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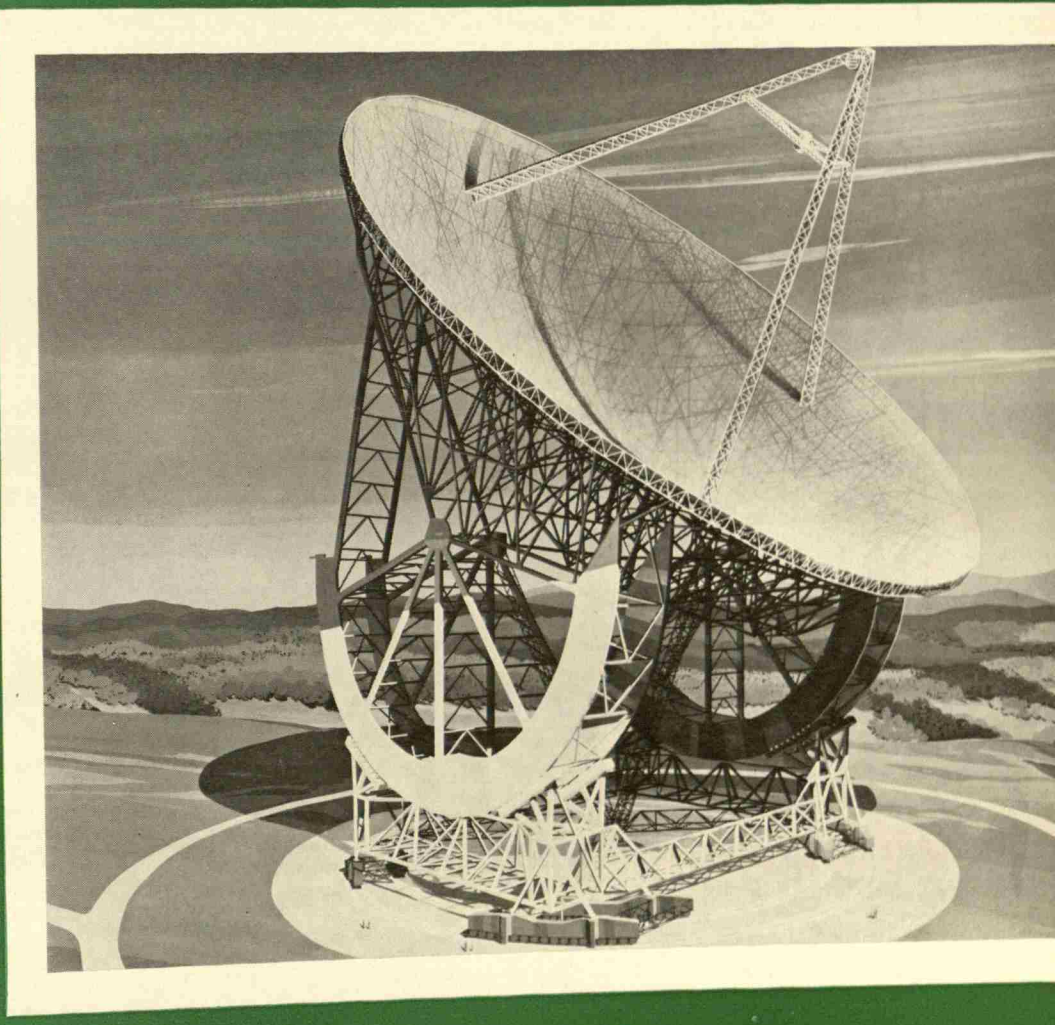
ENGINEER

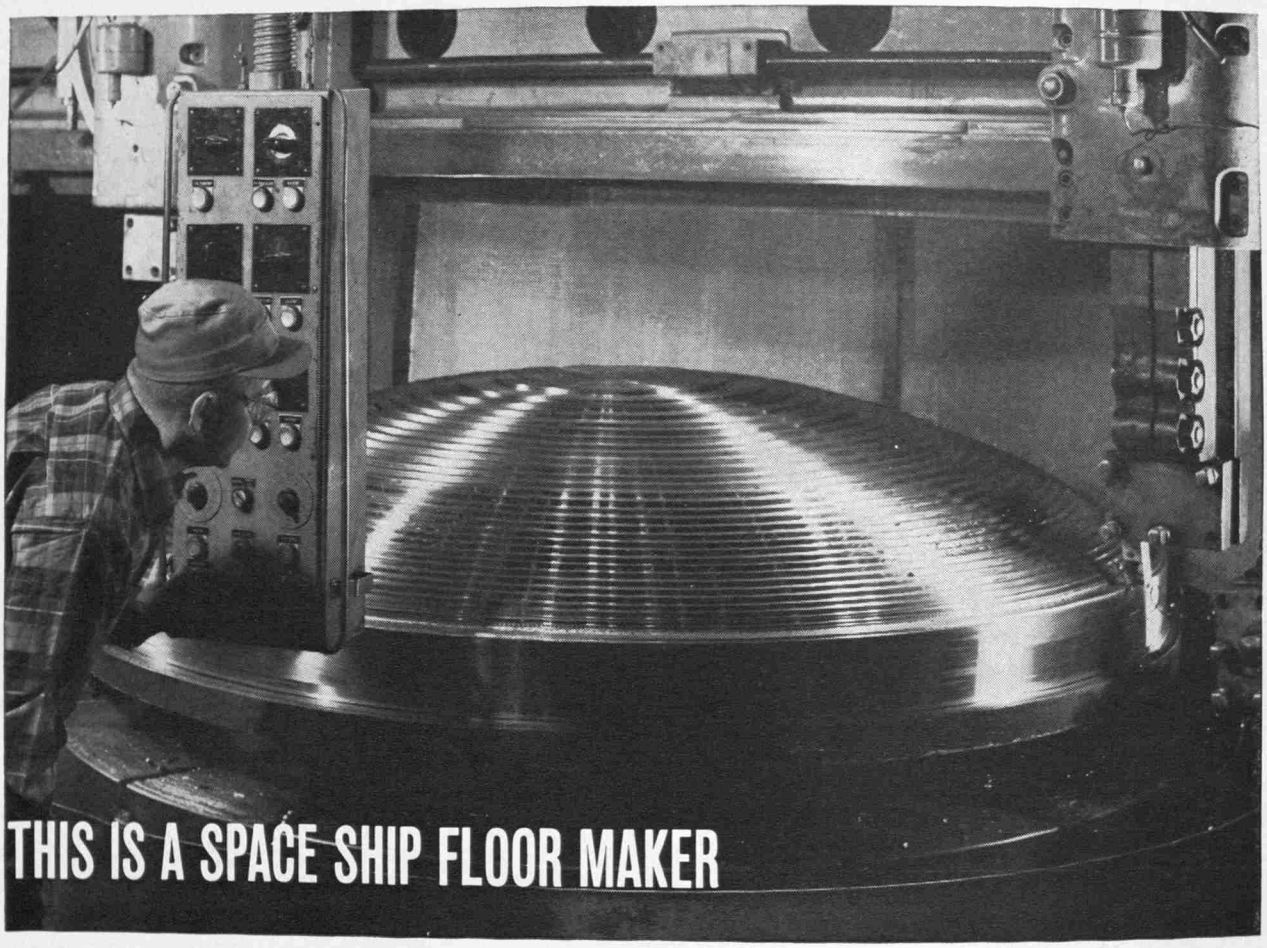
may 1961



NAVY'S GIANT RADIO TELESCOPE

SEE STORY ON PAGE 8

Sometime within the next several years, the first American will soar into orbit around the earth. He will be sealed in a small, cone-shaped space capsule mounted atop an Atlas missile. The missile will climb 100 miles in less than six minutes, where the capsule will disengage and go into orbit. The man will be alone in space.



THIS IS A SPACE SHIP FLOOR MAKER

The vehicle for this historic voyage is already in production under the auspices of the National Aeronautics and Space Administration's "Project Mercury." One of the methods of heat protection is a beryllium heat sink, forged on two giant steel dies. Both dies are USS Quality Steel Forgings. The top die (shown being rough-machined on one of our vertical boring mills) will be convex, 20 inches thick and will weigh 26,520 pounds. The bottom die, concave and 18 inches thick, weighs 27,700 pounds. Both are 92 inches in diameter.

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What kinds of engineers are needed most?

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What is Air Force Officer Training School?

A precommission training course of 3 months' duration at Lackland Air Force Base, Texas. Officer trainees upon graduation receive a commission as second lieutenant. They are then assigned directly to duty or additional training.

Does the Air Force offer career opportunities?

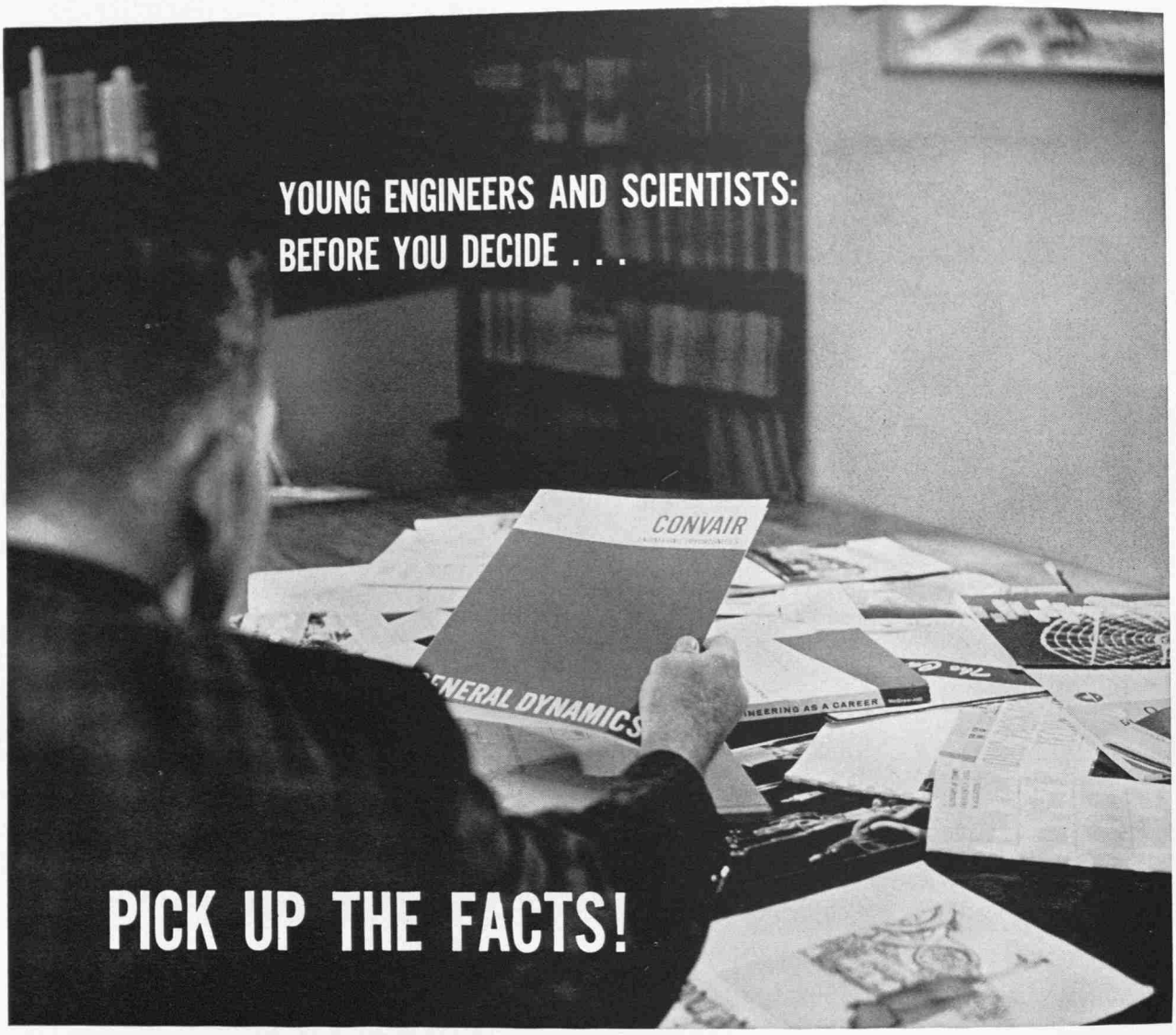
Yes. Technically trained officers have a particularly bright career outlook. They have good opportunities for graduate study.

How can further information be obtained?

Write to OTS Information, Box 7608, Washington 4, D.C., or inquire at any Air Force Recruiting Office, listed in the telephone directory under "U.S. Government—Air Force."

Civilian Career Opportunities

The Air Force also offers challenging jobs for engineers as civilians. Write to Directorate of Civilian Personnel, Hq. Air Force Systems Command, Andrews Air Force Base, Washington 25, D. C., concerning opportunities for individuals with degrees in aeronautical, electrical, electronic, and mechanical engineering. Write to Directorate of Civilian Personnel, Hq. Air Force Logistics Command, Wright-Patterson Air Force Base, Ohio, concerning opportunities for individuals with degrees in industrial engineering.



At Convair, we know how important it is to choose your first association wisely. We can almost always help to make the decision a little easier, whether or not you choose Convair.

No company can be all things to all graduates, but Convair offers some unusual advantages that should interest you. We're a big company, but provide many of the advantages usually considered unique to smaller firms. Our engineering departments, for example, are purposely organized into small, specialized groups, achieving a climate of individualism rare in a company our size. Also, a large organization can pursue a variety of independent research and technical studies; its resources provide an extra measure of stability.

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CONVAIR  A DIVISION OF GENERAL DYNAMICS

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Here's a chance to put theory to practice . . . to appraise what you have learned in relation to what industry requires on the job. You'll get a better idea of where you can go in your chosen field . . . and perhaps the route to take after graduation.

If you're a junior, senior, or graduate student of chemical or mechanical engineering, or chemistry, you may be given a regular plant or laboratory assignment, important and challenging work, keyed to your education to date. You'll get the same personal, interested training as our permanent employees.

A summer job with Du Pont can be an important step toward a good job with us after college. You learn about us and what kind of company we are. We learn about you.

Jobs for students are limited, of course, so write soon to Du Pont, Room 2430-2 Nemours Building, Wilmington 98, Delaware.

(There are some jobs, too, for freshmen and sophomores, as lab assistants and vacation relief operators. They should apply direct to the Du Pont laboratory or plant of their choice.)

DU PONT

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

WORK WITH DU PONT THIS SUMMER

Editor's Corner

YOU HAVE the feeling of pride and accomplishment . . . . . and it is well deserved, for you will soon complete a rigorous four-year engineering program.

You're among the very best of the nation's youth and the nation is waiting for you with open arms. She expects big things from you, so don't disappoint her . . . . . Place no limit on your visions and thinking . . . . . Dream big dreams and do your best to make those dreams come true.

You cannot limit yourself to what has been done. To quote Dean Ryder, "We have built buildings and bridges before, but when it comes to building rockets, we are not following a previous pattern."

Creativity is the prime requisite for engineers and scientists; they must think "big" and be pioneers.

More than 100 years ago, Michael Faraday was demonstrating his electromagnetic equipment to a British government committee in the hope of obtaining government support. One member admitted he was fascinated, but asked Faraday, "What practical benefits can we expect?" "I can't answer that question," Faraday replied, "but I can tell you that 100 years from now you will be taxing something like this."

When you get into the world of science, let your motivation be that of the mountain-climber . . . . . he climbs a mountain because it's there!

R.V.P.

Spartan Engineer

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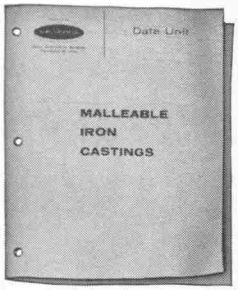

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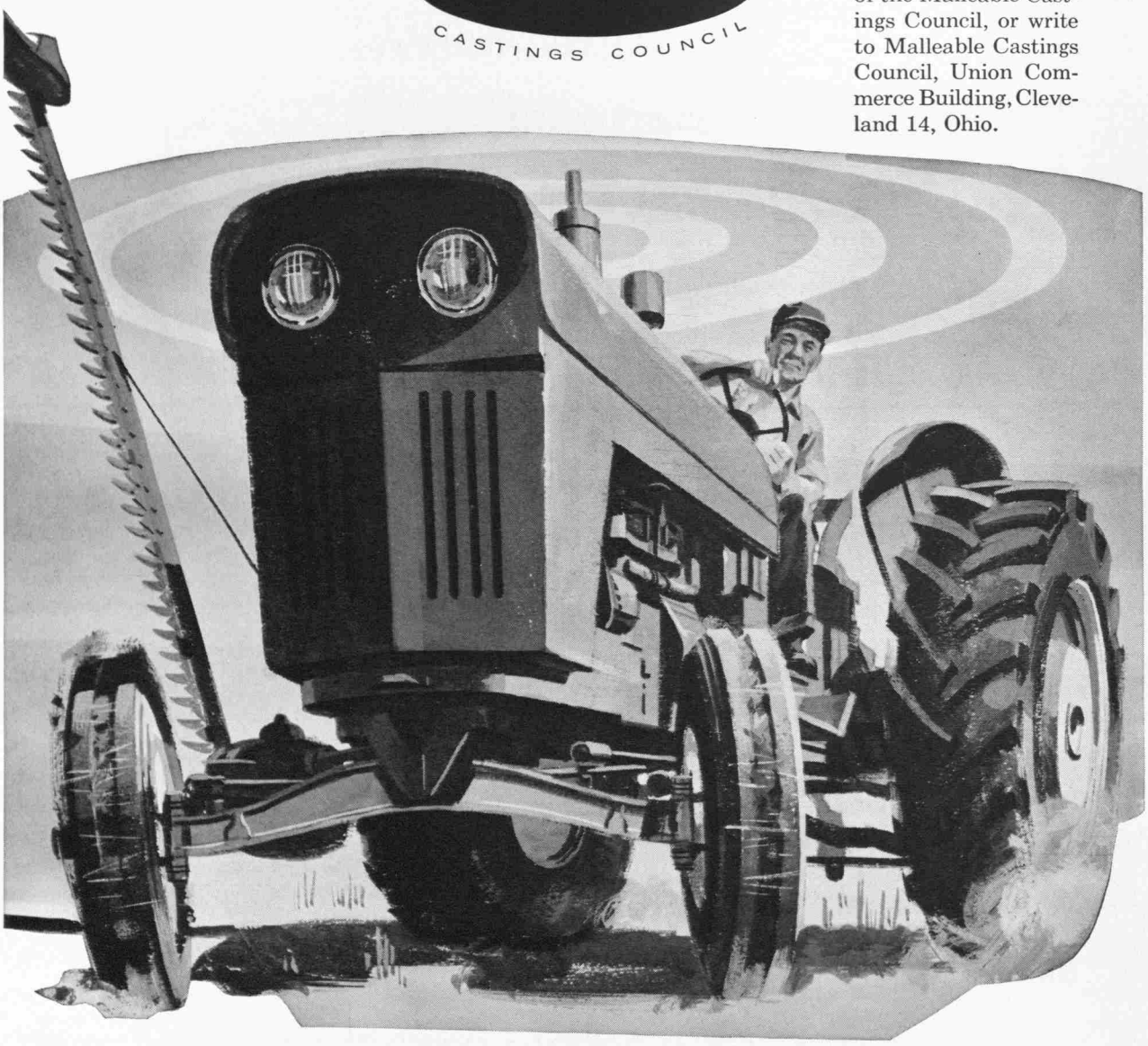


The versatility of Malleable Castings is reflected in the variety of ferritic and pearlitic Malleable tractor parts, from the tough, dependable front axle bar to bolsters, lift arms, clamps, clevises, hitches, hinges, foot pedals, transmission planetary carriers and clutch parts.

Dean's Letter

OUR SENIORS have just completed their parts in the annual hunt for college ivory—the campaign conducted by U. S. industry to guide the potential engineering graduate into the profession. This year, as for several past, has seen our campus attract representatives of more industrial companies and governmental agencies than visit any other institution in the state. During winter term alone, our 250 engineering seniors had nearly 2300 interviews with the visiting personnel representatives.

What do these men look for in the seniors they interview? We believe the foremost quality desired is "teachableness," or a willingness and ability to continue the learning process. How do they measure this quality? Certainly the first quantitative criterion applied is that of the student's grade-point average. A good average is at least an indication that he has learned in the past and should be able to continue the learning process in moving into our technical profession in the future. Interest in possible graduate study, in company-sponsored technical and business training programs, in the technical advantages offered by the geographical locale of the company's operations, all demonstrate to the ivory-hunter that a senior wishes to continue learning.

A good point average, however, is not all that is desired by the interviewer. After assuring himself of academic abilities, he next looks to personality, appearance, responsiveness, ability to speak. The interviewer knows that these qualities, not too well measured by the point average, have a major bearing on the future of an engineer—he must work with and supervise others—will he be a smooth-working member of the company team?

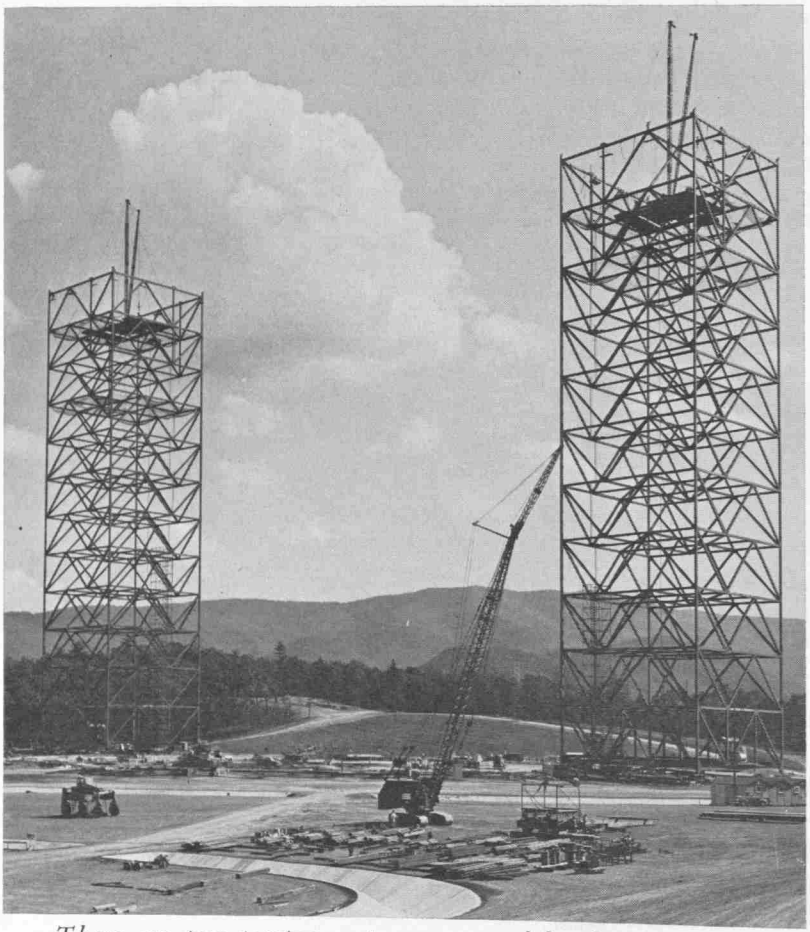
Many of these latter capabilities are present in a student before he even arrives on our campus as a freshman, and we must admit that often we only offer opportunity for exercise and polishing of these qualities. However, we would like to point out that the point average is the ticket of admission to the interview room—without this a graduate has lessened opportunities to demonstrate his other winning qualities or personality.

And even though such a mundane subject as salary should not enter, a good point average *has* been known to put more beef in the salary offer, which usually leads to more beef on the table at meal time.

J. D. RYDER

A GIANT FOR A NEIGHBOR

NESTED in a valley surrounded by the natural protection of the high mountains of West Virginia, a giant grows up. In the small nearby mountain town of Sugar Grove (population 125), the townspeople pay little or no attention to its growth and are little affected by its presence. Their life continues much as it has for decades prior to the conception of their new neighbor. Much of the outside world will be greatly influenced by the giant radio telescope being built there but the little town will continue its way of life nearly unaffected.



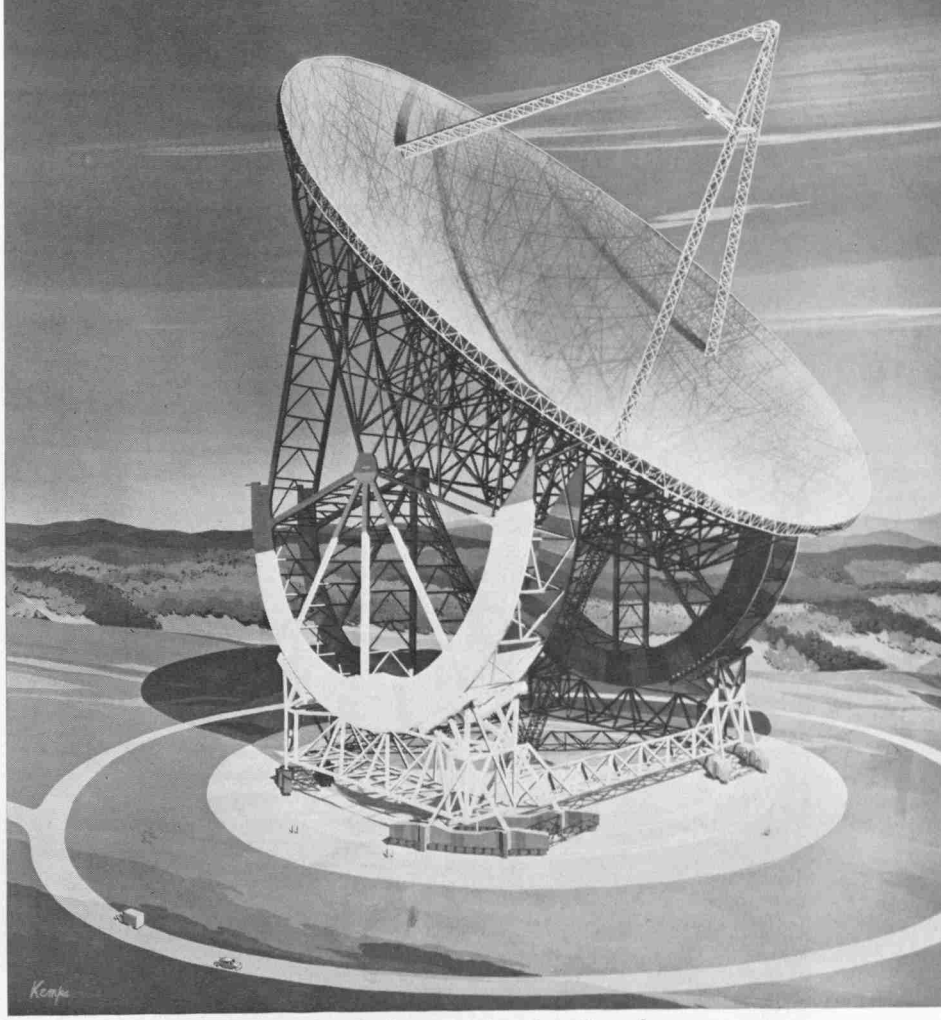
These are two temporary towers erected by the American Bridge Division of the U. S. Steel Corporation at the site of the Navy's huge radio telescope at Sugar Grove, West Virginia. The men at the tops of these towers are barely visible. The tower at the left is 360 feet high and 90 feet square. Both will be built to a height of 420 feet and will be surmounted by derricks with booms 200 feet long.

The new radio telescope, started by the Navy in the summer of 1959 and to be completed in 1962, will have dimensions presently unequaled anywhere in the world. Standing 665 feet above the ground level of the valley, the structure will require 20,000 tons of steel, 600 tons of aluminum, and nearly 14,000 cubic yards of concrete. A huge parabolic reflector, with a diameter of 600 feet, a circumference of approximately one-third of a mile, and a reflecting area of seven square miles will top the structure. When completed, it will have cost $79 million. The Navy feels that its investment will be realized.

For each operating day, the Navy will spend one-half day conducting research of a classified nature on items of interest to them; i.e., navigation, communication, ionospheric physics, etc. The other half of the day will be used by astronomers. A special Navy consulting board will allocate time according to pre-determined subject priorities.

The rigorous selection priorities are necessitated by the demand created for the telescope due to its outstanding qualities. The parabolic reflector, cradled between two ferris wheel-like structures, is capable of a 0 to 90° vertical scan and a 360° horizontal rotation facilitated by railroad trucks at the base. The surface of the reflector consists of individual aluminum wire-screen panels that are automatically compensated by servomechanisms for distortion due to wind, temperature changes, or the severe stresses due to gravity when in movement. To avoid

by Kenneth L. Lesley, E.E.



An artist's sketch of the completed radio-telescope.

distortion, the surface must not vary more than one inch at the important 21 cm. wavelength (hydrogen line wavelength). An inertial guidance system will allow the focusing of a spot only 1/60 of the area of the moon regardless of outside parameters such as the movement of the earth.

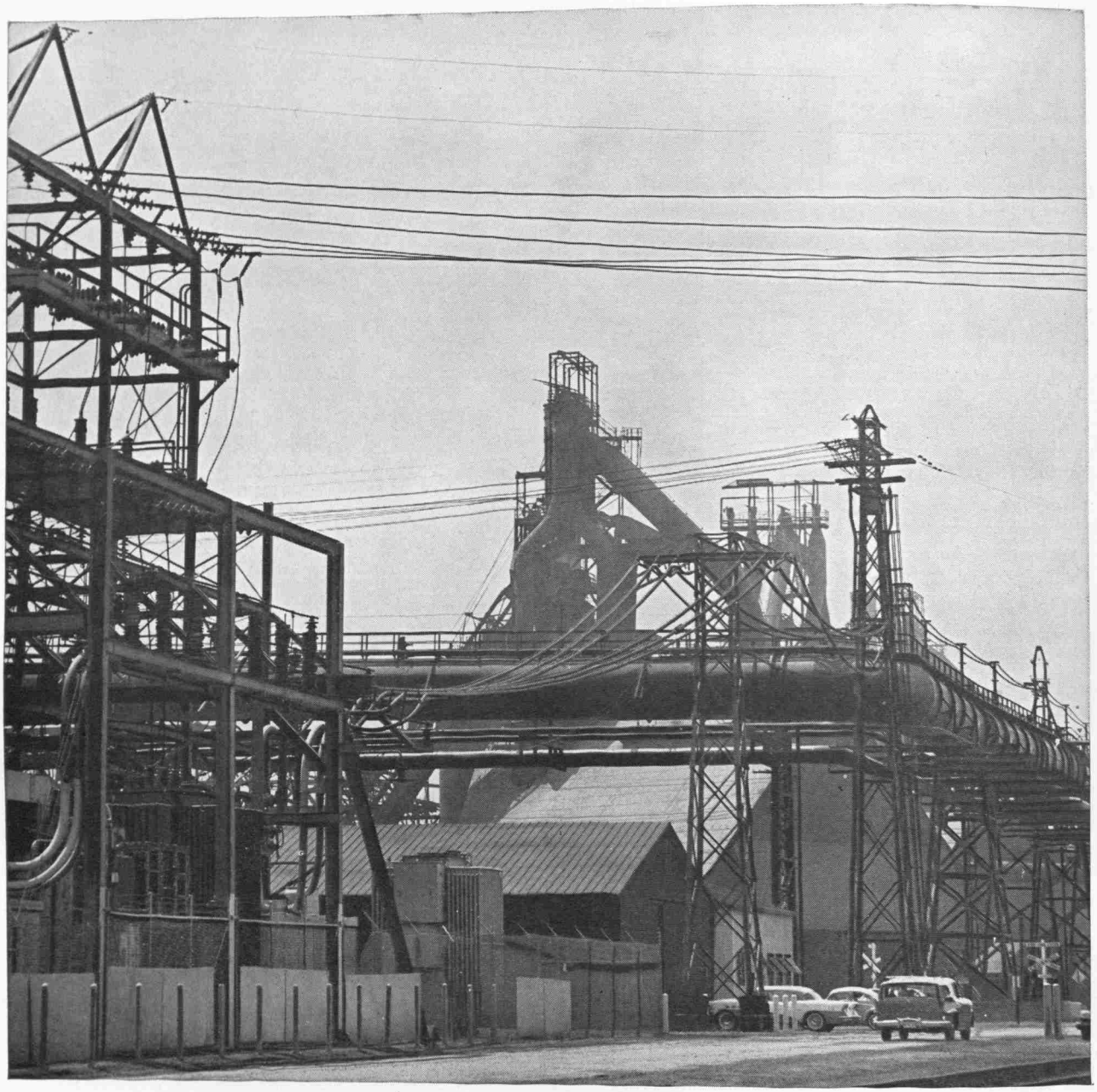
The control parameters to the guidance system will be determined by a computer using punched cards prepared by an expert operating crew from a detailed description of the experiment proposed by the astronomer. At the focus of the reflector (240 feet from its center) is the Navy receiving apparatus. If the astronomer desires to utilize his own gear, he may do so by placing it at the focus. Presently, it seems likely that the results obtained will be printed either on a punched-card or tape to allow the astronomer to utilize his own computer facilities thereby freeing the system for other projects.

A project having high priority with the Navy consulting board is the study of the temperatures on the surface of the moon. Since the resolving power of a telescope is defined as the ratio of the aperture (diameter) to the operating wavelength, it can be readily seen that the 600-foot radio telescope will have a very nice degree of resolution. This will allow studying the surface of the moon in greater detail than previously attainable. Optical and infrared studies have indicated that the surface of the moon remains warm for several days after it has turned away from the sun and that it remains cool for several days after returning again to the sunlight. To the scientist this suggests the possibility of the moon's surface being covered by a layer of some insulating material such as dust. The presence of this material could very well have a bearing upon any projected moon landings. The radio telescope verifies these previous findings and does so in a more accurate manner by being able to study smaller areas. It is also being used for temperature studies on the different stars and planets.

Scientists anticipate that the 600-foot radio telescope will permit the accurate measurement of the amount of radiation from the solar flares that accompany the appearance of sunspots on our own sun. The practical application of the results of this work will be in the field of communications. Atmospheric conditions generally attributed to sun-spot radiation creates interference on most present means of radio communication. Perhaps a more accurate knowledge of the nature of these interference causing conditions will lead to equipment that will not be affected by them.

An item of topical interest to any nation professing the desire to put man into space is the Van Allen radiation belt. Some short time ago, Dr. James Van Allen announced the discovery of two horn-shaped belts of intense radiation surrounding the earth. By means of the greater resolution available through the use of the 600-foot radio telescope, it will be possible to chart these belts with some fair degree of accuracy. A knowledge of the location and intensity of any radiation will enhance man's chances of returning unaffected back to earth once he has been put into orbit. To many concerned with the conquest of outer space, this may be considered ample qualification for the time and resources being put into the giant.

Thus it is that a giant can grow up in the mountains without bothering or perhaps even interesting the inhabitants of the local area. It will rise to its magnificent 665 foot heighth and probe the heavens in a manner heretofore impossible. It will search the skies for knowledge of the secrets there. It will contribute to the furthering of science and the betterment of man. The giant 600-foot radio telescope will not disturb the people of Sugar Grove—and, they will certainly not disturb it.



This steel plant consumes 1/400th of the electric power generated in the United States

Surprising? Not if you realize that steelmaking requires a tremendous amount of electric power.

It takes about 20,000 electric motors to drive the rolling mills and other equipment at our Sparrows Point Plant, near Baltimore, the nation's largest steelmaking plant. Here, at our own steam-electric generating station, we produce enough power for a city of 250,000.

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Bethlehem offers excellent career opportunities for men in virtually all engineering curricula: *metallurgical, mechanical, chemical, industrial, civil, mining, ceramic, architectural, and others. We suggest that you discuss Bethlehem with your Placement Officer. And be sure to pick up a copy of our booklet, "Careers with Bethlehem Steel and the Loop Course."*

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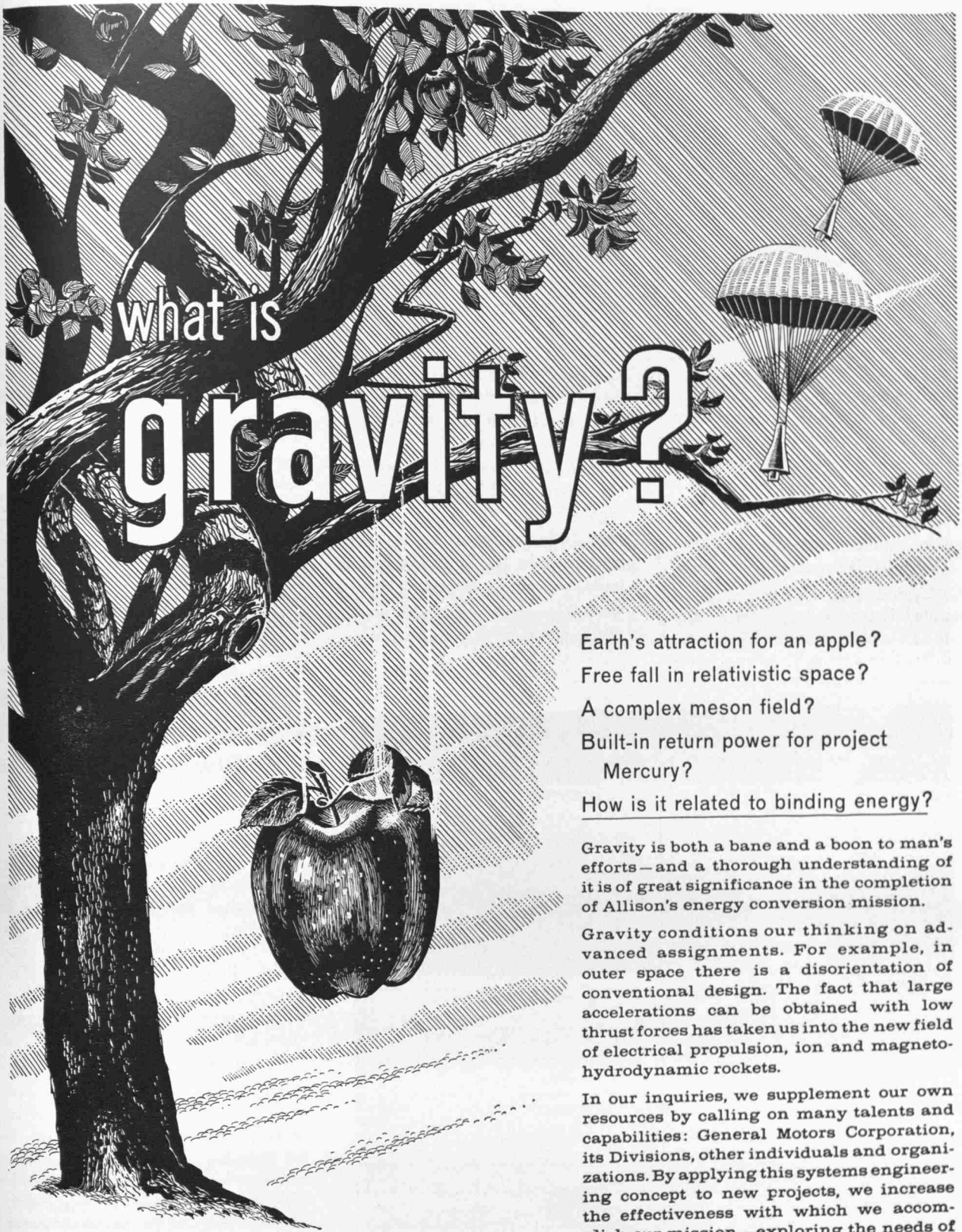


Earth's attraction for an apple?

Free fall in relativistic space?

A complex meson field?

Built-in return power for project Mercury?

How is it related to binding energy?

Gravity is both a bane and a boon to man's efforts—and a thorough understanding of it is of great significance in the completion of Allison's energy conversion mission.

Gravity conditions our thinking on advanced assignments. For example, in outer space there is a disorientation of conventional design. The fact that large accelerations can be obtained with low thrust forces has taken us into the new field of electrical propulsion, ion and magneto-hydrodynamic rockets.

In our inquiries, we supplement our own resources by calling on many talents and capabilities: General Motors Corporation, its Divisions, other individuals and organizations. By applying this systems engineering concept to new projects, we increase the effectiveness with which we accomplish our mission—exploring the needs of advanced propulsion and weapons systems.

Energy conversion is our business

ALLISON

Division of General Motors, Indianapolis 6, Indiana

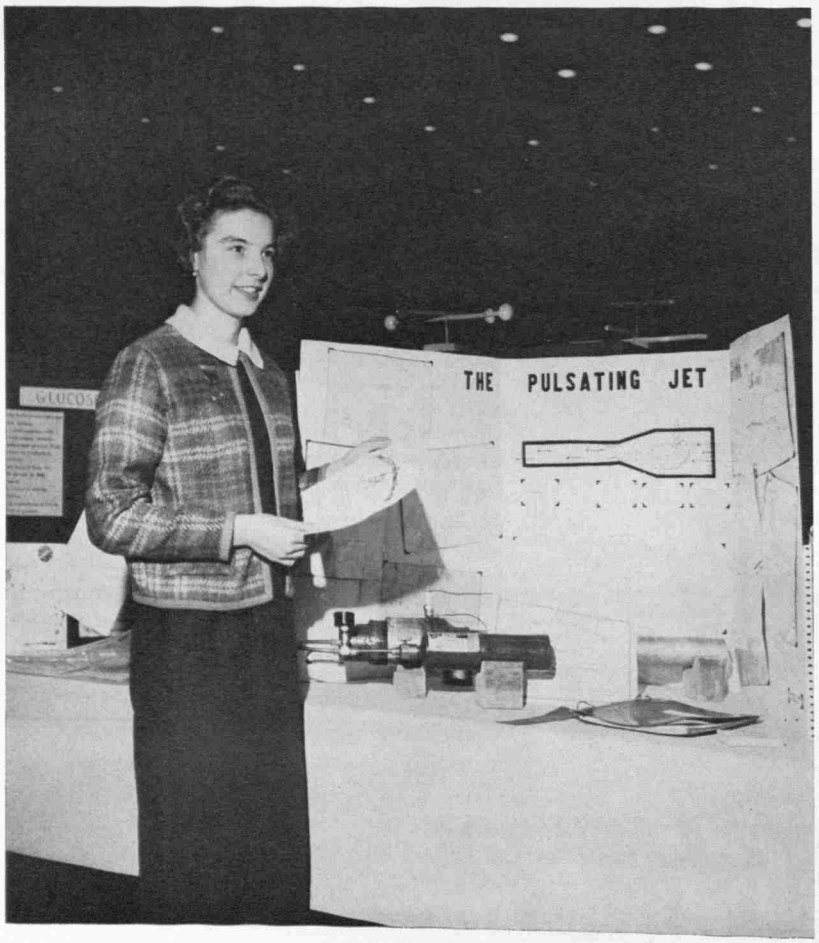
JETS

by Roberta Huffmaster, Math and Physical Science

DO YOU WANT to know how to build a pulsating jet engine—a radio controlled robot? Or see what a space station will look like, or examine the nucleus of a radioactive element? On May 12 and 13, these and other unusual displays will be shown at the 9th Annual JETS Engineering Exposition. The theme for this year will be The Space Generation.

Typical of the kind of projects presented is that of Shirley Heuchert, a JETS member at Sexton High School in Lansing. Her pulse jet engine (pictured below), won a special JETS award, plus a first place and Air Force award at the 1961 Youth Talent Exhibit and Science Fair sponsored by *The State Journal* and Oldsmobile. She designed and built it herself as a physics project. The engine uses propane fuel, and shoots an eight-foot blast from its tail. It took a year to build and works something like a torch.

Another JETS award winner from Sexton is Jim Hewitt. He will not be displaying his infra-red guidance system here at the exposition because he is taking it to the National Science Fair in Kansas City. The system can detect a heat source and tell where the heat is coming from.



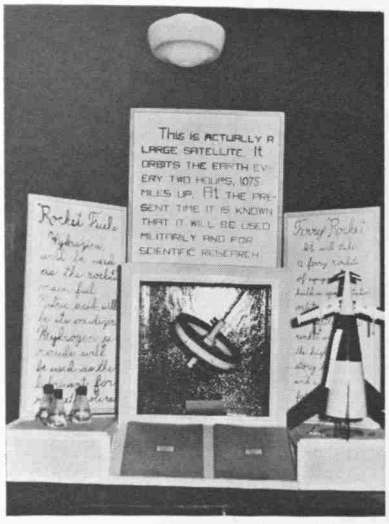
A radio-controlled robot will be displayed by Ray Gearhart, a Mt. Pleasant, Texas, JETS member. (Picture below). The robot has a system of mechanical devices that trip certain relays depending on the command given to it by means of a radio transmitter. This type of radio control is comparable to that used in controlling missiles, and is called command guidance.

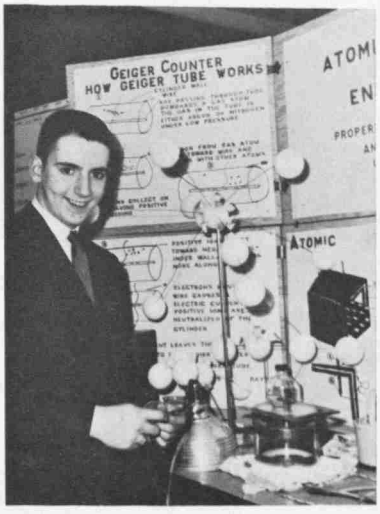
In all, there will be projects from at least 14 states at the exposition, including New York, Alabama, and New Mexico.

This year, there is a new rule that all projects entered must have won some award previous to entering it here. Each project must also be entered in one of the 14 specific categories, ranging from Agricultural Engineering to Mathematics, and all have to be workable applications of knowledge, not just posters or kits.

The JETS have also added another award to the exposition, the 1961 JETS National Technician, to be given to some outstanding member who is not planning on going to college, but wants to further his technical Knowledge. Both the winner of this award, and the 1961 JETS National Junior Engineer winner will be taken on a tour of the military bases and installations around Washington, D.C., in addition to other awards.

Various societies and companies will also give out prizes to entries in their fields. Republic Aviation will give one in the Aeronautical Engineering Divi-





sion, the American Society of Civil Engineers will give one in the Civil-Architectural Engineering group, and the Consumers Power Co. plans to give one common share of its stock, worth approximately $50, to the top entry in the Electrical Engineering division.

Awards will be given out at an awards luncheon in the Big Ten Room of Kellogg Center on May 13. The awards for the exhibits are: red and blue medallions, signifying excellent and superior achievement, slide rules, and drawing instruments. The speaker for the luncheon will be from the Air Force Systems Command.

Dr. Lorin Miller, Dean of the College of Engineering until 1954 and one of the founders of JETS, will be honored at the luncheon along with outstanding pilots(leaders of the JETS groups in the high school) and industrial co-ordinators.

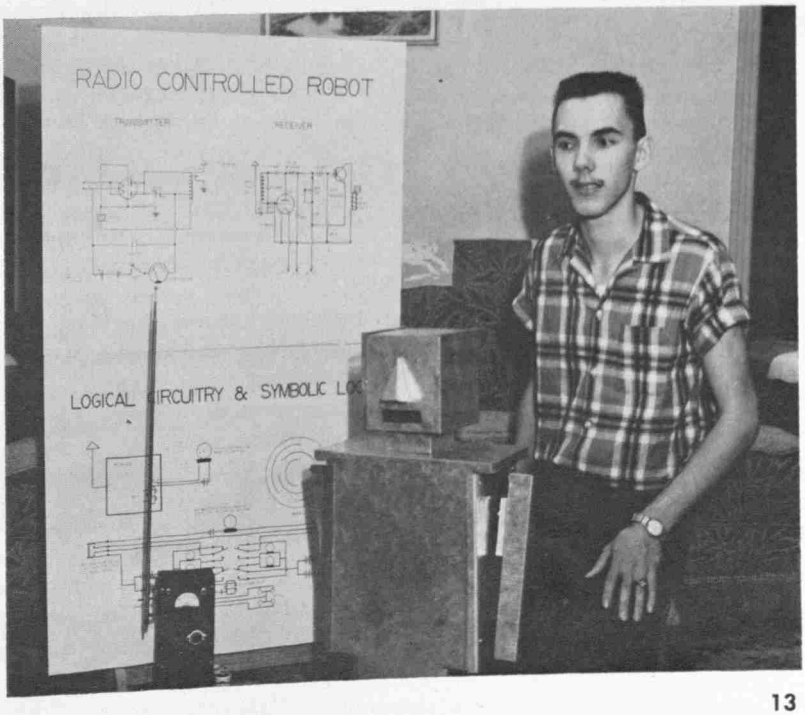
This is a sample of the work being done by members of JETS, but how did it come into being?

In 1950, Dr. Miller and Prof. Skamser of the MSU College of Engineering started a club whose purpose was to introduce high school students to the applied sciences, so that they would become aware of the opportunities and challenges connected with a technical career. The name, Junior Engineering Technical Society, was chosen with an eye on the initials. Miller and Skamser wanted the club's initials to indicate the forward-moving ideas and applications of science to be utilized in running the clubs.

One of the main ideas inherent in the clubs is that members learn by doing, not by rote memorization of formulas and statistics. Each club has a pilot, who is usually a science or math teacher in the school. He, along with any advisors from industry, guides the members in building projects, takes them on field trips to industrial plants, and obtains speakers who give talks on their special fields, such as thermodynamics or aerodynamics.

By 1958, the JETS had grown so large, with 365 chapters, that it had to be reorganized as a national, nonprofit society. The headquarters is in the Mechanical Engineering Lab on campus, with Dr. Fallon as director, and Dean Ryder as president of the society.

The JETS aim of introducing high school students to the many aspects of engineering and science has had two consequences. One, it weeds out those students who are not suited to engineering and science before they get a chance to flunk out in college. Secondly, it prepares the serious students for the type of study done in college. Through this, JETS has done a great deal to promote technical and scientific pursuits among the potential engineers of tomorrow.



AUTOMATIC HIGHWAYS

Take a nap while zooming along on the highway of the future

Edited by Jeannette McClees, E.E.

Photos courtesy Westinghouse Electric Corp.

UNDER A NEW concept for mass transportation put forward by Westinghouse engineers, a high-speed electrically driven system of "Roller Roads" would transport groups of automobiles and their occupants at speeds up to 150 miles per hour or commuters at speeds up to 75 miles per hour. The roadway would consist of a series of rubber rollers powered by individual motors and spaced approximately 20 feet apart to resemble inverted roller-skates. These rollers would both support and propel the flat-bottomed carriers in which automobiles and passengers would travel.

The Roller Road has potential for solving problems of highway traffic congestion and metropolitan rapid transit service in the near future. The new high-speed highway would provide more reliability and safety than any proposal Westinghouse has seen for solving the country's very complex transportation problems.

The number of automobiles in the U.S. (61,000,000 presently) is expected to exceed the 100,000,000 mark in the 1970's. Consequently, conventional methods of inter city turnpike travel will be inadequate, so Westinghouse engineers examined ways in which new highway systems might be constructed. Airborne conveyances, monorails, electrified trains, self-propelled trains and other concepts were considered. Only the Roller Road, however, seemed to offer the reliability needed without sacrifice in other essential requirements.

Essentials of the new concept are as follows: The conveyances which carry automobiles will be devoid of all apparatus whose failure might cause a highway shutdown or delay. Each lane of the highway will be a continuous, computer-controlled system of individually powered rollers, receiving electric energy from neighboring interconnected electric utility systems. This roller system will not only be the highway surface, but will accelerate the conveyances, keep them moving once accelerated, and provide braking power at proper locations. The conveyances will be stopped at fixed stations where the automobiles will be loaded and unloaded automatically to achieve uniform loading in minimum time.

Each carrier would be approximately 110 feet long. Provision would be made for 10 automobiles plus a lounge with rest room facilities.

The carriers would be operated in strings of 3 to 10 units under normal conditions. The only factor limiting the number of carriers would be the length of the loading platforms.

Guide wheels operating against the rails at either side of the Roller Road would steer the carriers along the rollers. As the only rotating devices on the carriers, these wheels could also be used to power generators to supply light and heat inside the carriers.

The drive package for each roller would consist of a three-phase induction motor, a torque coverter, a brake, and a reduction gear. The time required for a 1100-foot string of 10 carriers to pass over a given roller at 150 mph is about 5 seconds. Consequently these motors would work for 5 seconds and then would idle until the next conveyance came along. The motors thus could be heavily "overloaded" for short peak intervals, greatly reducing their size. The mechanical brake would be included on each roller to provide for emergency stops anywhere along the highway.

A loading and unloading time of one minute was set as a goal in order to maintain an average speed of 120

(*Continued on Page* 18)

"IT'S HERE—IF YOU WANT TO WORK FOR IT"

Even before Ron Spetrino received his engineering degree from Case he had good job offers from six companies.

He joined The Ohio Bell Telephone Company —his reason: "I was convinced an engineer could go further here—if he was willing to work for it."

As soon as Ron got his feet on the ground in telephone engineering, he was tapped for a tough assignment. The job—to engineer switching equipment modifications needed to prepare Cleveland for nationwide customer dialing of long distance calls.

Ron wrapped it up in five months, and found he had earned a shot at another tough assignment. In this job Ron helped engineer a completely new long distance switching center for Cleveland. This switching center connected Cleveland with the nationwide customer dialing network. It was about a year later that Ron put the finishing touches on the specs for this $1,600,000 project.

Today, as a Supervising Engineer, Ron heads a staff of five engineers and is responsible for telephone switching in much of the greater Cleveland area.

He supervises the design and purchase of $3 million worth of equipment a year. And even more important, he is charged with developing the technical and managerial skills of his staff.

Ron knows what he's talking about when he says, "In this business you have to do more than a good job. We expect a man to be a self-developer. We expect him to take responsibility from his first day on the job and think for himself. You don't get ahead around here by just doing time."

If you want a job in which you're given every chance to prove yourself, and real responsibility right from the start—you'll want to see your Placement Office for further information.

"Our number one aim is to have in all management jobs the most vital, intelligent, positive and imaginative men we can possibly find."

FREDERICK R. KAPPEL, *President*
American Telephone & Telegraph Co.

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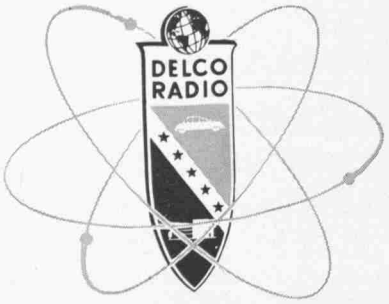

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. . . is a rare and marvelous possession. It is to be coveted and protected—nourished and encouraged—given freedom for expression, and, at the same time, intelligent guidance.

At Delco Radio Division of General Motors we have an appreciation for talent—the kind of talent which led Delco to a position of leadership in the fields of electronics and solid state physics.

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DELCO RADIO DIVISION OF GENERAL MOTORS

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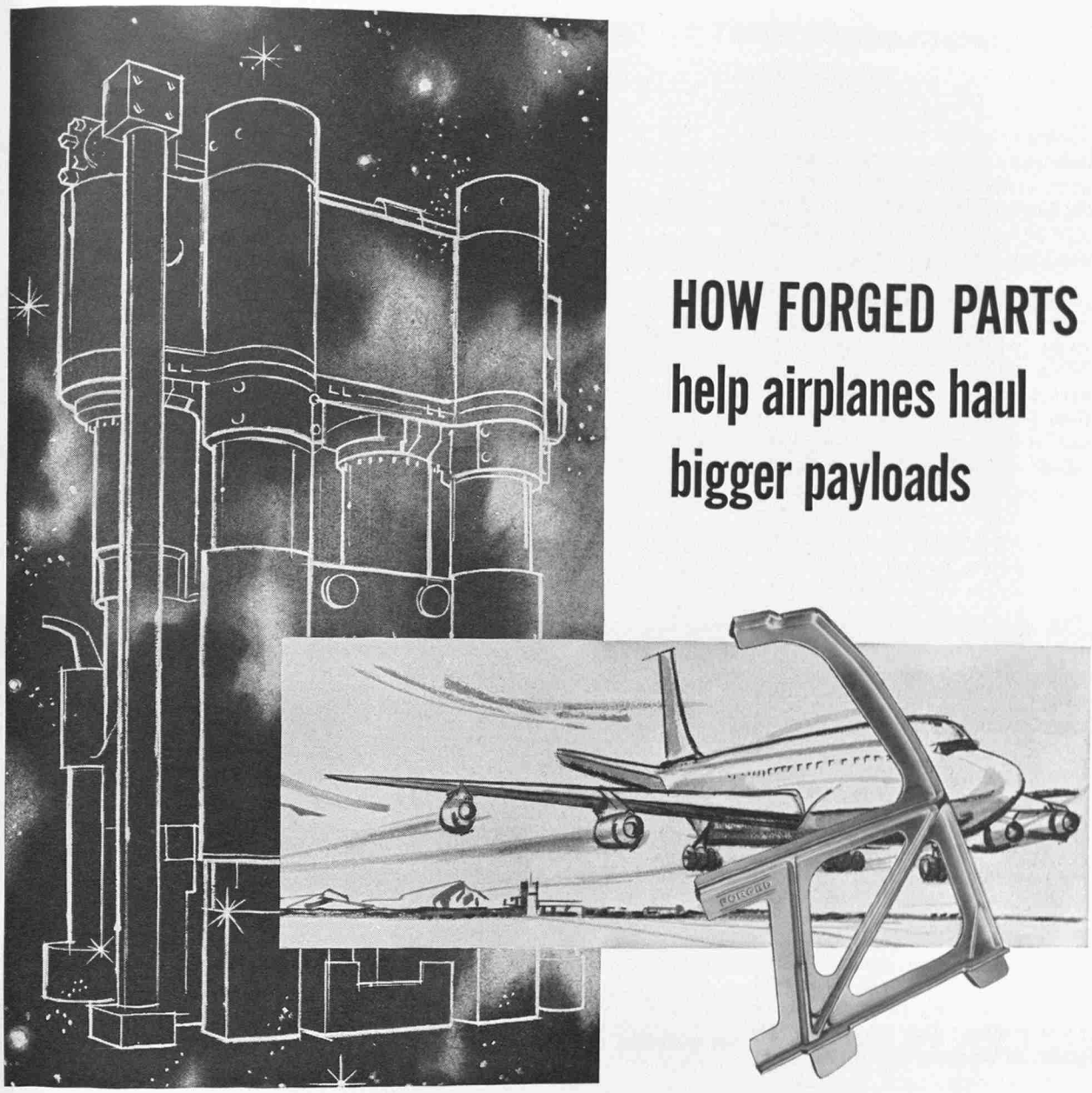

HOW FORGED PARTS help airplanes haul bigger payloads

In an airliner, every pound of weight saved is worth hundreds of dollars ... in revenue-making payload. And in military aircraft, pounds saved mean added miles-per-hour ... or added load carried.

In commercial products ... trucks, cars, materials-handling equipment ... the pounds of dead weight you eliminate by using forgings make money year-after-year for the operator. The forging process lets you put the metal exactly where you need it to carry the load, withstand shock or vibration, endure torsion. And with not a surplus ounce of non-working weight going along just for the ride.

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When it's a vital part, design it to be FORGED

Drop Forging Association • Cleveland 13, Ohio

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HIGHWAYS

(Continued from Page 14)

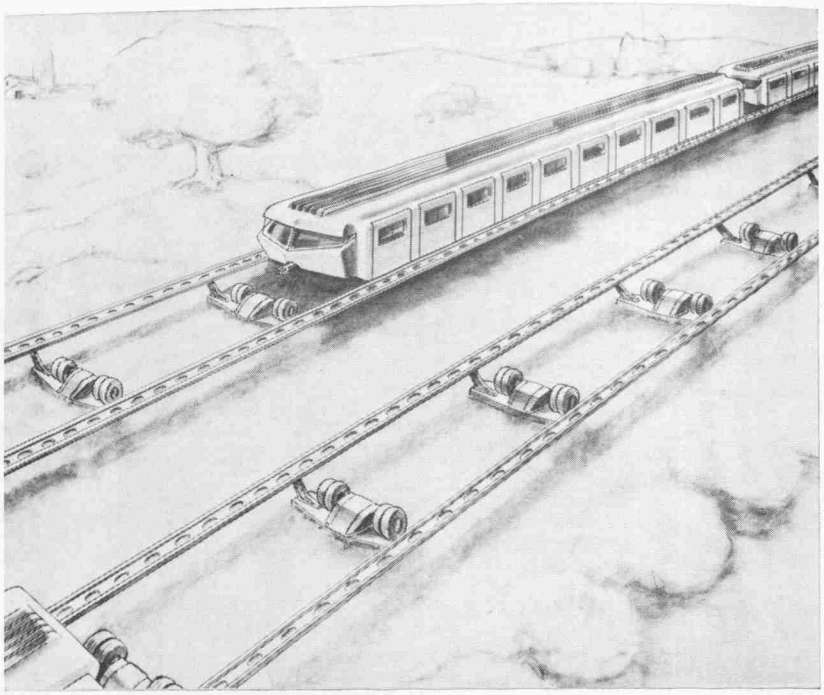
mph over the highways. Drivers intending to board a carrier would place their cars on dollies at platforms adjacent to the highway. This would be the last action required of the driver until he and his car were automatically unloaded at his destination.

Computer-controlled lights would indicate to a driver which spaces were empty on the approaching carrier. When the carriers stop, automatic devices attached to the station platform raise the proper doors on each side of the carriers. With the doors raised, a mechanical device would push the dolly and the car onto the carrier. The corresponding dolly on the carrier, whether or not it carries an automobile, is pushed off the carrier on to the other side of the platform.

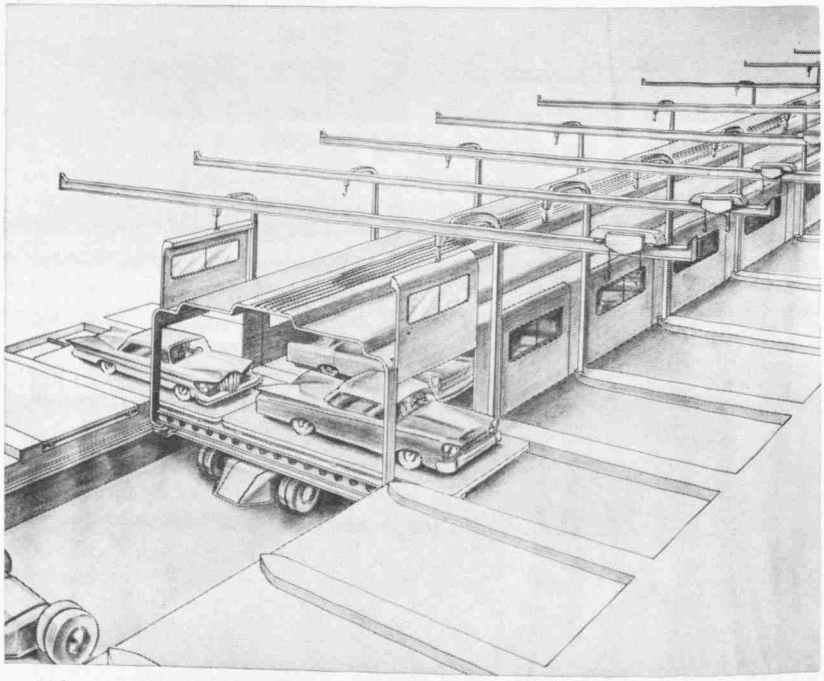
Consideration was given to the possibility of people driving automobiles on and off the carriers, but was discarded because of the uncertainties of human behavior. The computer control for the system would dispatch strings of carriers at proper intervals, provide protection against rear-end collisions, and control the automatic loading and unloading at stations.

A high-speed system of this kind would offer many advantages. It could handle conventional toll road traffic at twice the speed. Its capacity could be increased with little expense by running more than 10 carriers together as an operating unit. It could carry high-class freight in containers at speeds comparable to the airlines. It would be an all-weather route, invulnerable to delays from fog, ice, sleet or snow. It could carry passengers who desire to travel without their automobiles. The same principles could be applied to produce an excellent rapid transit system for large urban communities such as San Francisco, Los Angeles or Pittsburgh.

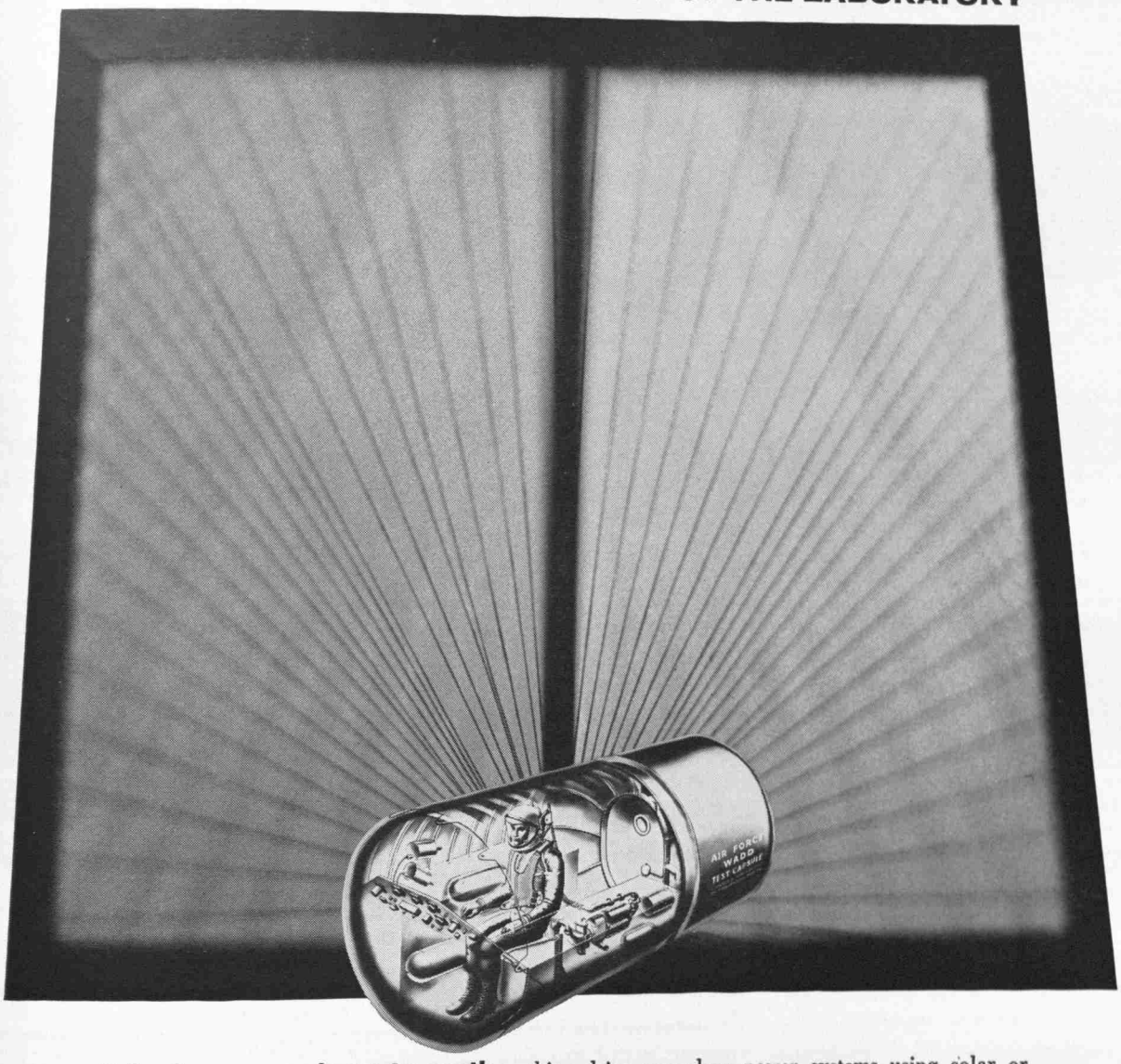
Westinghouse pointed out that "the major problem in an automatic system designed to handle the tremendous traffic of modern turnpikes is that of reliability in the propulsion system. While the Roller Road concept naturally introduces many problems, it encompasses the only propulsion plan which seems to offer the reliability needed to make a high-speed system of this kind workable."



The carriers rest on and are propelled by the series of rollers shown here. The two rails serve to guide the carriers along the rollers.



Sketch showing automatic loading station for cars and their occupants (front of carrier is removed in sketch).



Bringing space down to earth... this laboratory space capsule is designed to measure man's physiological and psychological limits and test life support systems under simulated space flight conditions. Now scientists will be able to study, simultaneously, the space flight stresses of high altitude, acceleration, heat and isolation.

Developed and being built by Garrett's AiResearch divisions for the U.S. Air Force's Wright Air Development Division, this ground test space capsule is an example of Garrett's research leadership in life support and secondary power systems for space vehicles for long duration flight at zero gravity. Development of these life support systems utilizing cryogenic gases and efficient turbine drive secondary power systems using solar or nuclear energy are opening up vast new worlds of exploration and career achievement for engineers in the space age.

A world leader in the development and manufacture of major systems and components for aircraft and missiles as well as advanced flight vehicles, The Garrett Corporation provides an orientation program lasting a period of months for the newly graduated engineer, working on assignments with experienced engineers in laboratory, preliminary design and development projects.

Should you be interested in a career with The Garrett Corporation, write to Mr. G. D. Bradley in Los Angeles.

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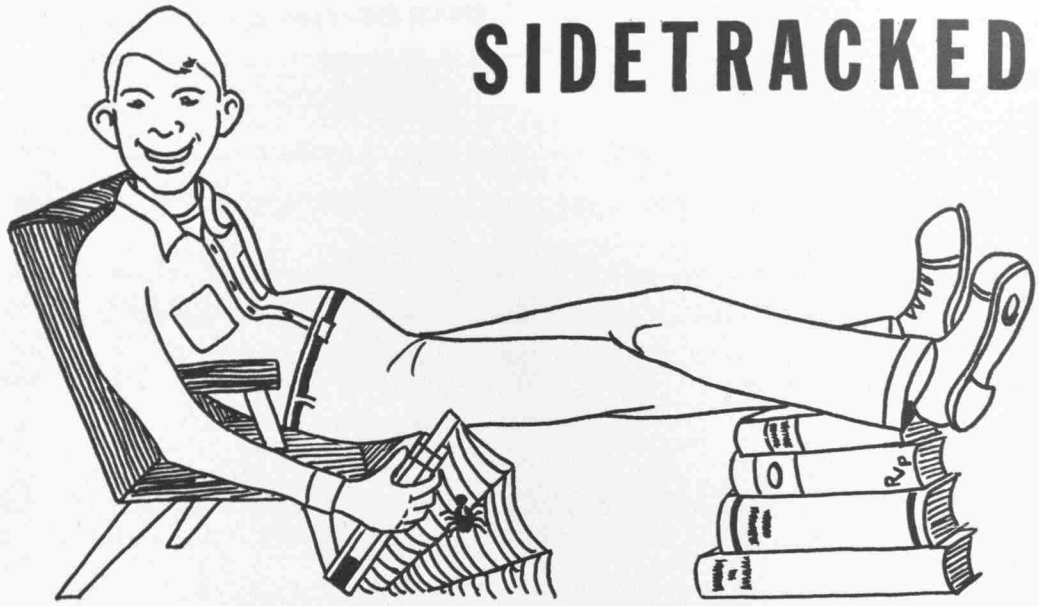


Salesman: "This slide rule is something you'll really need. It will do half your work for you."

Up and coming freshman engineer: "Fine, I'll take two."

* * *

A Chinese visitor was heard to observe: "Funny people, you Americans. You take a glass and put sugar in it to make it sweet and lemon in it to make it sour. Then you put whiskey in it to make it hot and ice to make it cold. And then you say, 'Here's to you,' and then you drink it yourself."

* * *

Prof: "If in running down this ramp I gain five feet per second, what will be my condition after 25 seconds?"

Phys. Major: "You'll be a centipede."

* * *

It was the sleepy time of the afternoon. The professor droned on and on; formulas, constants and figures. An engineer, sitting in the second row, was unable to restrain himself and gave a tremendous yawn. Unfortunately as he stretched out his arm he caught his neighbor squarely under the chin, knocking him to the floor. Worried, he bent over the prostrate form just in time to hear a murmur, "Hit me again, Sam. I can still hear him."

And then there was the freshman who thought a logarithm was a forester's song.

* * *

Professor: "Tell us what you know about nitrates."

Chem. E: "I don't know much about them except that they're cheaper than day rates."

* * *

Concluding his lecture a college professor started to dismiss the class when a student called out: "Professor, have you any documentary proof to support the things you've been telling us?"

Since the talk had been about life on other planets, the professor admitted that he hadn't any proof.

"Until you do produce proof," said the student, "do you mind if I call you a liar?"

"Not at all. Tell me, were you born a human or an animal?"

"A human, of course."

"Have you your birth certificate with you?"

"No, but—"

"Well, until you produce it, do you mind if I call you an impertinent jackass?"

Prof: I say there, you in the auto—your tubular air container has lost its roundity.

CE: Come again.

Prof: I said, the cylindrical apparatus which supports your vehicle is no longer symmetrical.

CE: What?

Prof: The elastic fabric surrounding the circular frame whose successive revolutions bear you onward in space has not retained its roundness.

CE: What's that?

Little boy: Hey, bud, you gotta flat tire!

* * *

CLASSROOM QUOTES

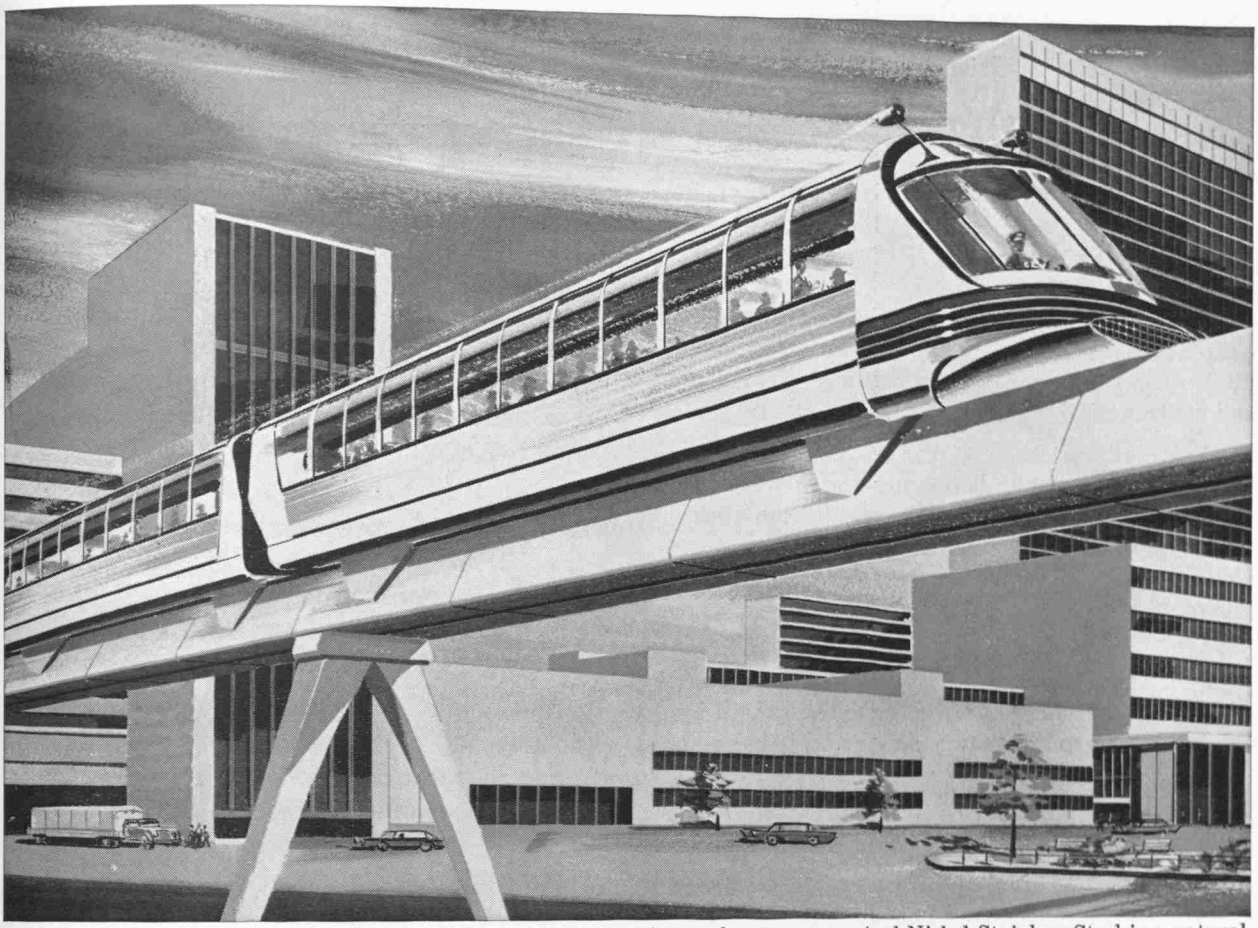
"It should now be obvious that . . ."

"We now make a few evident assumptions . . ."

"By making use of the conservation of energy, conservation of linear and angular momentum, Maxwell's equations and the first and second laws of thermodynamics, we find that we may readily derive . . ."

"Using the relations learned in freshman math . . ."

". . . giving us a simple and powerful theoretical tool."



Monorail "Airtrain" — a compact, high-speed transportation system that will be automatic and practically noiseless. Construction is now being planned by leading U.S. cities to provide efficient, low-cost urban transit. Lightweight Monorail design demands strong, weight-saving metals. Logical choice: Nickel-containing materials such as nickel steels for the basic structure, nickel steel castings for underframes, trucks, other load-bearing assemblies. And Nickel Stainless Steel is a natural for skin and trim on cars—its excellent strength-to-weight ratio permits thinner gauge body shells for dead-weight reduction, its handsome finish stays virtually maintenance-free.

How Inco Nickel helps engineers make new designs possible and practical

When engineers design a transit system, a nuclear ocean liner, or a gas-turbine car, chances are Nickel, or one of its alloys can help the equipment perform better. Nickel-containing metals can provide valuable combinations of corrosion resistance, ductility, workability, and strength at extreme high and low temperatures. Over the years, Inco has developed new alloys and gathered data on the performance of materials under demanding service conditions. This data is available to help solve future metal problems.

Write to Inco Educational Services —ask for List "A". You'll find descriptions of 200 Inco publications covering applications and properties of Nickel and its alloys.

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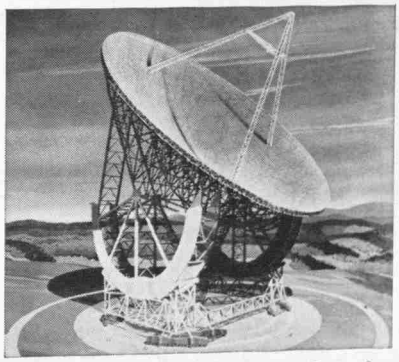
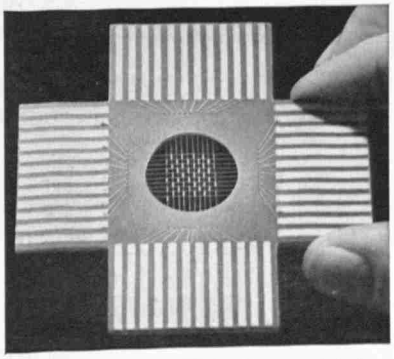


38 billion light years — that's how far this 66-story telescope can "see" into space. Nickel in steel gave engineers a material tough enough to maintain precision in the rotating mechanism even with anticipated 20,000 ton load. Nickel used in steel members provided high strength at minimum weight to support the giant reflector.



Magnetic memory. This tiny part takes advantage of the unusual magnetic behavior of a twisted high-nickel alloy wire. Interwoven wire can store thousands of "bits" of information magnetically, ready to answer the computer's call. When twisted, this high-nickel alloy shifts magnetization direction from longitudinal to a helical path.

INCO **INTERNATIONAL NICKEL**

The International Nickel Company, Inc., is the U.S. affiliate of The International Nickel Company of Canada, Limited (Inco-Canada) — producer of Inco Nickel, Copper, Cobalt, Iron Ore, Tellurium, Selenium, Sulfur and Platinum, Palladium and Other Precious Metals.

BOOK REVIEW

"ULTRASONICS AND ITS INDUSTRIAL APPLICATIONS"

by O. I. Babikov — Russian
224 pages, 6 x 9, with illustrations and diagrams
Consultants Bureau Enterprises, Inc., $9.75

The concept of ultrasonic oscillations and other basic ultrasonic topics are thoroughly explained in the first chapter of the book by means of plain words and mathematical equations.

A logical approach to the subject is followed throughout the book. Following the first chapter is the discussion of mechanical means for the generation of ultrasound. The *magneto-striction* and *piezo-electric effects* are explained with the aid of mathematics, illustrations, and schematic diagrams.

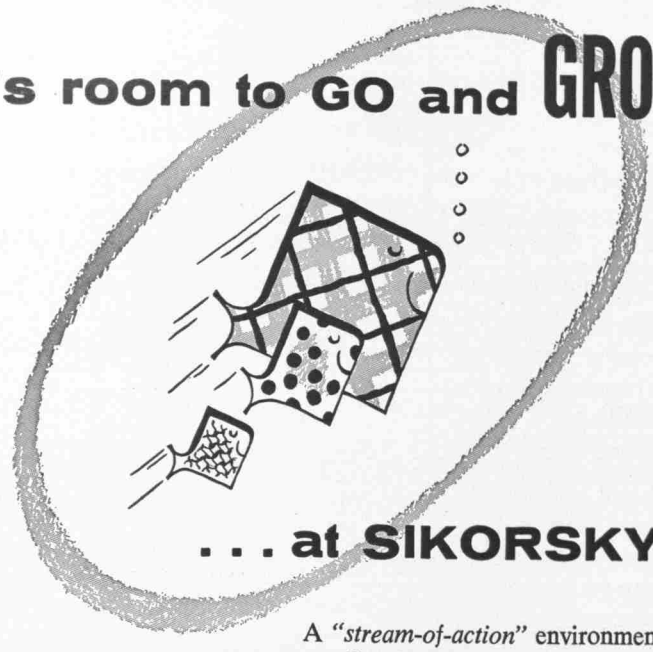
After one has digested the first two chapters, thus providing for a good foundation of the subject, he will then be prepared to make the transition from the theoretical to the pragmatic view of ultrasonics.

From chapter three to end, the book deals with the practical applications of ultrasonics. This begins with the explanation of the two methods used for ultrasonic flaw detection; namely the pulse method for ultrasonic flaw detection and ultrasonic flaw detection with undampened oscillations. Illustrations and diagrams are included to aid in the understanding of the two methods. Examples of ultrasonic flaw detection in industry are also given.

Practical applications touched on more than briefly are: 1) the investigation of the microstructure of metals and measurement of elastic constants; 2) ultrasonic pulse methods of physical-chemical analysis; 3) machining hard and brittle materials by ultrasonics; 4) aluminum soldering and plating; 5) ultrasonic cleaning; 6) metallurgical effects of ultrasonic processing.

Any inquiries concerning "Ultrasonics and Its Industrial Applications" should be addressed to: Consultants Bureau Enterprises, Inc., 227 W. Seventeenth Street, New York 11, N. Y.

there's room to GO and GROW—



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A *"stream-of-action"* environment with unusual growth possibilities should be a major factor in a choice of career. And that's an excellent reason for considering carefully the opportunities existing in Sikorsky Aircraft.

We believe that our company is just the *"right-sized stream"*. Young engineers can enjoy diversified, small-group activities, as well as stature opportunities in a field that is wide open to the expression of imagination and professional competence.

Sikorsky Aircraft is the company which *pioneered* the modern helicopter. Our current program is far-ranging and is recognized as one of the broadest and most challenging in the entire aircraft industry.

Work associations are stimulating and in an atmosphere of progress. Assignments could include joining an *electronic* team of twenty to thirty associates—or—working with a highly selective group of four or five on interesting problems of *radiation, instrumentation, auto pilotage, automatic stabilization,* etc.

If you want to enter this *"stream-of-action"*, the time is *now*. Opportunities for personal progress have never been greater.

For detailed information about careers with us, please write to Mr. James L. Purfield, Employment Supervisor.

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KNOW YOUR HONORARIES

Pi Tau Sigma is an honorary mechanical engineering fraternity, established to foster the high ideals of the engineering profession.

Tau Epsilon, the M.S.U. chapter of Pi Tau Sigma was formed on the campus in 1949 and was officially recognized by the national fraternity in 1950.

Although the social activities are limited to the initiation banquets, the Tau Epsilon Chapter takes part in a number of other activities, such as exhibits of an academic nature at the engineering exposition. An important project initiated recently is the L. C. Miller Award to honor the outstanding sophomore engineering student in mechanical engineering.

Scholarship is a necessary, although not sufficient requisite for membership in Pi Tau Sigma. Desirable character traits are also prime prerequisites. A prospective member must be at least a junior in the college of engineering and preferably have completed two terms of the mechanical engineering curriculum, and stand above average in scholastic record.

TAU BETA PI

Tau Beta Pi is an all engineering honorary, having as its purpose: "To mark in a fitting manner those who have conferred honor upon their Alma Mater by distinguished scholarship and exemplary character as undergraduates in engineering, or by their attainments as alumni in the field of engineering, and to foster a spirit of liberal culture in the engineering colleges of America."

Activities of Tau Beta Pi include, the annual presentation of a slide rule to the sophomore engineering student who in his freshman year achieved the highest scholastic record, as well as other activities to promote scholarship among the engineering students.

Members are chosen from junior engineering students who rank in the upper 12½% of their class and seniors in the upper 20%.

CHI EPSILON

Chi Epsilon is the national civil engineering honorary fraternity. Its purpose is to bestow honor upon those civil engineering students of outstanding character who have demonstrated exceptional scholastic ability. The members are elected from the upper one-third of the junior and senior classes in civil engineering.

The activities of Chi Epsilon include bi-weekly meetings which are professional and social in nature; bi-annual banquets; and participation in the engineering exposition and other activities sponsored by the engineering council.

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ETA KAPPA NU

Eta Kappa Nu is an honorary fraternity for students in electrical engineering. Its purposes are to promote scholarship, to recognize the outstanding students, and to further the profession of electrical engineering.

Members are elected from the junior and senior classes in electrical engineering on the basis of outstanding scholastic work and character.

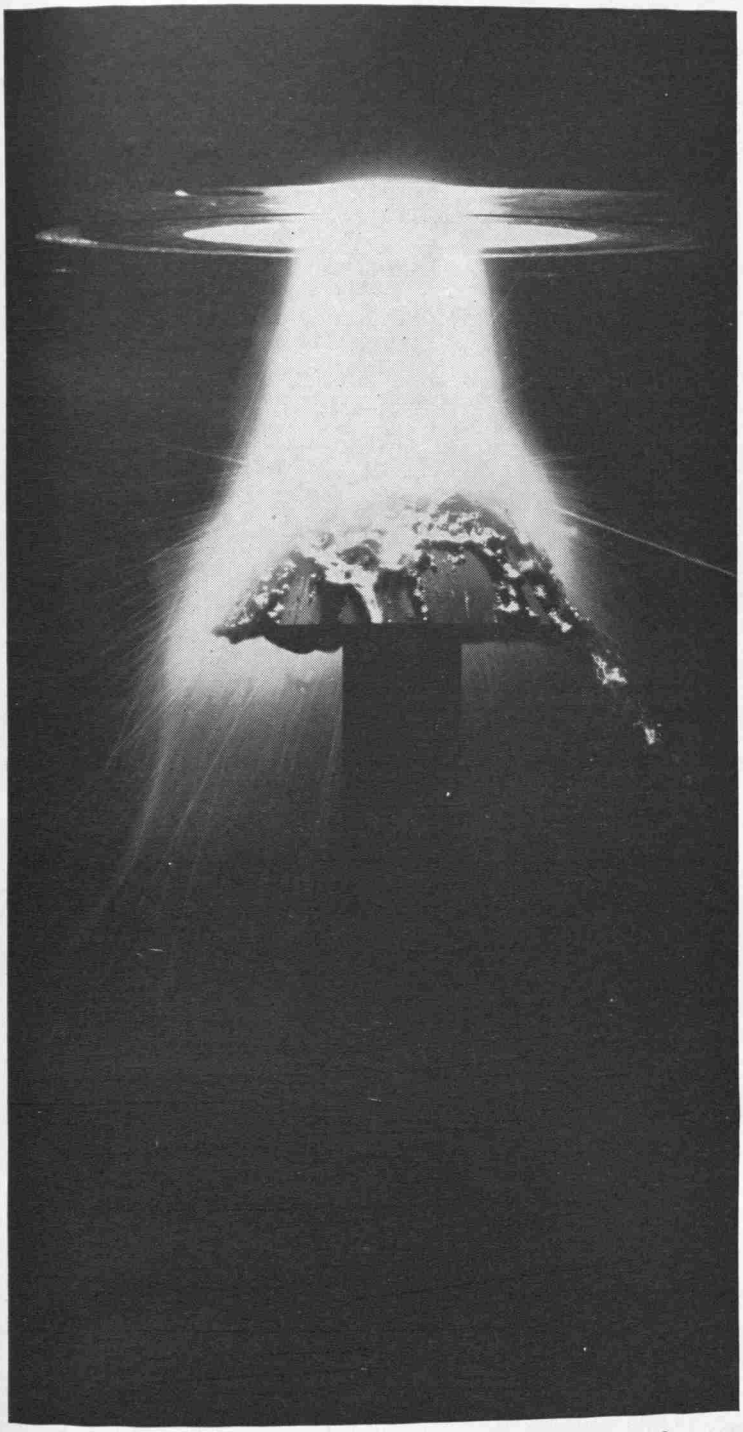
The local chapter holds business meetings about every three weeks during the school year. These meetings are usually attended by some guest who is well acquainted with some field of interest to the electrical engineers. Other activities include group and individual exhibits for the engineering exposition.

PHI LAMBDA TAU

Phi Lambda Tau is a local all engineering honorary for students outstanding in scholarship, leadership, and activities. Members are chosen from the top half of the junior and senior classes.

Activities of Phi Lambda Tau are: regular meetings; selection of the outstanding senior engineer and participation in the engineering exposition.

If your sights are set on research and development–



Jet heat blast of more than 15,000 degrees Fahrenheit flares over surface of an experimental nose cone shape in a physics laboratory of Avco Research and Advanced Development Division, Wilmington, Mass.

–you'll find **Photography at Work** with you

Research and development engineers find photography one of their most versatile tools. Camera and film can record the readings of instruments—can capture for study the fleeting transient on the oscilloscope face. The content and structure of metals can be studied by photospectrography or x-ray diffraction. And stresses in parts are visualized by photographing plastic models with transmitted polarized light.

There's hardly a field on which you can set your sights where photography does not play a part in simplifying work and routine. It saves time and costs in research, on the production line, in the engineering and sales departments, in the office.

So in whatever you plan to do, take full advantage of all the ways photography can help.

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TRADEMARK

One of a series

Interview with General Electric's

Francis J. Boucher

Manager-Manufacturing Personnel Development Service

How Good Is Your Best Job Offer . . .

Q. Mr. Boucher, with all the job interviews a graduating engineer goes through, how can he be reasonably sure he has made the right choice?

A. This is a good question because few seniors have enough work experience in industry, government and educational institutions to allow them to make a fully reasoned choice. However, I think the first step is to be sure that short-term factors like starting salary and location don't outweigh long-range factors like opportunity and professional growth. All of these factors should be evaluated *before making a final commitment.*

Q. But you do feel that starting salary is important?

A. Very much so. If you are married—it may be an even greater consideration. But you should also look beyond starting salary. Find out, for example, if the company you are considering has a good salary administration plan. If there is no way of *formally* appraising your performance and determining your appropriate rewards, you run the risk of becoming dissatisfied or stalemated due to neglect of these important considerations.

Q. What considerations do you feel should be evaluated in reaching a job decision?

A. Let me refer you to a paper written by Dr. L. E. Saline, now Manager of Information Systems in our Defense Systems Department. It is titled "How to Evaluate Job Offers." (Incidentally, you may obtain a copy by writing as directed in the last paragraph.) In it, Dr. Saline proposes six questions—the answers to which should give you much of the information you'll need for an objective job-offer evaluation. He suggests you determine . . .

- to what degree will the work be challenging and satisfying?
- what opportunities are available to further develop abilities?
- what opportunities are there for advancing in the Company (and how dynamic the Company is in the marketplace is an important aspect of this question).
- what salary potentials are possible with respect to the future?
- what about geographical location —now and in the future?
- what effort does the Company make to establish and maintain a professional climate?

There is more to these questions than meets the eye and I think you would enjoy reading Dr. Saline's paper.

Q. What about the openings on defense projects that are listed in the various magazines and newspapers?

A. Presumably, there will always be a need for technical manpower in the defense business. But I want to point out to you that most of these opportunities are for experienced personnel, or personnel with specific additional training received at the graduate level.

Q. How do you feel about training programs? Do they offer any particular advantages over any other offer I might accept?

A. I feel training programs are particularly helpful in easing the transition from an academic to a business environment. Of course they provide formal training designed to add to the individual's basic fund of knowledge. They also provide working experience in a variety of fields and a broad knowledge of the company concerned and its scope of operations. Upon completion, the individual is generally better prepared to decide the direction in which he will pursue his professional career.

General Electric conducts a number of training programs. Those that attract the greatest number of engineers are the Engineering and Science, Manufacturing, and Technical Marketing Programs. Each combines a formal, graduate-level study curriculum, on-the-job experience, and rotating assignments. There is little question in my mind that when an engineer completes the Program of his choice, he is far better prepared to choose his field by interest and by capability. I might also add that because of this, he is more valuable to the Company as an employee.

Q. Then you feel that a training program is the best alternative for a graduating engineer?

A. Not always. Some seniors have already determined the specific field they are best suited for in terms of their own interests and capabilities. In such cases, direct placement into this specific field may be more advantageous. Professional self-development for these employees, as for all General Electric technical employees, is encouraged through a variety of programs including the Company's Tuition Refund Program for work toward advanced degrees, in-plant courses conducted at the graduate level, and others designed to meet individual needs.

Q. For the record, how would you rate a job offer from General Electric?

A. I've tried to get across the need for factual information and a long-range outlook as the keys to any good job evaluation. With respect to the General Electric Company, seniors and placement offices have access to a wide variety of information about the Company, its professional environment and its personnel practices. I think qualified seniors will also discover that General Electric offers professional opportunity second to none—and starting salaries that are competitive with the average offered throughout industry today. From the above, you can see that I would rate a job offer from General Electric very highly.

Want more information about General Electric's training programs? You can get it, together with a copy of Dr. Saline's paper "How to Evaluate Job Offers" by writing to "Personalized Career Planning," General Electric Company, Section 959-15, Schenectady 5, New York.

GENERAL ELECTRIC