the TV camera "sees" is projected over a flexible multiconductor cable to a remote control TV monitor aboard the Service's research vessel.

Such a system can conceivably be operated at much greater depths than a diver can withstand and for much longer periods of time without the risk at-

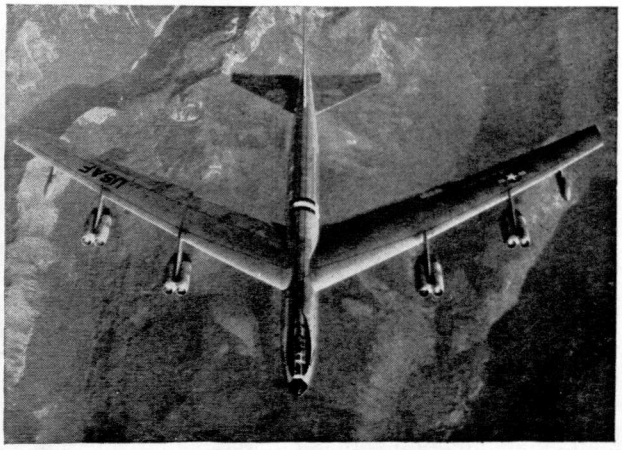
(Continued from Page 35)

Underwater application of closed-circuit television is enabling U.S. Fish and Wildlife Service to remotely observe and test performance of experimental fishery methods and equipment under actual oceanic conditions.

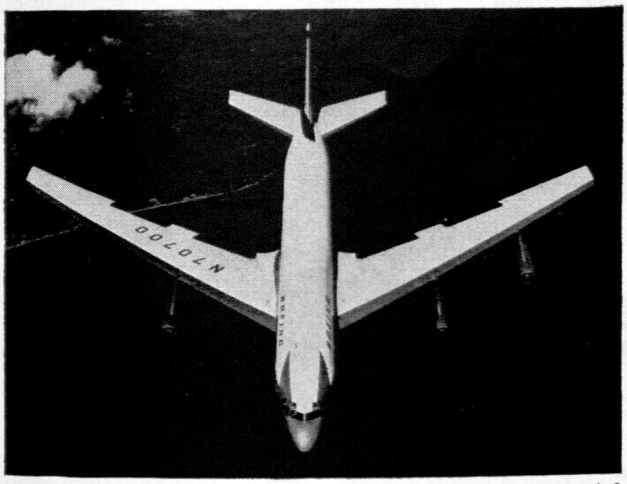

World's most powerful
production aircraft engine
The J-57 axial-flow jet engine with
afterburner, designed and developed
by Pratt & Whitney Aircraft.



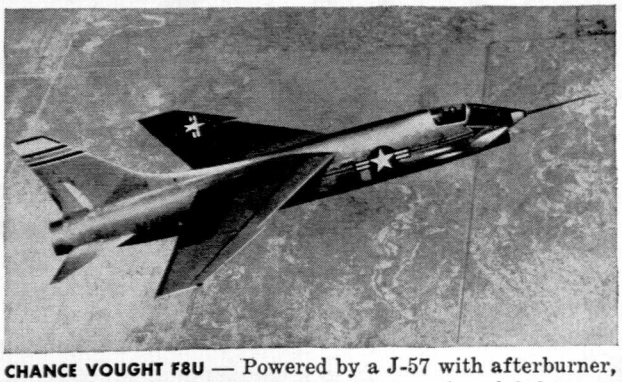
McDONNELL F-101 — The Voodoo, an Air Force supersonic fighter that has two J-57 engines with afterburners, is the most powerful jet fighter yet built.



BOEING B-52 — Eight J-57 engines, mounted in pairs, power this all-jet, heavy Air Force bomber.



BOEING 707 — The Stratoliner will usher in commercial travel in the jet age. It is the counterpart of the KC-135, a military tanker-transport powered by four J-57 engines.



CHANCE VOUGHT F8U — Powered by a J-57 with afterburner, the Crusader is the Navy's fastest carrier-based fighter.

The best airplanes... are designed around the best engines

Today's most valuable military aircraft, capable of supersonic or intercontinental flight, include various Air Force and Navy fighters, bombers and transports. Among these are nine types that have a significant feature in common. They all fly on one type of engine — the J-57 turbojet.

Also entrusted to the efficient, dependable operation of Pratt & Whitney Aircraft's jet engines will be the commercial jet transports soon to travel along the air lanes of the world.

The excellence of the J-57 is attributed to the engineering team that has determinedly maintained its leadership in the field of aircraft powerplants. Effort is now being directed toward the improvement of advanced jet and turboprop designs. Still to be anticipated is mastery of current technology's most provocative problem — the successful development of a nuclear aircraft engine.

Many engineering graduates would like to be concerned with the air power of the next generation. One way to fulfill that ambition is to pursue a career alongside the Pratt & Whitney Aircraft engineers who have consistently produced the world's best aircraft engines.

World's foremost designer and builder of aircraft engines

PRATT & WHITNEY AIRCRAFT

DIVISION OF UNITED AIRCRAFT CORPORATION

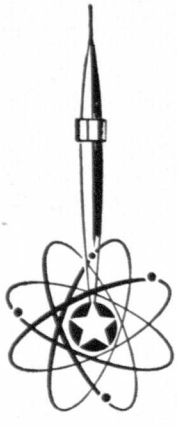
EAST HARTFORD 8, CONNECTICUT

Popular Choice of Students

It's no accident that so many graduating engineers have selected CONVAIR-FORT WORTH as the most attractive place for starting their professional careers.

Young engineers with imagination and ambition have unlimited opportunities with CONVAIR. Broad diversification of projects provide opportunities in numerous fields of specialization. Working in ideal, air-conditioned surroundings and with advancement based on merit, you are enabled to make full use of your individual talents.

Life is good in Fort Worth — where the year-around climate is conducive to outdoor living and recreation — and there are excellent schedules of athletic events, musical and theatrical presentations, ice arena, large lakes, etc. CONVAIR'S in-plant program enables candidates to earn graduate engineering degrees.



Write now for information about CONVAIR'S interest in Engineering graduates.

Address
H. A. BODLEY
CONVAIR Engineering Personnel Dept.
FORT WORTH, TEXAS

CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION

FORT WORTH, TEXAS

An enlarged reprint of the above cut-out silhouette, suitable for framing or pinning up, will be sent free to any engineering student on request.

DEW LINE

(Continued from Page 23)

ments was a major accomplishment. This reduces diesel oil requirements by about 1/3 in a land where fuel consumption is always a factor. In the areas where the DEW Line is being constructed winds sometime exceed the velocity of 100 mph and temperatures 50°F below freezing are not an exception. Equipment design and all construction must recognize such conditions.

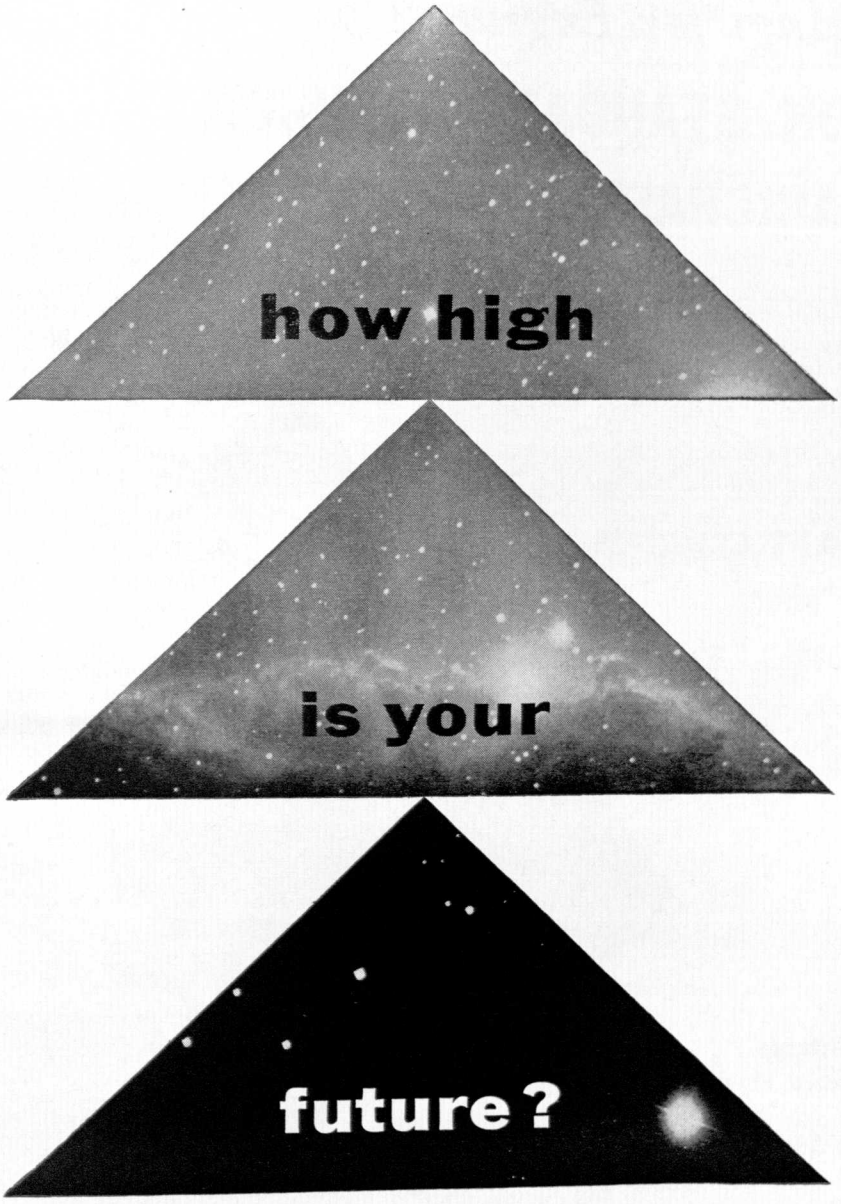
The DEW Line must also conserve manpower wherever possible. This is being accomplished by the use of unmanned stations and automatic equipments wherever practicable. Here is engineering where equipment must be designed to operate faithfully around the clock with an absolute minimum of maintenance.

Many skills are being used to successfully complete the DEW Line project. The men with these skills come from the colleges as well as industry.

Research scientists and electronic and communication engineers specializing in transmission, propagation, and outside plant pooled their talents to devise the functional apparatus. Special skills of procurement, expediting, purchasing and transportation were needed to effect materials, equipment, vehicles and men being at the right destination at the right time. Lawyers in the domestic and international field made it possible to live with the domestic and international relations which, if normally applied or interpreted, could have prevented such an undertaking from even being attempted.

The DEW Line project is a noteworthy example of cooperation—between governments, armed services, and civilian enterprises. They are building tomorrow's communications system today. Some techniques developed for this work were unknown even three years ago. Now shrouded for security reasons, these advances will be serving the public in everyday use in the foreseeable future.

Top of the world — Bush planes land on the frozen snow to supply lonely construction camps like this one. Some of these bases are only ten minutes by air from Russia.



Today at Martin, one of the finest engineering teams in the world is at work on tomorrow's development and design problems in the fields of AERODYNAMICS, ELECTRONICS, STRUCTURES, PROPULSION AND NUCLEAR POWER.

If you're on the way up – and going far . . . if you are willing to apply your ability to the toughest engineering challenge . . . you'd do well to look into the Martin story.

No matter *how limited* or extensive your background, there will always be openings on the Martin team for the engineer who has what it takes to go *higher*.

Contact your placement officer or J. M. Hollyday, The Martin Company, Baltimore 3, Maryland.

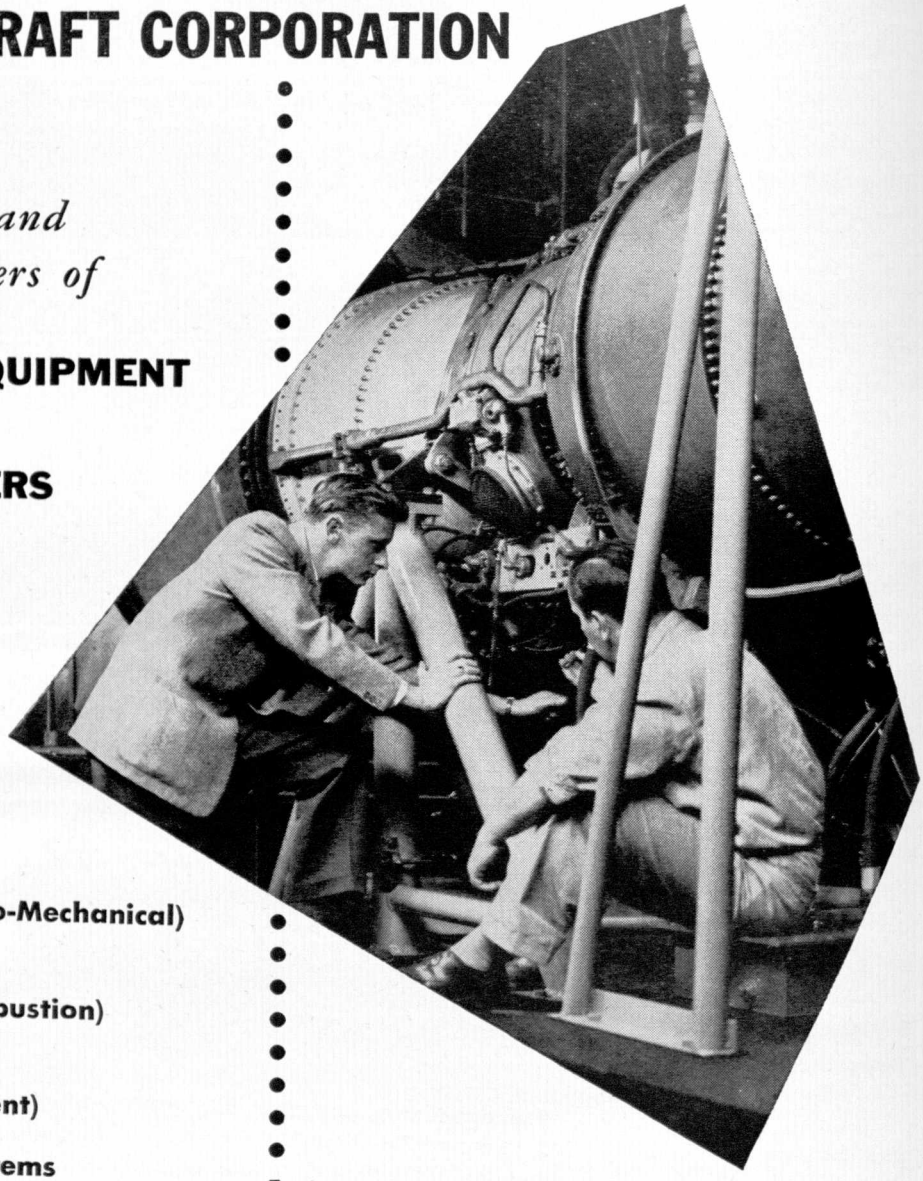
MARTIN
BALTIMORE

Openings for Engineers at

HAMILTON STANDARD DIVISION
UNITED AIRCRAFT CORPORATION

Designers and Manufacturers of

JET AIRCRAFT EQUIPMENT AND PROPELLERS



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- **Jet Turbine Starters (Pneumatic and Combustion)**
- **Hydraulic Pumps (Variable Displacement)**
- **Air Conditioning Systems (Air Cycle and Vapor)**
- **Controls and Accessories for Nuclear Engines**
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Engineering Staff Continuously Expanded for the Past 30 Years — and Still Growing.

Largest New Jet Aircraft Equipment Development Program in Our History.

Local Graduate Study Program with R.P.I. Available — Liberal Tuition Assistance.

Modern Plant with Extensive Research Facilities.

For descriptive booklet and additional information, write to Mr. T. K. Bye, Engineering Dept.

HAMILTON STANDARD

UNITED AIRCRAFT CORPORATION

HAMILTON STANDARD DIVISION

WINDSOR LOCKS, CONNECTICUT

(Continued from Page 27)

tendant to a diver operating an ordinary underwater film camera.

The value of underwater television as an aid to investigations in marine biology and in limnology has been demonstrated in these operations. In addition to gear research in the commercial fisheries, it may prove to be of assistance in the delineation and harvesting of clam, oyster, and scallop beds. Closer views might also be obtained of bottom formations, bottom-type fishes, and fishes in their natural habitat, which at present may be located only with difficulty by depth-sounding equipment. Further, underwater TV offers possibilities of direct monitoring of water temperatures, current flows, turbidity, and other oceanographic data related to the fisheries.

Moving Sidewalk

A moving rubber sidewalk, capable of handling 15,000 people an hour and featuring the widest conveyor belt ever used commercially to transport humans, is now in operation in Houston's recently expanded Coliseum.

The rubber sidewalk began operation as crowds on hand to attend the 23rd Annual Houston Fat Stock Show and Rodeo stood three abreast on the 82-inch wide moving rubber sidewalk. The sidewalk carried them across a pedestrian bridge that links a huge parking area with the Coliseum's exposition hall and auditorium.

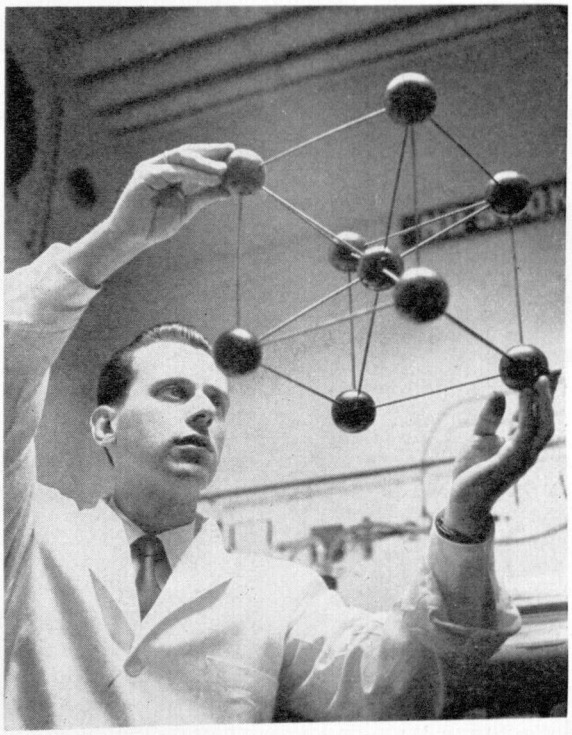
First moving sidewalk to be installed on a bridge, the belt spans the Buffalo Bayou at a height of 50 feet, traveling at a speed of 132 feet a minute. The moving rubber sidewalk will transport more than a million people a year who visit the Coliseum for its year-around schedule of events.

In its 114-foot course, the sidewalk belt rises 12 feet to deliver passengers to the exposition hall. To accommodate passengers leaving the Coliseum area, the direction of the sidewalk is reversed. Sidewalls, three feet high, enclose the sidewalk on both sides and are equipped with moving handrails synchronized with the speed of the belt. Passengers step on and off the belt as if it were an escalator.

The belt measures 230 feet in length, is seven-eighths of an inch thick with seven plies of fabric for interior reinforcement. A specially compounded rubber cover provides a scuff-resistant, easy-to-clean surface.

The belt travels on closely spaced steel rollers which assure a smooth, effortless ride for passengers. The sidewalk is powered by an electric motor which turns a drive pulley located at the upper end of the walk. The belt wraps tightly around this pulley and moves in the same direction as the motor-driven pulley. To install the belt, engineers vulcanized the two ends of the belt into an endless loop.

The Houston moving rubber sidewalk, part of a $2,000,000 improvement program for the Coliseum and Music Hall, is the first ever to serve a municipal auditorium. Similiar installations are seen as the answer to the safe, efficient movement of people through many highly congested areas.



Scientist inspects iron "crystal."

Scientists Make Perfect Iron

Pure and perfect slivers of iron, having breaking strengths approaching a million pounds per square inch—far greater than any other known metal—have been produced on an unprecendented scale by scientists. Slivers of iron, or "whiskers" as they are called, are each a pure iron crystal so perfect that no defects can be detected in its structure. The crystals are as much as two inches long and a thousandth of an inch thick. Previous attempts to produce these "whiskers" have given crystals which could be observed only with the aid of a microscope.

Very little is known about metals that are completely free of impurities and imperfections simply because they are never found in nature and, until recently, could not be prepared in the laboratory.

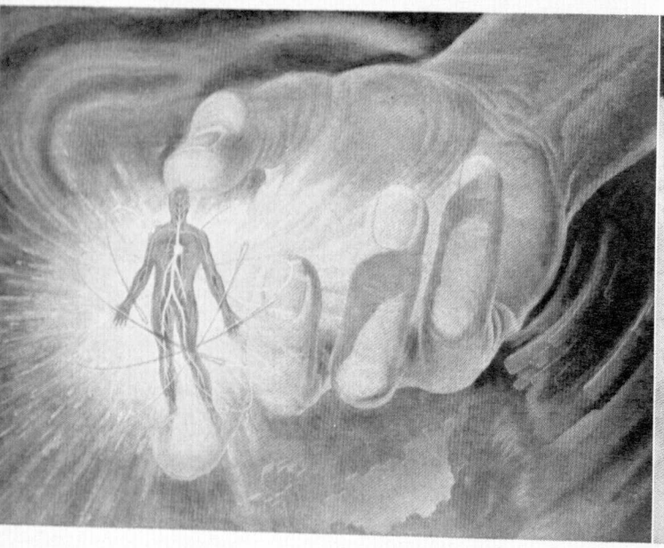
Pure iron has an ultimate tensile strength of more than a million pounds per square inch. This is at least 10 times the strength of ordinary iron which has been drawn into wire and at least three times the strength of the kind of steel used in making piano wire.

Perfect iron "whiskers" were made in this manner: Highly purified Iron chloride, a common 'salt' of iron, is heated in an atmosphere of hydrogen gas inside a special furnace at a temperature of about 1100

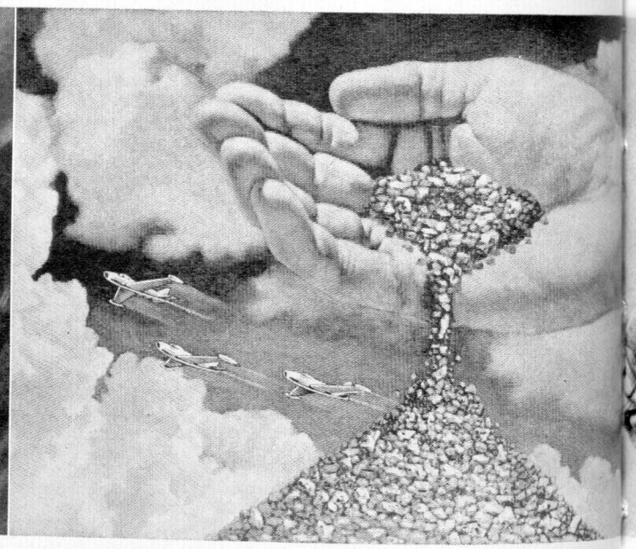
(Continued on Page 39)

A job you can grow with ...

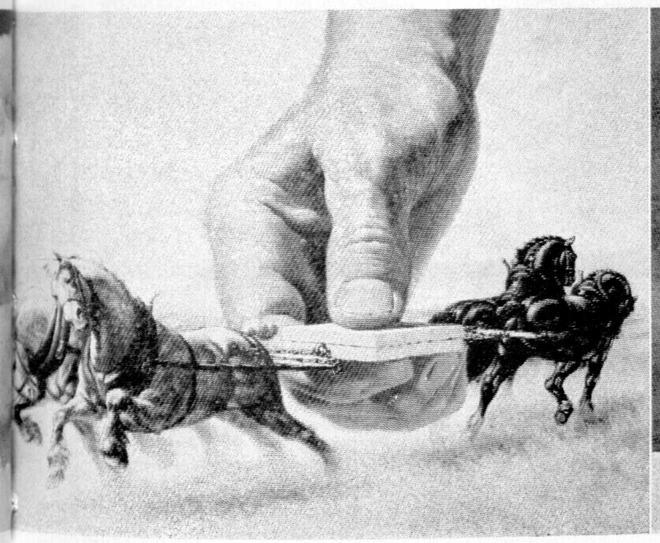
Union Carbide offers you opportunities to grow in some of the most rapidly expanding fields in industry. You may have the qualifications that will help you to "get in on the ground floor" on new developments by the Divisions of Union Carbide in alloys, carbon products, industrial gases, chemicals, plastics and atomic energy. Examples in four of these growing fields are illustrated below.



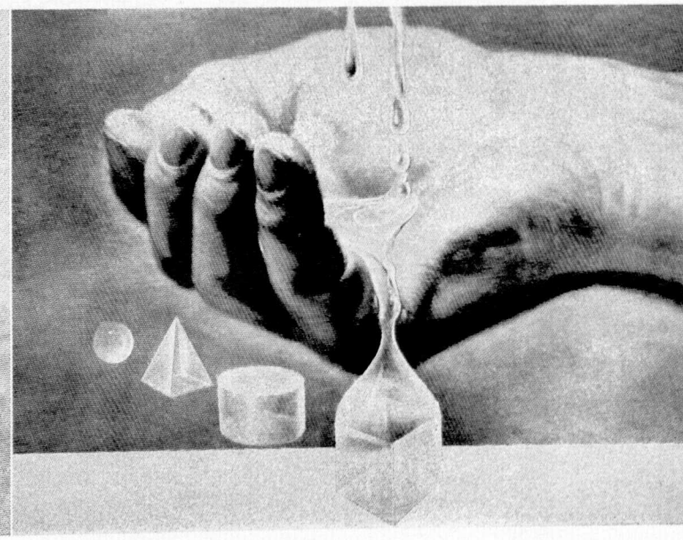
RADIOISOTOPES — Union Carbide's Divisions are leaders in the field of nuclear research and development. One Division, Union Carbide Nuclear Company, operates for the government Oak Ridge National Laboratory, the Nation's chief source of radioisotopes. In medicine, radioisotopes are used to investigate the human bloodstream —how it supplies nourishment, defends against disease, or becomes diseased itself.



TITANIUM — Electro Metallurgical Company is rapidly completing a new plant to produce titanium, the wonder metal whose strength and lightness are combined with resistance to heat and corrosion. The new plant will use a process developed by Union Carbide research, and will have an annual capacity of 7,500 tons of crystalline sponge —half again as much as the total United States production in 1954.



PETROCHEMICALS — Carbide and Carbon Chemicals Company produces more petrochemicals than any other company in the world. Some are being used to develop whole families of new adhesives and bonding agents. It is now possible to make almost any materials stick together permanently. Union Carbide research into the nature of bonds— mechanical, chemical, molecular—will make possible new and better adhesives.



EPOXY PLASTICS — Bakelite Company is a major producer of most types of plastics, including the sturdy epoxies. Two liquids, a resin and a curing agent, form a tough, dimensionally stable solid when poured together. They are used for long-lasting, accurate patterns for foundry work, for dies that stamp out auto parts and airplane wing sections, for embedding delicate electronic parts to protect them from moisture and vibration.

THE HORIZONS ARE UNLIMITED *for engineers, chemists, physicists, and business and liberal arts majors. Union Carbide offers many opportunities to explore those horizons.*

Contact your Placement Director and make appointments with the recruiting representatives of Union Carbide and its Divisions.

For further information, write:

UCC divisions include . . .

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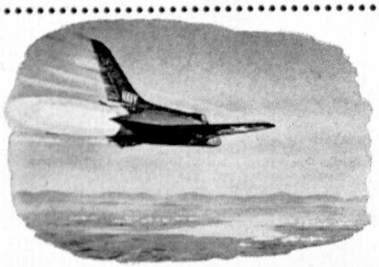
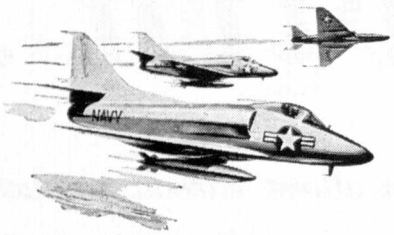
Electro Metallurgical Company · Haynes Stellite Company
Linde Air Products Company · National Carbon Company
Union Carbide Nuclear Company

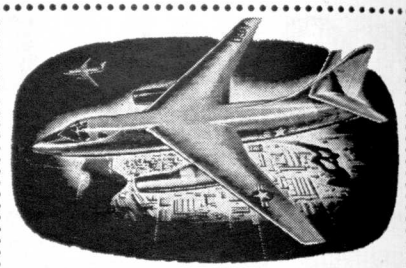
UNION CARBIDE
AND CARBON CORPORATION
Industrial Relations Department, Room 406
30 East 42nd Street UCC New York 17, New York



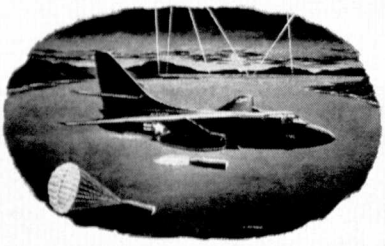
F4D, "SKYRAY"— only carrier plane to hold official world's speed record



A4D, "SKYHAWK"— smallest, lightest atom-bomb carrier

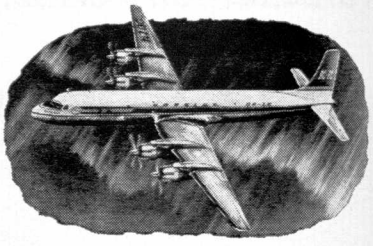


RB-66 — speedy, versatile jet bomber



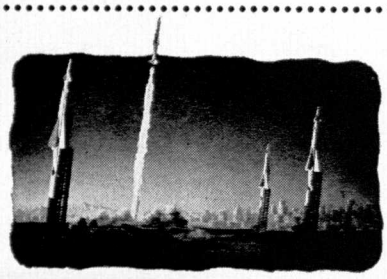
A3D, "SKYWARRIOR"— largest carrier-based bomber

C-124, "GLOBEMASTER"— world's largest production transport

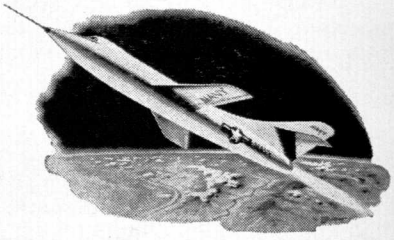


DC-7 "SEVEN SEAS"— America's finest, fastest airliner

Engineers: join this winning team!



"NIKE"— supersonic missile selected to protect our cities



D558-2, "SKYROCKET"— first airplane to fly twice the speed of sound

At DOUGLAS you'll be joining a company in which the three top executive officers are engineers...you'll be associated with men who have designed the key airplanes and missiles on the American scene today! Nothing increases an engineer's ability faster than working with other engineers of top calibre.

Not only is Douglas the largest manufacturer of commercial aircraft in the world, but it also produces outstanding aircraft and missiles for *every* branch of the armed services! This diversity, besides giving you job security, provides unequalled opportunity for the engineer with an eye to the future.

Challenging opportunities now exist in the following fields:

Mechanical design
Structural design
Power plant installation design
Weapons delivery
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Electronic computers
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Aircraft air conditioning
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Electronics
Mechanical test
Structural test
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Missiles

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Brochures and employment applications are available at your college placement office.

For further information relative to employment opportunities at the Santa Monica, El Segundo and Long Beach, California divisions and the Tulsa, Oklahoma division, write today to:

DOUGLAS AIRCRAFT COMPANY, INC.

C. C. LaVene, Employment Manager...Engineering General Office
3000 Ocean Park Blvd....Santa Monica, California

NEW DEVELOPMENTS

(Continued from Page 35)

degrees Fahrenheit. Through rigid control of the temperature and flow of hydrogen, the chlorine atoms in the iron chloride are allowed to unite chemically with the hydrogen at a certain precise rate. This leaves unattached atoms of iron, which 'migrate' slowly toward each other and deposit one upon another in perfect arrangement. Thus, billions of iron atoms 'grow' without any observable defects into a single perfect crystal of pure iron, exactly square in cross section, and often attaining a length of two inches.

OPERATION T.V.

A new color television camera—developed specifically for medical use—provided more than 1,000 American and Canadian surgeons with vivid, scalpel-edge views of a major operation at Philadelphia.

For thirty minutes, the surgeons assembled in Philadelphia's Convention Hall were transported visually over the housetops to the Veterans' Administration Hospital, where Dr. W. G. Nichols, chief surgeon, removed an internal growth from a 65-year-old-patient.

The new camera, much more compact and flexible than conventional color cameras, was mounted directly above the operating table and focussed on the area of surgery. As the operation proceeded, scenes were picked up and transmitted by cable to a mobile color TV unit outside the hospital, and thence by radio relay to Convention Hall for viewing.

Two studio-type color cameras also were employed during the demonstration. One of these provided wide-range roving views of activities in the operating room, including Dr. Nichols' explanation of the surgery to be performed and a brief discussion of X-rays.

The new color camera, in its initial service to the surgical profession, proved today its excellence in picking up close details of a critical operation for viewing by one of the largest professional audiences ever to witness such an event simultaneously. The transmission was carried on a closed-circuit, with images visible only to the International College of Surgeons gathering.

THINGS TO COME

Cordless electric clocks automatically regulated by short wave from Arlington, Va., picture-on-the-wall television, New York to Paris flights in three hours, an oven roast in a few minutes, luminous ceilings . . .

These and many other marvels of the electrical industry will come sooner than we realize.

Despite the marvels already wrought, the electrical age is actually only beginning and future developments based on electricity will over-shadow all the accomplishments thus far.

Within five years many homes will be heated entirely by electricity at a cost comparable to present fuels. Flexible lighting is not far off, with every room having luminous ceilings which can be varied in brightness and color for any seeing needs. Switches will turn on the lights automatically, as one enters the room. New types of insulation will allow room for 18 cubic feet of food storage space, both frozen and conventional, in the area now required for an 8 cubic-foot refrigerator.

BAILOUT STUDIED

Hurtling into the air from a rocket sled traveling nearly 700 miles an hour, a steel-and-rubber replica of Test Pilot George R. Smith has given engineers the first calculated picture of what happens to a pilot during a supersonic bailout.

Smith became the first man to live through an ejection escape from an airplane going faster than sound at low altitude on February 26, 1955. He smashed into the hurricane-like airstream at a speed of Mach 1.05—777mph—at 6500 feet altitude and suffered injuries that put him in the hospital for six months.

Recently at Edwards Air Force Base in the Mojave Desert, human factors engineers, in the first such tests ever conducted to match a particular pilot's experience, duplicated in every respect the escape of Test Pilot Smith.

A detailed anthropomorphic dummy was built and dressed to correspond to Smith's size, weight, and even the clothes he was wearing on the day of his accident. The joints were tightened and measured to duplicate the muscular resistance of a man of Smith's size and strength. Equipped with life vest, helmet, and oxygen mask, the dummy was strapped in an ejection seat and positioned in the sled the same as in an airplane cockpit.

Inside the dummy's head and torso engineers placed delicate instrumentation to record the tremendous accelerative and decelerative "G" forces that were felt by Smith during the wild tumbling and sudden decrease in velocity immediately after he left the plane. This instrumentation consisted of six accelerometers to measure forces vertically, horizontally, and laterally at both head and stomach.

From the time the dummy was shot from the sled until it hit the ground, data from these instruments was telemetered constantly to recording devices in a concrete building next to the center of the track. Movements and forces were recorded in increments of a thousandth of a second and preserved on charts and graphs for the engineers' future use and interpretation.

Vital information was also obtained through photography from a battery of forty-two movie, still and sequence cameras along the track and inside the sled.

The tests were conducted in a series of rocket sled runs at the Experimental Track Branch of the Air Force's Flight Test Center at Edwards AFB. Runs were made at speeds approximating the same "q" forces (of dynamic airstream pressure) felt by George Smith at 777 mph and 6500 feet altitude.

From the data obtained, human factors engineers were not only able to substantiate previous calculations about the actions of a man as he is shot into

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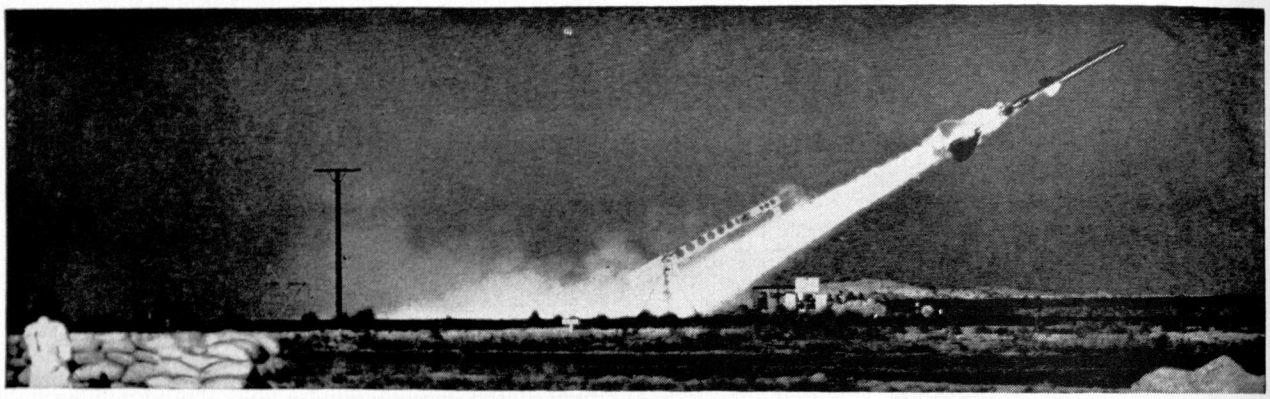

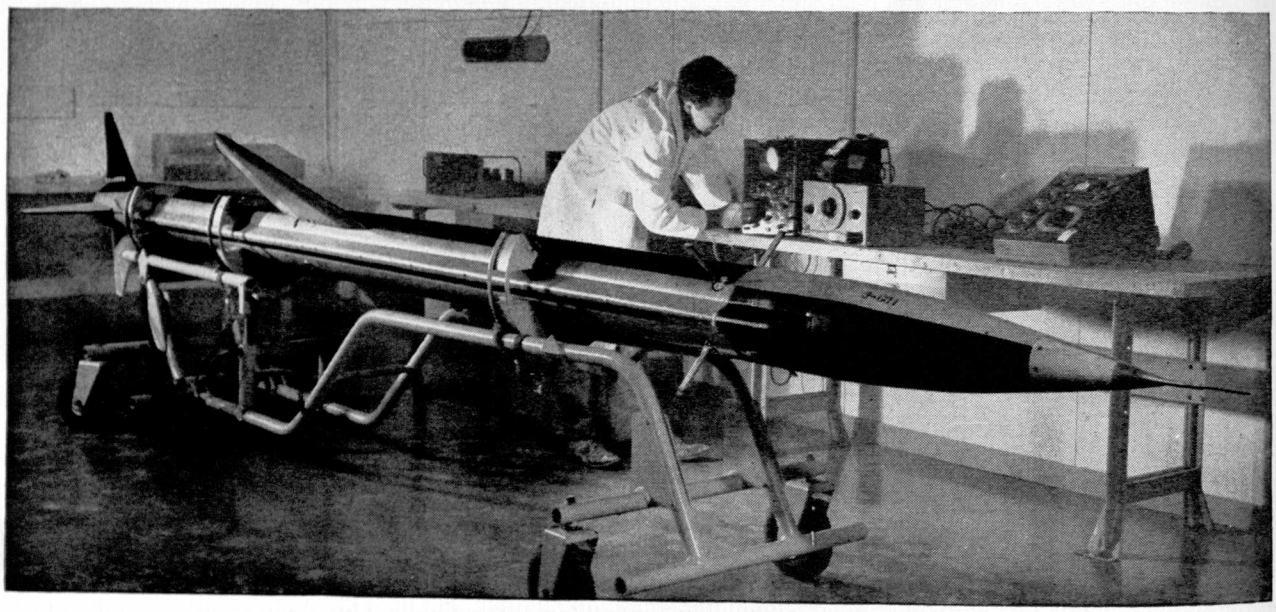

Boeing engineers are insiders on top-secret work

Engineers are doing vital work on significant new developments at Boeing. For example, the Boeing BOMARC IM-99 pilotless interceptor. Its predecessor, the Boeing GAPA, is shown here, because photographs of BOMARC are highly classified. BOMARC is a supersonic long-range missile that spearheads an entirely new weapons system. It is a key weapon in America's defense planning.

BOMARC, as well as other "years ahead" Boeing projects, which cannot be discussed here, are complex challenges to all kinds of engineers. These men find real creative interest in the problems of very high speed flight: heat, compressibility, vibration, rocket, jet and nuclear power, miniaturization, electronic control, and others. Their goal is to design structures and components that will "weigh nothing and take no space," yet withstand extreme velocities and altitudes.

The prestige of Boeing engineers is second to none. They have created such recent aviation milestones as the B-52 global jet bomber, the 707 jet transport, and the B-47. There are superb facilities at Boeing: the multi-million-dollar new Flight Test Center, the world's most versatile privately-owned wind tunnel, the latest electronic computers, and much more.

Boeing engineers enjoy exceptional opportunities for career stability and growth. There are more than twice as many engineers with the firm now as at the peak of World War II. Living is pleasant in the progressive, comfortable-size communities of Seattle and Wichita.

There is room for top engineering talent on Boeing research, design and production teams. If you feel that you belong with aviation's leader, it will pay you to investigate the advantages of a career with Boeing.

For further Boeing career information, consult your Placement Office or write to either:

JOHN C. SANDERS, Staff Engineer — Personnel
Boeing Airplane Company, Seattle 14, Wash.

R. J. B. HOFFMAN, Administrative Engineer
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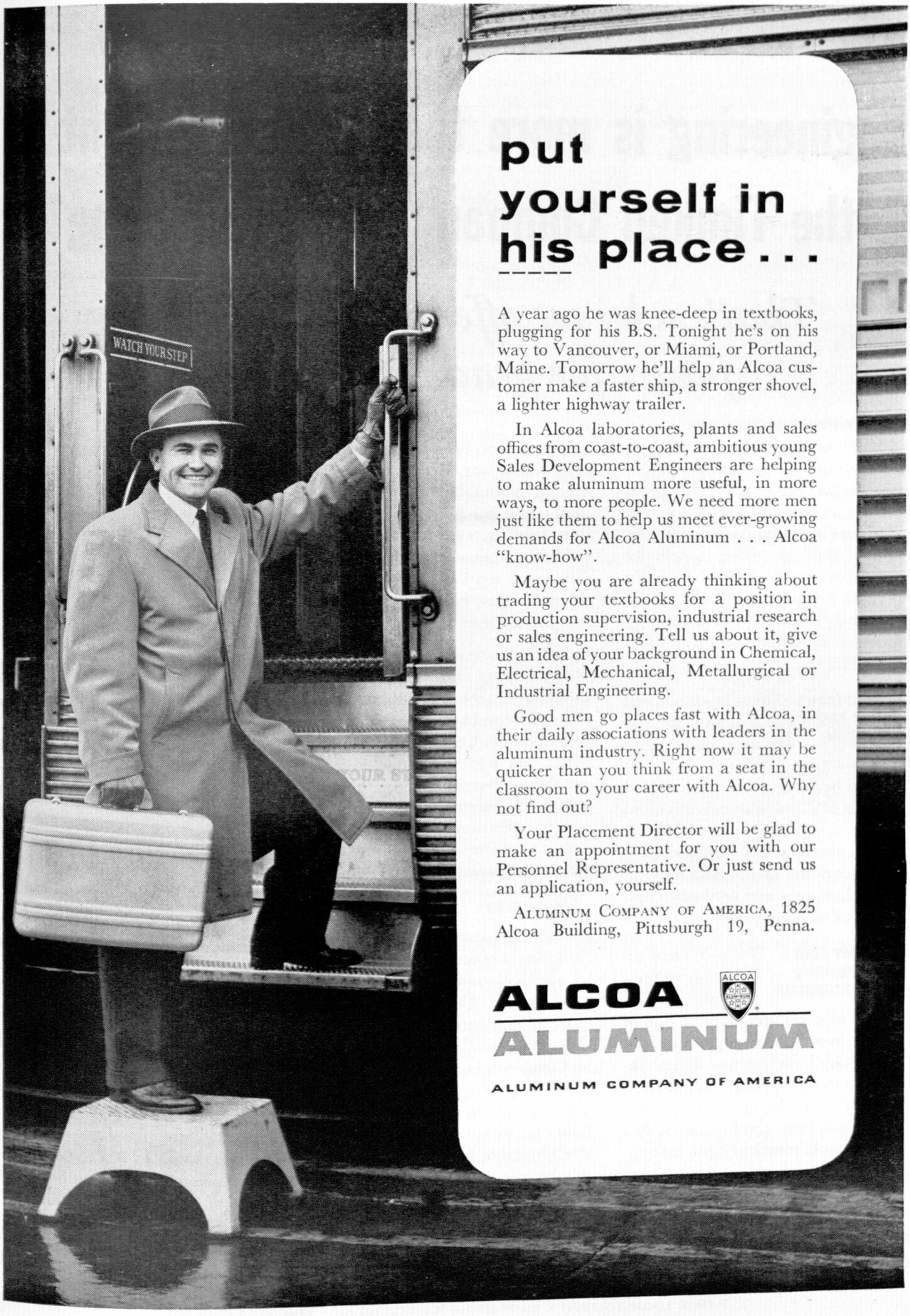

put yourself in his place . . .

A year ago he was knee-deep in textbooks, plugging for his B.S. Tonight he's on his way to Vancouver, or Miami, or Portland, Maine. Tomorrow he'll help an Alcoa customer make a faster ship, a stronger shovel, a lighter highway trailer.

In Alcoa laboratories, plants and sales offices from coast-to-coast, ambitious young Sales Development Engineers are helping to make aluminum more useful, in more ways, to more people. We need more men just like them to help us meet ever-growing demands for Alcoa Aluminum . . . Alcoa "know-how".

Maybe you are already thinking about trading your textbooks for a position in production supervision, industrial research or sales engineering. Tell us about it, give us an idea of your background in Chemical, Electrical, Mechanical, Metallurgical or Industrial Engineering.

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Engineering is more than a department at the Timken Company—it's everything!

That's why we offer such a promising future for graduate engineers

FEW companies can offer engineering and metallurgy graduates such a wide variety of opportunities as you will find within the Timken Company. And we are constantly seeking college graduates who have specialized in these fields because every phase of our manufacturing, research, and marketing requires advanced technical skills and training.

PROMOTIONS MADE FROM WITHIN There is an unusual opportunity for you to advance in the Timken Company. This is highlighted by the fact that one hundred percent of the men in executive and supervisory positions, including the president of the company, have risen from the ranks. And most of these key men are graduate engineers or metallurgists.

MANY FINE TECHNICAL OPPORTUNITIES The Timken Company offers a splendid opportunity to every graduate in one of the many specialized spheres of the company's operation. These include research and development in tapered roller bearings, alloy steel, and rock bits; production of fine alloy steel; metallurgical testing, quality control, and technical service; bearing design and manufacturing control; bearing application engineering for aircraft, automotive, agricultural, railroad, industrial, and other fields; rock bit design, forging, and heat treatment; and sales engineering, covering development work in every market where Timken bearings, steel, and rock bits are used or have a potential.

Another especially important part of engineering work at the Timken Company is the design of plants and specialized equipment for making Timken Company products better and faster. An outstanding example is our revolutionary new, completely automatic bearing plant now in operation in Bucyrus, Ohio.

SOLVE PROBLEMS FOR ALL INDUSTRY You can be assured of an interesting and stimulating career with the Timken Company because of the diversity of applications into which our products go. Every industry is a user of these products. That means that Timken Company engineers and metallurgists are constantly involved in solving problems and designing for new applications in fields far removed from their own drafting table or laboratory bench. We believe that this opportunity to play a part in the advancement of *all* American industry is an important reason why technically trained graudates like being on the Timken Company team.

RECORD OF PIONEERING, PROGRESS The Timken Company was founded 56 years ago. Since then, it has grown to become the world's largest manufacturer of tapered roller bearings and removable rock bits, and a foremost producer of fine alloy steel bars, billets and seamless steel tubing. Our unique combination of experience and research has built an enviable reputation for solving difficult problems for our customers. By constantly expanding and strengthening our technical staff with aggressive and imaginative young engineers and metallurgists, we intend to continue our record of pioneering and progress. And if you possess the abilities and qualities we need, we'll be happy to have you share in that progress.

SEND FOR MORE INFORMATION For more detailed information about The Timken Roller Bearing Company, its training program, and the career opportunities for you, write to the college relations manager for your free copy of the booklet, "*This Is Timken*".

The Timken Roller Bearing Company

Canton 6, Ohio

TAPERED ROLLER BEARINGS • ALLOY STEEL & SEAMLESS TUBING • REMOVABLE ROCK BITS

NEW DEVELOPMENTS

(Continued from Page 39)

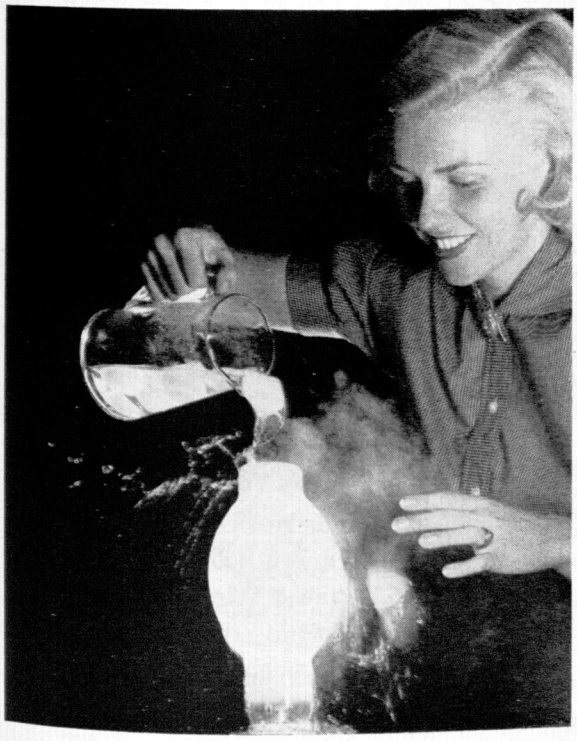
dense air at speeds faster than sound, but to obtain valuable new information as well.

One of the newer theories borne out by the tests, for example, is that the pilot performs a series of violent rocking motions, rather than complete revolutions of tumbling, upon hitting the airstream and while still in the ejection seat. It is these violent changes of direction that cause the many hemorrhages due to "heavy blood", as well as the bone-snapping flailing of the man's arms and legs.

The supersonically-ejected pilot is also subjected to violent yawing motions, engineers discivered, that cause him to rotate sideways a full 180 degrees and back within the first two seconds after his ejection. Rapid rolling motions further complicate the actions of the man, and resultantly, the data and computations of the researchers.

Much of the data has not yet been reduced to workable figures.

Even this, when analyzed, will be only the beginning, new knowledge of supersonic escape will lead to constant further experimentation in the development of new and better protective equipment for the human being that is still needed to fly today's aircraft.



Burrrn that candle!

New Lamps for Outside Use

Icy water steams and sputters harmlessly in this informal demonstration of the new line of mercury and fluorescent-mercury lamps.

An outer bulb of tough and heat-resistant special glass permits the new lamps to be operated out-of-doors and indoors, wherever exposure to corrosive vapors, moisture, thermal change, or slight mechanical hazards requires a heavy-duty lamp.

Developed to permit wider application of mercury lighting, the new lamps are available as alternates to standard lamps in 400- and 1000-watt ratings.

ONCE-OVER TILLAGE

(Continued from Page 19)

there wasn't sufficient difference to warrant the use of the conventional methods.

The highest yields of beets and beans on Brookston loam were obtained on "once-over" tillage acreages. There was only 0.9 bushel greater oat yields from conventional methods than from "once-over" methods. The extra 0.9 bushel per acre did not pay for the extra discing and harrowing.

The corn yields on Hillsdale Sandy loam were almost the same with the "once-over" tillage and conventional methods. The use of the plow-packer was the best of all methods by 1.6 bushels of corn per acre.

The results of the tests on Brookston Clay loam were about the same as on Brookston loam, with less than 1 bushel difference between the "once-over" and conventional methods. Corn yield results were the same.

If the results of these tests are indicative of the values of "once-over" tillage, there will be many changes in farm operations in the next few years. Farm implement manufacturers are seeing the need for the new types of implements. Already, many new and better pieces of farm implements designed for "once-over" tillage methods are in the implement dealer show rooms and in operation on farms.

The weed control problem has been reduced with the use of "once-over" tillage. The weed seeds and trash are turned under too deep to sprout and come up again. On the other hand harrows and disc operations tend to pull the seeds and trash back up on top of the soil where they sprout and compete with the grain crop for plant nutrients and moisture.

The results of these tests show that it would be well worth the farmer's time to look into the possible use of "once-over" tillage for their farms.

MILITARY TELEVISION

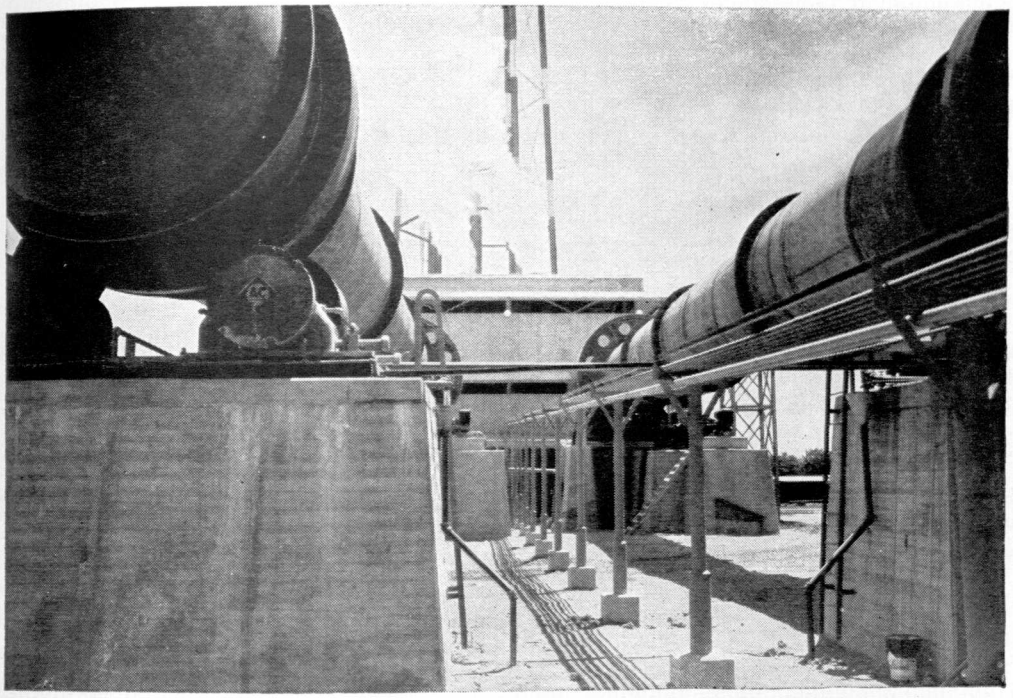
(Continued from Page 9)

variety of colored marking and signals used by friendly and enemy forces.

At one point in the color program, a television picture from the Signal Corps black-and-white airborne camera was picked up and broadcast nationally to illustrate the ability of the aerial unit to detect movements behind the enemy's lines. This was the first

(Continued on Page 47)

Index To Advertisers



CONSTRUCTION—Tremendous rotary kilns, like these, typify Allis-Chalmers role in the cement industry.

Join the company that serves 3 GROWTH INDUSTRIES

Match your engineering talents to the future needs of the construction, power and manufacturing industries. These are growing needs—for the population is climbing at the amazing rate of 50,000 people every *week!*

Many billions of dollars for highway *construction* alone are called for by the President in the next ten years. Allis-Chalmers builds equipment used in making cement, aggregate and steel as well as earth movers and graders.

Electric *power generation* will double in ten years. A-C builds the machines that make electricity.

Manufacturing output must increase $3.5 billion by this time next year. Allis-Chalmers builds motors, control, drives and many other types of equipment for this industry.

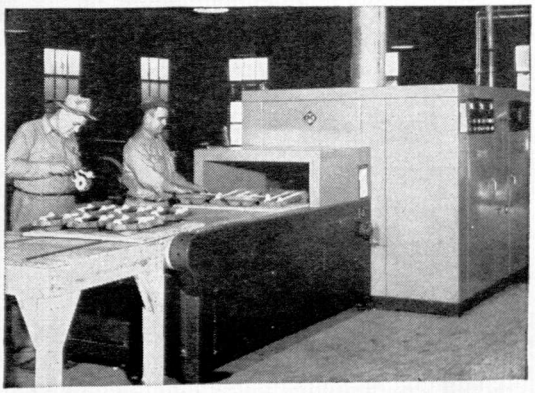
Here's what Allis-Chalmers offers to Young Engineers:

A graduate training course that has been a model for industry since 1904. You have access to many fields of engineering: electric power, hydraulics, atomic energy, ore processing.

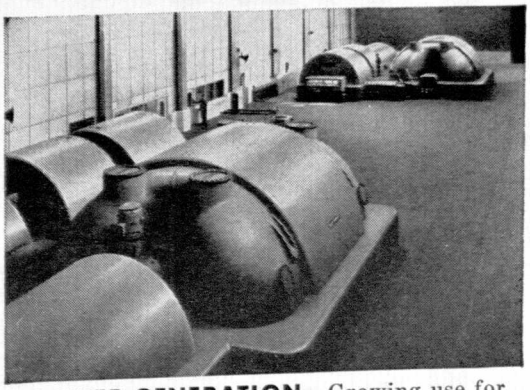
There are many *kinds* of work to try: Design engineering, application, research, manufacturing, sales. Over 90 training stations are available, with expert guidance when you want it. Your future is as big as your ability can make it.

Or, if you have decided your field of interest and are well qualified, opportunities exist for direct assignments on our engineering staff.

In any case—learn more about Allis-Chalmers. Ask the A-C manager in your territory, or write direct to Allis-Chalmers, Graduate Training Section, Milwaukee 1, Wisconsin.



MANUFACTURING—A-C aids high speed production and helps improve quality with dielectric sand core dryers like the one above.



POWER GENERATION—Growing use for power means growing demand for A-C steam turbines, transformers, and other equipment.

ALLIS-CHALMERS

A-4685

UNEDUCATIONAL . . .

"I'll see you," said Jim as he laid down four aces in a game of strip poker.

° ° ° °

An Idaho potato married a Long Island potato. Pretty soon they had a little sweet potato, and when the little sweet potato grew up it said: "I want to marry Lowell Thomas."

And said Mama: "You can't marry Lowell Thomas. He's a commentator."

° ° ° °

Boy: "Teacher, I don't have an eraser."
Teacher: "Use the little girl's behind."

° ° ° °

"Daddy, if you give me a dime, I'll tell you what the iceman said to Mamma."
"All right, here's your dime."
"He said: 'Any ice today, Lady?' "

Actress: "They laughed when I came on in shorts, but when I sat down they split."

° ° ° °

Horatio: "We're not making any money on this amphitheatre."
Nero: "Yeah, the lions are eating up all the profits."

° ° ° °

Love is a game that is never called off because of darkness.

° ° ° °

Excerpt from a soldier's letter—I have had so much latrine duty they call me Flush Gordon.

° ° ° °

"If a drunk is a Souse of the Border in Mexico, what is he in France?"
"Plaster of Paris."

THE VITAL LINK

(Continued from Page 7)

output of his laborors with respect to an agreement of their employer.

No, the engineer does not only convert abstract and impractical ideas into useful objects, but he must deal with individuals, the technical and the non-technical, and he must be prepared to work with and for these individuals.

Each year more and more universities are interjecting into their curriculum an increasing number of liberal arts courses for engineers. Many universities have even increased the engineering curriculum to five years with the first three being liberal arts and the last two scientific studies. At the end of five years their students receive two degrees, a BA and a BS degree. With this addition of liberal art courses, the engineer is now equipped with a well rounded background without which he could not hope to progress very far up the professional ladder.

We must always remember that the efficiency of anything is dependent upon the efficiency of its parts, and obviously the greater the efficiency the greater the output. So it is with the whole field of engineering, the greater the efficiency of its men, the greater its output. Engineering is not recognized by its number of technical men, not even by its number of degree holders, but by its output of useful goods and services. Engineering is a big field with many job opportunities, and the men in it, capable of seeing the whole picture, will be its leaders.

MILITARY TELEVISION

(Continued from Page 43)

public broadcast of a signal from any of the Army's combat television cameras.

The nationwide colorcast emphasized the future role of color television in two ways. The color conveys more complete information to the commander and his staff. The nationwide broadcast watched on color receivers in the Pentagon, at the White House and at the military headquarters throughout the United States, demonstrated another role of television as a future means of communication between a theatre of operation and headquarters in Washington or elsewhere.

"Operation Threshold" is another milestone in the history of teamwork between industry and the Armed Services in the interest of national security—teamwork that typifies the combined effort of American industry and the various military departments in developing the best weapons and techniques for our defense forces.

In the words of General Sarnoff at the conclusion of the Fort Meade demonstration: "The results already achieved through Army industry cooperation give us good reason to believe that further achievements are within our reach. This teamwork is continuing in the laboratories and in the field. The goal is to provide the Armed Forces of the United States with the most effective communication by sight, as well as by sound."

TWO SECONDS TO LIVE

(Continued from Page 5)

Smith's experience will be felt by every pilot in the inevitable faster days of aviation to come. Every fighter will now be equipped with an ejection seat with the knowledge that it has been proven that a pilot can live through a supersonic bailout. It constitutes a major contribution to aero-medical research in supersonic escape.

And what of this pilot who became, inadvertantly, one of the most valuable personal contributors to the knowledge of Aviation medicine and the science of pilot survival. Today George Smith is feeling fine and eager to fly for his company again. On August 23 he passed the CAA physical examination, regaining his commercial flying certificate. Because of an injury to his liver, he cannot drink anything containing alcohol for the rest of his life. But he is already resigned to this and feels glad to save his money in the bargain. His weight is back up to 175 pounds, 25 pounds over his weight at the immediate end of his convalescence, which actually fits his six foot, one inch frame more proportionately than his original 215 pounds.

And what does he think of his contribution to Aviation? "Frankly, I'd just as soon it were somebody else who had done it," he admits. "But as long as I did, I just hope it does some good, that we learn something from it that will increase a guy's chances in trouble." Chances are that we'll never know how many pilots in the future will owe their lives to that near-deadly "research" done on the other side of the sound barrier by test pilot George F. Smith.

"Your feet are cold," he complained to his little bride. "Keep them on your own side of the bed."

She immediately began to cry, sobbing, "But John, you never used to say that before we were married."

° ° ° °

"Son, after four years of college, you're nothing but a drunk, a loafer, and a damn nuisance. I can't think of one good thing it's done!"

The son was silent a moment. Suddenly his eyes brightened. "Well," he said, timidly, "it cured Ma of bragging about me."

COEFFICIENT OF . . .

LIPSTICK DISTRIBUTION

When two surfaces, one of which is coated with a layer of lipstick, meet, a certain distribution of the lipstick takes place. The second surface, which was originally clean, retains a portion of the material. This paper is a study of the variables affecting this distribution and the determination of the coefficient of distribution.

NOMENCLATURE

P—pressure

T—number of applications

C—temperature

A^1—area of transmitter

A^2—area of receiver

i—Newton's constant

p—pucker factor

t—time

Π—passion

B—surface conditions

□—distribution coefficient

D—distribution

NOTES ON THE VARIABLES

The most important variable in the distribution of lipstick is that of pressure. Harris reports that in 1943 tests, using variations in pressure, the amount of material transferred was a direct function of the pressure. The report tends to bear out the experiments of Stockfleth, who used several transmitters under the same laboratory conditions, i.e., on the same night. Stockfleth conducted his tests in the Pi Beta Phi laboratory in 1941. When the pressure is zero, the distribution is also zero; as the pressure increases, the flow of lipstick increases rapidly up to a certain maximum. Under extremely high pressures the equilibrium occurs when the amount of lipstick on one surface is equal to that on the other.

B, the variable measuring the surface conditions, is an exponential function of the pucker factor and pressure. Under normal operating conditions, the surface of the contacting areas is fairly smooth. However, if the surfaces are contracted and drawn up into folds and wrinkles, i.e., puckered, surface conditions are far from being ideal for complete distribution. As pressure increases, the surface becomes more ideal, i.e., smooth.

Other factors are also important in the distribution ratio. The intensity of light, i.e., has an inverse effect. As light becomes brighter, less and less lipstick is distributed. The amount dispensed in total darkness approaches infinity.

Temppig attempted a series of experiments to determine the effects of passion, but failed at first because of transmitter trouble. In another attempt the defense failed, and accurate results were obtained. The cause of Π, passion, is as yet unknown, but it has been shown that any amount of it renders useless the consideration of any other variable. Π causes the number of applications per unit time to increase greatly. The study of this variable is the most difficult of all, but Temppig's work seems quite adequate.

Other variables of less importance include temperature, area of the transmitter, and area of the receiving surface. It seems that more lipstick is distributed in the month of June, a period of high mean temperature, than in any other month of the year. The areas of the contacting surfaces have their direct effect.

WORKING EQUATIONS

Units

P—pressure in lb./sq. in.

T—number of applications

C—means centrigrade temperature of the mouth

A^1—area of transmitter in sq. in.

A^2—area of receiver in sq. in.

t—time in seconds

i—light intensity in candlepower

B—Standard Rasp Number (A.S.M.)

p—pucker factor in wrinkles/linear inch

METHODS OF CONDUCTING TESTS

To secure the necessary data for use in the equations, tests must be conducted under the standard conditions. One variable alone is allowed to vary in each set of determinations. The only apparatus necessary is the lipstick, two willing surfaces, and a standard 200-mesh linen handkerchief which must be unstarched. A test of pressure, for example, will probably require twenty determinations, all with different pressures. The results should be placed in order around the edge of the handkerchief with notes as to the surface conditions. If any signs of passion are present, disregard the results of the test, but continue to run them until all signs of passion are dissipated. As many as 150-175 determinations may be run in the course of an evening under normal operating conditions. If conditions become ideal do not hesitate to take advantage, as they may be hard to duplicate.

—*From Montana Engineer*

TO AN ENGINEER'S SWEETHEART . . .

Verily I say unto you, marry not an engineer, for the engineer is a strange being and possessed of many devils.

Yea, he speaketh eternally in parables which he calleth "Formulae."

And he wieldeth a big stick he calleth a slide rule, and he hath one Bible—a Hand Book.

He talketh always of stresses and strains and without end of Thermodynamics.

He showeth always a serious aspect and seemeth not to know how to smile.

And he picketh his seat in the car by the springs thereof and not by the damsel bseide him.

Neither does he know a waterfall except by its power, nor a damsel except for her specific heat.

Always he carrieth his books with him and he entertaineth his maiden with "Steam Tables."

Verily though she expecteth chocolates when he calleths, she opens the package to disclose samples of iron ore.

Yea, though he holdeth his damsel's hand but only to measure the friction, and he kisses only to test the viscosity.

For in his eyes shineth a faraway look which is neither love nor longing, but a vain attempt to recall a formula.

There is one key dear to his heart, and that is a Tau Beta Pi key, and one love letter for which he yearneth, a "B."

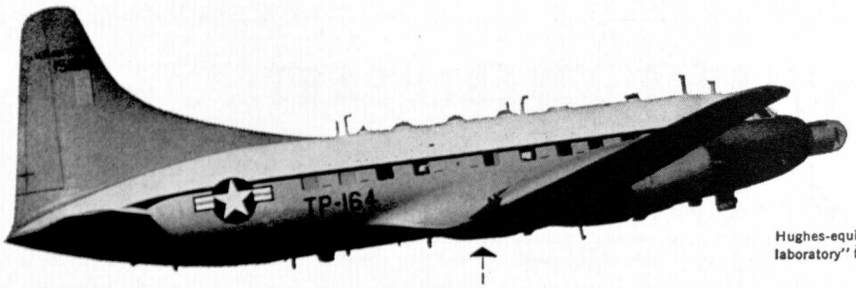
And when to his damsel he writeth of love and signeth with x's, mistake not these symbols for kisses, but for unknown quantities

When a boy, he pulleth a girl's hair to test the elasticity, but as a man he discovers different devices.

or he would count the vibrations of her heart beat and he reckoned her strength of materials.

or he seeketh ever to pursue the scientific investigation, even his heart flutterings he counteth as a vision of beauty, and inscribeth his passion in a formula.

And his marriage is a simultaneous equation, involving two unknowns and yileding diverse answers.



Hughes-equipped T-29 "flying laboratory" for systems evaluation.

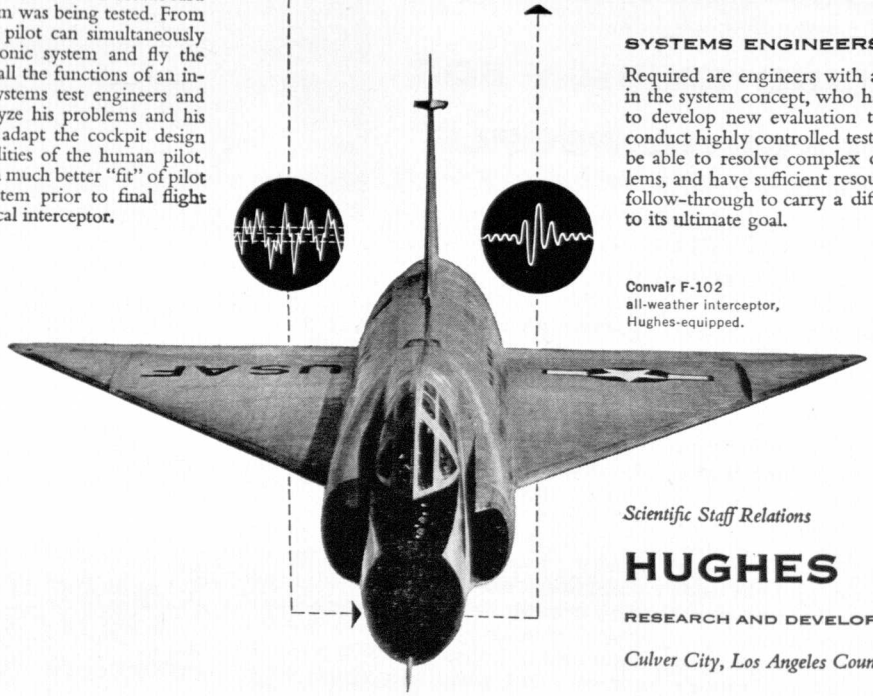
Flight evaluation of advanced interceptor electronic system uses unique approach.

T-29 "INTERCEPTOR"

THE DEVELOPMENT OF AIRBORNE ELECTRONIC SYSTEMS REQUIRES THOROUGH FLIGHT EVALUATION OF BREADBOARD AND PROTOTYPE EQUIPMENT PRIOR TO FINAL DESIGN. AT HUGHES, SYSTEMS FOR INTERCEPTORS ARE FIRST TESTED IN "FLYING LABORATORIES" IN WHICH THE EQUIPMENT IS READILY ACCESSIBLE TO SYSTEMS TEST ENGINEERS

One interesting problem recently confronting Hughes engineers was that of evaluating the requirements imposed upon the pilot of a high-speed one-man interceptor. This arose in the development of a new integrated electronic system to control several phases of an all-weather interceptor's flight. Because of the great importance of providing the pilot with the optimum design and arrangement of displays and controls, it became necessary to determine accurately the pilot's work load during flight, and the human factors that affect his ability to carry out his task.

The solution was to install a complete mock-up of the actual interceptor cockpit in a large T-29 aircraft in which a breadboard model of the system was being tested. From this cockpit a test pilot can simultaneously operate the electronic system and fly the T-29, performing all the functions of an interceptor pilot. Systems test engineers and psychologists analyze his problems and his performance, and adapt the cockpit design to the natural abilities of the human pilot. The result will be a much better "fit" of pilot and electronic system prior to final flight testing in the tactical interceptor.



Convair F-102
all-weather interceptor,
Hughes-equipped.

SYSTEMS ENGINEERS

Required are engineers with a basic interest in the system concept, who have the ability to develop new evaluation techniques and conduct highly controlled tests. They should be able to resolve complex circuitry problems, and have sufficient resourcefulness and follow-through to carry a difficult program to its ultimate goal.

Scientific Staff Relations

HUGHES

RESEARCH AND DEVELOPMENT LABORATORIES

Culver City, Los Angeles County, California

"When I look over the fence...

"Since the day when man made his first brief airborne flight, the advance in aeronautics has been little short of fantastic. Tremendous achievements have opened new avenues of progress that were but idle dreams of yesteryear. We live in a new dimension!

"To the young men of today, these new avenues of progress in aeronautics and the related sciences reveal almost limitless opportunities for success. As an engineer in quite another field I am constantly drawn to look over the fence to see what I see. And I am fascinated with the great and fast-growing opportunities that are there. So much so, that to the potent message of a previous century, 'Go West, young man,' I am prompted to add...'Look *up*, young man, reach for the stars, for they lead to great things.'"*

CHARLES LUCKMAN
Partner—PEREIRA & LUCKMAN
Planning—Architecture—Engineering

Out of his own successful engineering career, Charles Luckman sets a sure course for today's trained young man when he says "reach for the stars."

In the aircraft industry, the expression is strikingly exemplified by the records of thousands of far-seeing young men who have graduated into secure positions that offer lasting success. What was yesterday's single field has today come to include a multitude of specialized sciences.

At Northrop Aircraft—world leader in the design and production of all-weather and pilotless aircraft—the young engineer is provided a host of activities from which to choose. Each offers success opportunities positively unbounded.

For detailed information regarding specific openings in your field of specialization, write Manager of Engineering Industrial Relations, Northrop Aircraft, Inc., 1001 East Broadway, Hawthorne, California.

NORTHROP

Pioneers in All Weather and Pilotless Flight

**From an address to the American Society of Civil Engineers, Los Angeles, California*

Editorial

Has engineering sterotyped your mind? Do you find yourself continually contemplating engineering subjects? These questions are not directed at you, but listen to those other fellows in Olds Hall converse. Between class, bull sessions are continually spiced with numbers, formulas and theories. The halls are filled, between the hour and ten after, with interesting conversation on how close your answer was to mine, the instructor's wrong theory and how did you do it. One can't tell where class ends or begins. You must walk outside and down the sidewalk a ways to get a "break."

Let's get away from Olds Hall and broaden our conversational repertoire. For diversion, the trip to the coast supplies interesting subjects. Those of you who took the trains must have had an enjoyable trip. They have surely made progress on the rails. Swift transportation with the diesel. Smooth riding. The noise excluded from the cars. Grandad never dreamed of some of the conveniences now on iron wheels.

Myself, I drove out in a driveaway. Those automobile men built their imagination itself into that new Lincoln. In Oklahoma somewhere we reached the thousand mile point. No need to drive in for a grease job, just press the button.

Those of you who rode the trains missed Hoover Dam. What a spectacle that is. How they could even crawl into that canyon, let alone bring materials and stop that mighty flow, astounds me. Somebody used his head.

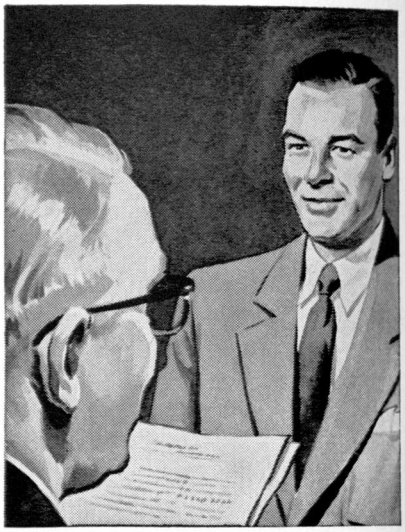
There wasn't anybody who missed those slot machines in Vegas though. Like myself, you thought you could beat them too. After pouring my nickels into them, I was told they always pay off sixty-forty. Guess who gets the sixty. They were perfect examples of the science of probability that we studied last term. After recalling my lessons I noted that my chance of three gold nuggets popping up was one chance in three thousand one hundred and twenty-five.

And then there was L.A. What a fabulous place that was. Disneyland, nite clubs and Pershing Square; but what do you remember most? I can't help visualizing those ultra modern freeways. Layed down through the heart of the city. An engineering feat that causes marvel. Engineering! How did we get on that?

H.N.

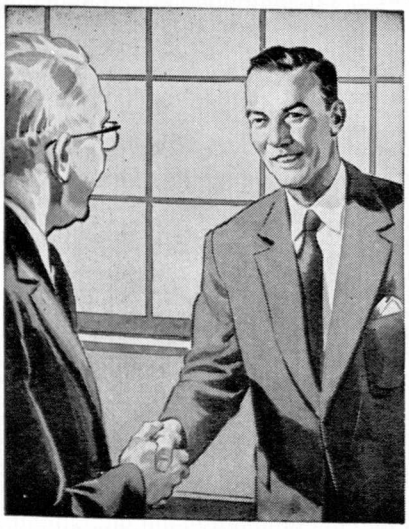
Here's what happens when you take a job with DELCO PRODUCTS

1 When you take a job with Delco Products, you start a career with General Motors—with a division known throughout the world as a leading manufacturer of electric motors, hydraulic shock absorbers, and many other products.

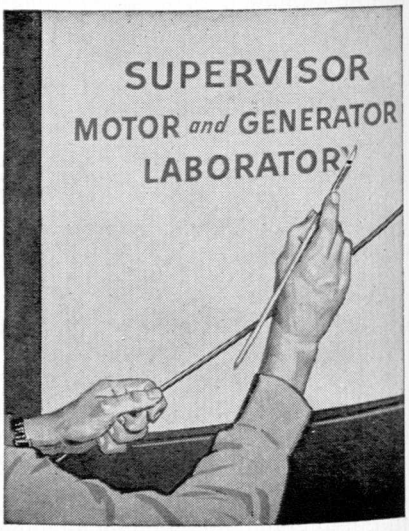


2 You enter into a well-organized training program—a program specifically designed to take full advantage of your particular interests and abilities. You don't just "go back to school." Instead, you *learn* by *doing*, with top-flight supervision.

3 As a trainee you get into every conceivable phase of Delco's engineering operations — engineering laboratory, plant engineering, drafting, sales, processing, standards, quality control. Additional assignments are often made in related departments for broader experience.



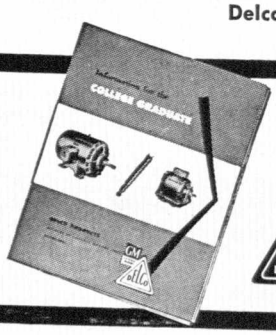
4 Training completed, you'll be given a specific departmental assignment. Progress can be made in product development, technical staff operations, sales, or in manufacturing supervision—according to your interests and capacity for future development.



5 With Delco's policy of promotion from within, your opportunities for advancement are virtually unlimited. Not every trainee becomes a supervisor, but some go much farther. Many General Motors top executives today are "graduates" of Delco Products Division.

If this opportunity interests you, sign up for the GM interview on your campus and ask for referral to Delco Products. For booklet detailing Delco's engineering activities, write to:

E. J. Bentley, Supervisor, Graduate Training
Delco Products Division, GMC
Dayton 1, Ohio

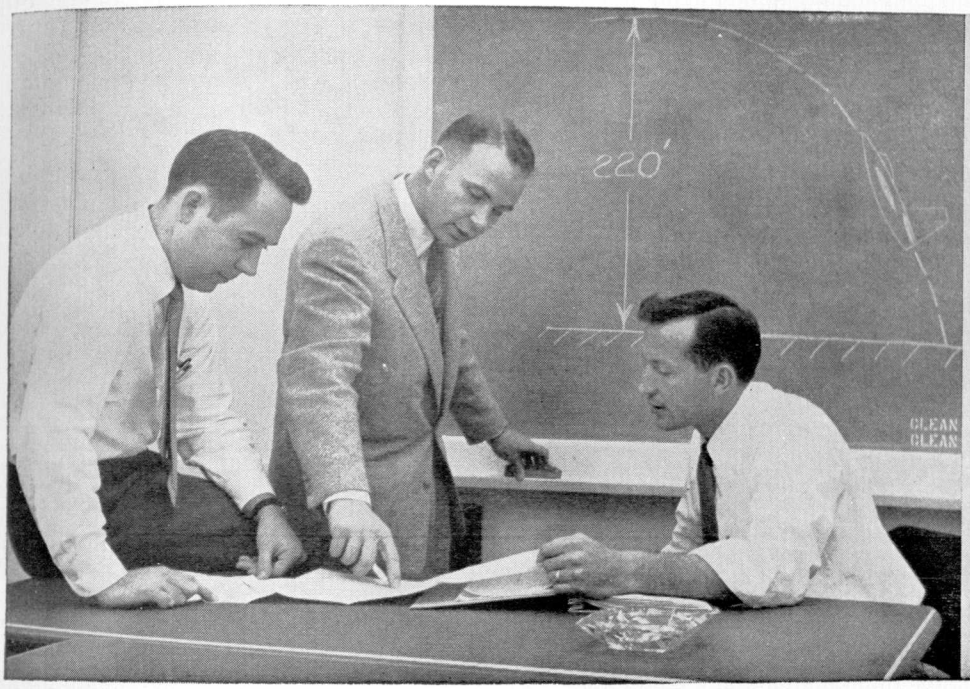


DELCO PRODUCTS

DELCO DAYTON OHIO

GM GENERAL MOTORS

Division
General Motors
Corporation
Dayton, Ohio



N. T. Avant, aerodynamicist (left), R. R. Heppe, Aerodynamic Department head (center), and C. F. Branson, aerodynamicist, discuss wind tunnel tests to determine transition height of a supersonic superiority fighter.

Hovering to High Speed Flight:

Lockheed Aerodynamics Projects Offer Advanced Problems

Aerodynamics Engineers at Lockheed are working on advanced problems that cover virtually every phase of aircraft. The full scope of their work can be seen in the wide range of aerodynamics problems encountered in Lockheed's diversified development program.

Among the advanced problems are:

1. Determine means of controlling a supersonic vertical rising aircraft through the transition flight stages from horizontal to vertical flight.
2. Determine the dynamic response of supersonic aircraft in high rate rolls by application of five degrees of freedom analysis procedures.
3. Study optimum operating descent procedures to minimize costs on a new turboprop commercial aircraft.
4. Conduct and analyze wind tunnel research on new and radically different external radomes to be carried at high speed by early warning aircraft.
5. Perform generalized aeroelastic analysis combining structural and aerodynamic knowledge to determine optimum lateral control devices for use on very high speed, low load factor aircraft.

These—and many other—significant problems have created new positions for experienced Aerodynamics Engineers and Aerodynamicists in Lockheed's expanding program of diversified development.

You are invited to contact your Placement Officer for a brochure describing life and work at Lockheed in the San Fernando Valley.

Additional information on these problems and data on Lockheed's Aerodynamics Division is available to interested engineers. Address inquiries to R. R. Heppe.

LOCKHEED AIRCRAFT CORPORATION

CALIFORNIA DIVISION BURBANK **CALIFORNIA**

SIDETRACKED

Peeved patron in restaurant: "You say you're the same waiter I gave my order to? Somehow I expected a much older man."

° ° ° °

An Engineer is a person who passes as an exacting expert on the basis of being able to turn out with prolific fortitude infinite strings of incomprehensible formulae calculated with misromatic precision from vague assumptions which are based on debatable figures taken from inconclusive experiments carried out with instruments of problematical accuracy by persons of doubtful ability and questionable mentality for the avowed purpose of annoying and confounding a hopelessly chimerical group of fanatics referred to all too frequently as Engineers.

(Editor's note: Engineers have no use for English; so supply your own punctuation.)

° ° ° °

One lady passenger on the train asked the porter to open the window next to her. "Otherwise, I'll suffocate," she said. The lady next to her protested, "If that window is opened, I'll freeze to death!"

"What would you do, boss?" the porter asked a traveling salesman seated nearby.

"Keep it closed for a while and suffocate the first one," muttered the salesman. "Then open it and freeze the other one!"

° ° ° °

Ed: "Give me a cigarette, Joe."
Joe: "I thought you had quit smoking."
Ed: "Well, I got to the first stage. I've quit buying."

° ° ° °

The chorus girl swept into the dressing room with a mink coat draped casually over her arm.

"Dearie," asked one of the other girls, "how did you ever get such a gorgeous mink? Why, I've been struggling for years to get one."

"Honey," replied the other, "you mustn't struggle . . . ever."

° ° ° °

"Could I have a furlough, sir? I have to help my wife with the spring cleaning."

"I don't like to refuse you, Jones, but I have a letter from your wife and she says that you are of no earthly use around the house during spring cleaning."

"Sir, there are two people in this outfit who handle the truth very loosely. One of them is me. I am not married."

ROTC Sergeant: "Does your uniform fit satisfactorily?"

Frosh: "Well, the jacket is okay, sir, but the pants are a bit snug under the armpits."

° ° ° °

"The more I think about going out and getting a job the more I think about staying on for a Master's."

° ° ° °

A self-styled reformer was watching a trench being dug with modern machine methods. He said to the superintendent:

"This machine has taken jobs from scores of men. Why don't you junk it and put 100 men in that ditch with shovels?"

The superintendent snorted: "Better still, why not put 1,000 men in there with teaspoons?"

PERPETUAL MOTION

A beachcomber was walking along the beach when he spied a small crowd at the water's edge. Two life guards had succeeded in rescuing a drowing man and were now unsuccessfully trying to revive him. A pulmotor didn't seem to do much good, so the rescue crew tried a stomach pump.

Out of the victim's mouth came seaweed, oyster shells, salt water, more oyster shells, more seaweed, more salt water. . . . Finally he could stand their incompetency no longer. Strolling over he observed:

"Say, look here. I think it would help a lot if you fellows would take his behind out of the water."

° ° ° °

Hit by an army jeep passing through the French countryside, a hen got up, straightened her feathers and muttered, "Lively little cuss, but he didn't get anywhere."

° ° ° °

A professor, whose theories were always open to doubt, but who nonetheless found many and devious ways of proving them, was lecturing on insects at a university.

"On my right hand," he said to his students, "I have a flea. I now order him to jump over to my left hand. As you see, the flea obeys me. "Now," he continued, "I remove the legs of the flea and order it jump. You note that it does not jump. Therefore, we have scientific proof that a flea whose legs are removed becomes deaf."