John W. Hirt, Class of '49
speaks from experience when he says,

"U.S. Steel offers an interesting and challenging future in a key industry."

Following graduation with a B.S. degree in 1949, Mr. Hirt went directly to the Irvin Works of United States Steel as an operating trainee. U.S. Steel trainees are given extensive training as well as practical experience in many phases of the steel industry. In this way, they are fully prepared to accept responsibilities as they move up. Just 16 months after starting as a trainee, John Hirt was advanced to Relief Foreman—Rolling, in the 80" Hot Strip Mill. He found the job, "one of the most interesting processing sequences in modern industry."

Two years ago Mr. Hirt was promoted to General Foreman—Hot Strip Finishing. In this capacity, he says, "I am responsible for coordinating the many finishing processes required to produce hot rolled strip."

Mr. Hirt now supervises a labor force of over 300 men in finishing 45,000 tons of hot sheets and coils per month. He sees a need for "a wide range of talents necessary to fill the great variety of vital jobs in the steel industry. There's a solid future in steel," says Mr. Hirt.

If you are interested in a challenging and rewarding career with United States Steel and feel that you can qualify, you can obtain further information from your college placement director. Or, we will gladly send you our informative booklet, "Paths of Opportunity," upon request. Just write to United States Steel Corporation, Personnel Division, Room 1622, 525 William Penn Place, Pittsburgh 30, Pa.

SEE THE UNITED STATES STEEL HOUR. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.
A highly unusual application of industrial mathematics. This string-suspended structure is a mechanical analogue of a differential equation illustrating a theory of why automobile brakes squeal. The engineers are observing the period of oscillation set up by an air stream blowing up through the vaned members to obtain values for substituting in the equation.

**GM engineers in action**

Lots of times an engineer must interpret an ordinary problem in an unusual way to get the best results—as these General Motors engineers are doing.

So when a young engineering senior seeks to join GM’s technical staff, the balance is weighed in his favor if he shows imagination, initiative, adaptability.

And that’s true whether he happens to be a Chemical Engineer, Electrical Engineer, Mechanical Engineer, or whatever. For there’s a broad range of opportunities where so many different products are made—automobiles, trucks, tanks, Turbo-Prop airplane engines, Diesels, earth-moving machines, home appliances—we can’t hope to list them all here.

Yes, opportunity is the middle name of a company like GM, that operates 34 separate manufacturing divisions throughout the United States, and plants in 64 cities.

If you’d like to know more about plant locations, training programs, chances for advancement in GM, you’ll enjoy reading a valuable 136-page handbook called, “Job Opportunities in General Motors.”

Why not ask to examine a copy in your school library or placement office, and then arrange an interview with our college representative soon as possible?

**GM Positions Now Available in These Fields:**
- Electrical Engineering
- Chemical Engineering
- Mechanical Engineering
- Aeronautical Engineering
- Metallurgical Engineering
- Industrial Engineering

**General Motors**

Personnel Staff, Detroit 2, Michigan

November, 1955
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When you make pumping equipment that has to stand up and deliver year after year anywhere in the world, you've got to be sure it will perform as specified.

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Naturally, our new test equipment is a big help to our research engineers, as well as our customers. Now they get performance data on products quickly and accurately. Using it, we can save months, even years, in developing new Worthington fluid and air-handling devices — equipment for which this company has been famous for over a century. For the complete story of how you can fit into the Worthington picture, write F. F. Thompson, Mgr., Personnel & Training, Worthington Corporation, Harrison, N. J.

See the Worthington representative when he visits your campus

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The Cover

The cover depicts the construction of one of the large piers on the yet to be completed Mackinac Straits Bridge. Courtesy of AMERICAN HOIST AND DERRICK COMPANY.

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May we call attention to our Complete Printing Service.

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140 North 6th Street
Terre Haute, Indiana
HIGH SCHOOL GRADUATES OF 1956

You are cordially invited to visit Rose Polytechnic Institute during the present school year to learn more about your college entrance and the highly accredited engineering courses available to you at Rose. The next freshman class will be admitted September 10, 1956.

OFFICE OF ADMISSIONS
ROSE POLYTECHNIC INSTITUTE
Terre Haute, Indiana

November, 1955
F4D, "SKYRAY"—only carrier plane to hold official world's speed record

F4D, "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

A3D, "SKYWARRIOR"—largest carrier-based bomber

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**Engineers: join this winning team!**

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:

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- Aircraft air conditioning
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- Structural test
- Flight test
- Process engineering
- Missiles

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:

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C. C. LaVene, Employment Manager...Engineering General Office
3000 Ocean-Park Blvd....Santa Monica, California
HERE’S A PROBLEM
FOR ELECTRICAL ENGINEERS

To protect short transmission lines against severe damage due to internal short circuits, Detroit Edison normally uses a pilot wire differential system to activate circuit breakers and thus stop the flow of electricity along the damaged wires. This system is technically limited to the protection of relatively short transmission lines.

Longer lines of all overhead construction can be economically protected by carrier pilot relaying systems. However, where there are long composite lines—overhead lines which go underground and come back overhead again—variations in line characteristics make it difficult to preselect the correct frequency for the usual carrier pilot relay.

How would you determine whether carrier pilot will work on a composite line? And, if carrier won’t work, what system would you use to protect this type of line construction?

* * * * *

The above problem is typical of those you would encounter as a member of Detroit Edison’s outstanding electrical engineering staff. If you can confront and solve such interesting and diversified problems, you have a firm foundation for building a successful career.

The future of Detroit Edison is a bright one. Edison’s constant expansion in a thriving industrial area means more opportunities for you. Why not see our representative when he’s on campus; visit us when you are in Detroit, or write . . .

THE DETROIT EDISON COMPANY
2000 Second Avenue, Detroit 26, Michigan
For Seniors...

For the past month, interviewers from several companies have been daily present on the Rose campus to retain the services of future engineers who are about to graduate. From present indications the young engineering graduate will be very much in demand to these interviewing companies to fill vacancies in an expanding economy.

In dealing with these companies let's play fair with these prospective employers, and by the same token we will benefit ourselves. Ethics are essential to the young engineer.

Before an interview is taken the student should prepare himself by reading literature and talking to his adviser, also he should prepare questions to ask the interviewer. The mimeographed sheet handed out by the placement department covers this very well. He should also be prompt for the interview.

He should be courteous at all times with the interviewer, and be prompt in answering the correspondence that may result from the interview.

After he has accepted an offer from one of these companies, he should be prompt in notification of those companies whose offers are to be rejected and accept no further interviews. These prompt replies make it easier for his classmates to find the job they want.

He should keep the placement office informed of what his plans are, and above all else he should conduct himself like a gentleman at all times because he has to sell himself to get the job and to get promotions.

By the same token the interviewer should play fair with the student. They should not build up a student they are not interested in. They should not invite a man for a plant trip only to turn him down by letter. This makes the student wonder about the reputation of such a company.

This problem is taken care of very nicely by the screening of interviewers by the placement office. They do an excellent job.

C.R.H.
Late in 1957 the lower half of Michigan will be linked to the upper half across the Straits of Mackinac with a four-lane highway bridge five miles in length which is now under construction. The Mackinac Straits Bridge will contain the world’s largest and longest suspension bridge. Though longer than the Golden Gate Suspension Bridge, its center span of 3800 feet will be 400 feet shorter than that of the Golden Gate Bridge.

When Michigan applied for admission to the Union in 1835, it did not intend to become a state divided. However, when a boundary dispute arose with Ohio over the possession of a 470 square mile section of land on Michigan’s southern border, Michigan received the 16,000 square mile Upper Peninsula in return for ceding the disputed area to Ohio. In those days, only hunters and trappers had penetrated this region. Industrial growth of the iron and copper mining operations required adequate means of transportation across the Straits. At first, state owned ferries were used. They could operate only during the warm months, and it was felt that Upper Peninsula should be joined permanently to the body of the state.

Everything from a floating tunnel to filling in a causeway across the Straights was discussed and rejected for one reason or another. The most practical idea, a bridge, was turned down because at the time no one could construct a bridge capable of withstanding the terrific pressures of the wind, ice, and current. After years of bickering on the part of the state legislature, a bill was passed by the United States Congress in 1940 to allow the State of Michigan to bridge the Straits of Mackinac, a federal waterway. The start of World War II put an end to all construction plans for the duration. In 1950, the Mackinac Bridge Authority was created by the Michigan State Legislature. Consulting engineers were engaged to “determine whether a bridge could be safely and feasibly constructed across the Straits of Mackinac.” The following year, the consultants reported that the bridge could be constructed, and that it should extend directly from Mackinac Point.” They estimated that the bridge could be completed and ready for traffic within four years of the award of the first contract. The Korean conflict hampered the plans temporarily; but in 1953, the initial financing was begun.

Funds were raised by a bond issue and in February of 1954 the authority was given a check for $99,800,000. Of this about $79,275,000 is estimated as the actual cost of the bridge, the balance being earmarked for administration, real estate and preliminary expenses and financing charges. The contract for the bridge substructure, comprising the foundations and piers, was awarded to the well-known contracting firm of Merritt-Chapman & Scott Corporation in the amount of $51,544,563, the work including the erection of steel and spinning the suspension cables, also attachment of suspenders and fittings. Additional contracts which cover the installation of paving, building the approaches, and constructing the administration building, etc., bring the construction cost close to $80 million.

Interesting Facts

Dimensions of structural parts of the Mackinac Straits Bridge include the following: Length of the main suspension span, 3800 feet. Length of two side spans, each 1800 feet. Length of suspension span including the anchorages, 8614 feet, which includes the two unloading backstay spans of 472 feet each. Length of the north approach, including mole, 7,791. Total length of bridge and approaches, 26,444 feet.

Height of the main towers above water, 552 feet. Width of bridge, 68
orders of magnitude: namely, velocities of 632 miles per hour for the lowest mode of oscillation and 942 miles per hour for the next higher mode. The highest wind velocity ever recorded in the vicinity of the bridge site is 78 miles per hour.

As a point of comparison, similar wind-tunnel investigations show the critical wind velocities of other notable suspension bridges to be only 1/10 those of the Mackinac Bridge. Maximum torsional stability has been achieved by providing two systems of lateral bracing, located in the planes of the top and bottom chords of the truss.

Construction

Construction is proceeding on schedule at the present time. A delay last fall has been made up in the summer's work. Ground was broken on May 7, 1954, and at the present time the six central foundations piers have been completed and work has been started on the erection of the cable towers and other superstructures. When completed, the south approach to the suspension section of the Mackinac Straits Bridge will be 5,694 feet long and consist of 16 deck-truss spans. The north approach, however will be 3,610 feet in length and consist of 12 deck-truss spans. The trusses in the approaches will be 68 feet wide and they will range in depth from 16 to 53 feet and carry a 6-inch roadway slab of reinforced concrete which is topped with a layer of bituminous concrete.

Each of the two suspension bridge towers will be of the conventional flexible type of cellular construction with a fixed base. The two shafts of each tower, resting on one pier, will be connected at four levels by means of horizontal struts of open-truss design. The main towers will rise 552 feet above the water and extend 200 feet below the water and mud to solid bedrock. All but ten of the 33 water-based piers will be founded directly on bedrock. In the case of the ten piers, there is enough overburden above bedrock to permit the use of heavy steel H-piles to serve as pier supports for the bridge. The H-piles can be driven in every one of the ten piers to bedrock, which ranges in depth to 174 feet below the water surface. The tops of the H-piles will then be embedded in the concrete foundations of the piers.

The most massive of all piers in the Mackinac Straits Bridge will be the anchorage piers in which the suspension cables are embedded after passing over the cable rest piers. The foundations of the two anchorage piers measure each 135 feet long by 115 feet wide. Each anchorage pier requires about 85,000 cubic yards of concrete which can resist a total pull from both suspension cables of 60 million pounds.

To construct these 33 water-based piers, the Merritt-Champan & Scott Corporation brought to the bridge site the largest and one of the costly fleets of floating equipment ever assembled by a contractor for a single project. Approximately 50 pieces of floating equipment, most of it newly built to meet the special requirements of the Machinac Straits Bridge project, was called into action to construct the 33 water-based piers of reinforced concrete in water and mud, extending from the surface to a maximum of 200 feet at bedrock. (Concluded on Page 30)
Twenty Five Years Of Flashbulbs

Condensed from a General Electric Bulletin

A new era in photography began on August 1, 1930, when General Electric introduced photoflash lamps for the first time in the United States. The old cumbersome and dangerous system of producing light for flash photography involved smoke, odor, noise, danger, fire, and inability to control the amount of light accurately. The old cumbersome and dangerous system of producing light for flash photography was to ignite flash powder on metal trays. This had always involved smoke, odor, noise, danger of fire, and inability to control the amount of light accurately.

Now the safe, efficient and easily operated photoflash lamps soon replaced the earlier method. There was no muss, no fuss, and the used bulbs were easily disposable. They so greatly increased the convenience of flash photography that they created a large new market among both professional and amateur photographers.

General Electric purchased the American patent rights of the inventor of photoflash lamps, Johannes Ostermeier, of Germany. At Nela Park, G.E.'s Lamp Division headquarters, in Cleveland, specialists developed the lamps further. These first photoflash bulbs, of the same size as today's 150-watt household lamps, contained oxygen gas and a loose filling of crumpled thin aluminum foil. When the lamp was connected to a source of electricity, a small filament in the lamp became heated. This caused sparks to fly from a zirconium powder "primer" with which the filament was coated, and ignite the foil and oxygen. The result was a flash of light of high intensity and short duration.

Today's flashbulbs operate on the same principle, but are smaller in size, use shredded foil instead of sheets, have thinner filaments and more sensitive primer. Coats of transparent lacquer both inside and outside the bulb minimize the shattering of the glass.

The desirability of a glass-enclosed flash lamp for photography was pointed out as early as 1898. However, no such lamp was produced commercially, so far as is known, until 1930, when General Electric introduced the foil-filled lamp.

The sheets of foil were so thin they could be ignited readily, and they burned with a short flash of high intensity. The light output could be controlled within reasonable limits by the amount of foil inserted, and the duration of the flash by various combinations of foil thickness.

These lamps were used initially for what is called "open shutter" photography, in which the camera shutter is first opened, the light flashed, and then the shutter closed. The light produced so predominated over the casual illumination existing that only what occurred during the short peak of the flash illumination would show on the finished picture.

Shortly after their introduction, these flash lamps also began to be used in synchronization with camera shutters in the taking of action shots of such activities as sports events. The use of the shutter was necessary whenever the duration of the flash produced by the lamp itself was not short enough to stop the action or whenever the camera was hand-held. By using a synchronizer, the shutter could be opened for the requisite short time during the peak of the lamp's illumination.

Because the peak produced by the leaf foil lamp was quite short, accurate synchronization with the camera shutter was required. Thus it became desirable to develop a longer-burning lamp, which would allow greater leeway for errors of synchronization. In 1938 General Electric broadened its flashbulb line by introducing a lamp filled with aluminum wire, and having a flash of long duration. Also introduced was a lamp filled with heat-treated foil, thicker than sheets used earlier, having a flash of intermediate duration.

The demand for broad-peak lamps was greater than G.E. could fill, largely because of the cumbersome and expensive drawing process required to produce the aluminum wire. Accordingly, the company sought and found a new method by which to produce lamps having the desired long-burning characteristic.

This new method involved the production of shredded foil. Much thicker aluminum foil than was used in the sheet foil lamps was cut into thin eight-inch-long strips or ribbons, several hundred of which were sucked into each lamp by vacuum. The number of strips depended on the amount of light desired. Fluffing of the shredded foil within the bulb was affected by a jet of air.

The lamps filled with shredded foil also was found to be a satisfactory substitute for the leaf foil used in General Electric's lamps of intermediate and short flash duration. Hence by 1942 leaf foil was discontinued, operating characteristics of the lamps being changed to suit the demands of the market by varying foil thickness, width of the cut, and number of shreds per lamp.

When General Electric introduced the first photoflash bulb in the
United States on August 1, 1930, few could have imagined the terrific impact it would have on American society in the next quarter century.

More than two billion flashbulbs have been produced in this country during the past 25 years. Production has reached the rate of half a billion lamps a year, about 24 percent of all electric lamps of all types, having a retail value of $65,000,000.

Flash photography probably is America's fastest growing hobby. Approximately 68 million cameras owned in the United States are equipped for flash picture taking, and virtually 100 per cent of cameras now being made are so equipped.

It is estimated that about 26 percent of all pictures taken are with flash, and experts see 45 percent as a realistic goal for the foreseeable future. In the near future flashbulb production is expected to reach the 700,000,000 rate annually.

Photoflash lamps' first important effect was to revolutionize the art of pictorial news reporting. They accelerated the creation and growth of the country's great picture service and syndicates, and made practical the scores of picture magazines which now are published.

For the first time the news photographer was able to obtain unposed news pictures quickly and easily, indoors as well as out, night and day. Occurrences now could be recorded with pictures which theretofore could be told only with words or artist's sketches.

Advantages were many. They included silence, cleanliness, safety, convenience, effectiveness, absence of fire hazard, dense clouds of smoke and frightening noise, practicality in rain and high wind, independence of time and place, uniformity in light output and flash duration. These benefits all pointed up disadvantages of flash powder which photographers previously depended upon.

The New York Times of April 6, 1931, in a story about the return of Mayor Walker to "Bagdad on the Subway" after a sojourn in Palm Springs, recognized the boon of photoflash lamps in news photography:

"They held the Mayor at the station gates for 20 minutes, and occasionally women in the crowd screamed as flashlights went off close at hand. On the way up the stairs to the exit from the station to the Hotel Biltmore, two particularly loud flashlights went off at once, and the crowd pushed excitedly to get away. The fact that many of the photographers were using electric flashes, which are soundless prevented the excitement from spreading."

Just as the flashbulbs were welcomed by the news photographers, so were they appreciated by persons in the news who had to be photographic subjects. The Cleveland Plain Dealer of April 27, 1931 told of the arrival of Rosa Ponselle in Cleveland to appear with the Metropolitan Opera:

"Ponselle, first to leave the train, walked up the marble steps and turned to the right, running smack into a bunch of photographers. The powderless flashlights started working; Ponselle graciously posed and posed.

"'Cleveland,' she said, tapping the floor with what looked like a walking stick, 'Cleveland is just part of me. This new station is so lovely. The old station rather depressed me and do you know, I think I've just discovered why I'm so willing to pose for photographers today. It's these new lamps the photographers use. No smoke . . . Oh, they're lovely.'"

During the first few years after its introduction the flashbulb was used largely by the press photographers and other professionals. By 1938 the annual flashbulb production was only nine million. The following year saw General Electric develop and introduce the "midget" flashbulb, however, which was to prove a great stimulus to flash photography for the next 15 years.

The original flashbulb was a large cumbersome photolamp by today's standards. The smaller, less expensive and more efficient midget flashbulb was a welcome change, not only to the overburdened photographer, but to the entire photographic business.

By 1942 the amateurs were in the flash-photography field to such an extent that production of flashbulbs soared to 42,000,000 annually. During World War II, G.E. cut back its production of lamps for the amateur market, directing all its bulbs to the armed services, press photographers and other professional users. Production dropped to a low of 19 million in 1943, and didn't regain pre-war levels until 1946.

Millions of box camera users began to take hundreds of millions of "candid" shots with and without flash. Thousands of camera clubs were formed. Only 75 million bulbs were produced in 1947, but by 1949 the figure was 152 million. Trying desperately to keep up with the demand, flashbulb manufacturers produced 289 million in 1951 and in 1953 the number soared to 478 million.

What of the future? G.E. photographic lighting authorities expect to see the trend toward smaller flashbulbs continue. The M2 is expected to replace the No. 5 as the most popular flashbulb within a few years. Eventually, it is believed, the M2 will be the largest of the flashbulbs generally employed by amateurs.

The need for less light from flashbulbs and other artificial sources is an outgrowth of the trend toward more sensitive film. But since photographic experts recommend flash to remove harsh shadows even in sunlight snapshots, the improved film is not expected to affect the flashbulb business adversely. And flash will always be needed for pictures at night, in poor visibility conditions, and to assure stopping motion.

Benefits of smaller flashbulbs to the photographer, retailer, distributor and manufacturer are many. Chief of these are their conservation of space, their light weight, their ease of handling, and their low price.

One of the most intriguing prospects to come out of the miniature flashbulb development is the automatic flash camera, which fires a half-dozen or so bulbs in succession, in much the same manner as a revolver fires its bullets. This trend toward repeating flash is likely to be a continuing development by manufacturers of photoflash equipment.
Again this year the intramural program under Clarence E. Kelly, intramural director, got off to a fine start. The first activity this semester was touch-football, which started September 27 and will continue until November 18. Other minor fall sports are horseshoe and tennis. There are to be two tennis tournaments, singles and doubles, both this fall and in the spring. Also there are to be two horseshoe tournaments, singles and doubles, one this fall and one in the spring.

The sports program for the winter session will consist of basketball, volleyball, ping pong and handball. The dates for these various activities are as follows:

- Basketball—Two leagues November 29 - March 4
- Volleyball—Two leagues November 28 - February 15
- Ping Pong—Singles and doubles March 7 and 15
- Handball—(One Wall) November 15 until indoor track season starts

As set up, the spring sports program consists of softball, tennis, horseshoe and track. The softball league will run from April 2 to May 27.

Each student not competing in varsity athletics is eligible and is encouraged to compete in intramural sports. However, there are a few exceptions. If there are any questions concerning eligibility to participate in intramural sports, reference should be made to the intramural director. The participation of a student on a fraternity team does not affect his eligibility to participate on an intramural team.

The organized intramural program is for the benefit of the students. It promotes inter-departmental competition to a well-balanced degree. It helps one to learn self-control and the art of cooperation. In intramural games everyone is equal. Awards are given, however, to those who are winners in each sport or in each league. Points are also given to all students who participate in each sport. There will be a graduated scale for the points, thus some sports will count more than others. Prizes are given each year for at least three places to the men who have the highest number of points.

Participation in each game that your team plays is not required. Your team will, in most cases, play about two or three games a week, but you do not have to play unless you want to play. The rules for most of the contests are strict, but they are not tough. Safety is a major factor that is always stressed, in the intramural games here at Rose.

A special invitation is made to the new men here at Rose to help in our intramural program. The program offers wonderful opportunities to you men to meet your fellow classmates and the upperclassmen here at Rose. I know that most of you feel that you don’t have time to participate because of your studies, and it is true that your grades shouldn’t suffer because of your outside activities. However, I think that it has been generally accepted that you can study better if you will take time once in a while to relax and forget your problems.

A new sport has been added to the program this year. This sport is handball. This is something new around here, and all the talk concerning the forth-coming activities of this sport is very encouraging.

Something else new is being added this year. This is a national athletic fraternity—The SIGMA DELTA PSI fraternity. Membership is gained by passing fifteen tests and by paying a fee of ten dollars for a shingle and a pin, or three dollars for the shingle only. The passing of seven tests is required for local club membership. Tryouts will be held during the fall and again in the spring. All men who are interested contact the intramural director for additional information.

There are a few notes of general information which should be made. The department does not give out towels! Locks and lockers may be obtained by placing a one dollar deposit with the intramural department. All official notices are posted each day on the Intramural Bulletin Board located just outside of the Book Store. The notices contain the rules, team standings, playing dates and times, postponements, and any other pertinent data.

The intramural department will provide equipment and facilities whenever it is possible. All students are encouraged to come and to make use of this equipment and facilities and to help the program continue to be a big success!
A Campus-to-Career Case History

Emmett Smith, E.E., '50, supervises operation of the training switchboard which he originally helped to design.

"I Didn't Know There Was Such a Job"

"Communications have always been one of my main interests—in the Navy and at the University of Michigan. So I was very happy when the Michigan Bell Telephone Company invited me to visit their headquarters to talk about a job.

"In Detroit I had a chance to look at a number of departments, including one I'd never heard of before, the Traffic Department. I found that, in addition to the engineering of switchboards, it involved the supervision and handling of calls. It struck me like a wonderful opportunity to combine staff engineering and field management.

"My first impression was right, too, because my work covered both. First, I had on-the-job training assignments in several different kinds of offices—local, Long Distance, dial and manual. Then I worked in engineering, translating estimates of future growth into the actual number of circuits and switchboard positions required.

"Now I'm supervising the operation of one of the boards I helped engineer. Briefly my job is to see that my district gets the kind of equipment it needs and that what we have is working properly. Another major part of my job is advising the supervisors of the Long Distance operators. I like this because it means working with people, too.

"Needless to say, I'm happy with my job. A job I didn't even know existed."

Emmett Smith's job is with a Bell Telephone Company. There are similar opportunities for engineers with Bell Telephone Laboratories, Western Electric and Sandia Corporation.

BELL TELEPHONE SYSTEM

November, 1955
SUBMERSIBLE MOTOR FOR GASOLINE PUMPS

A new submersible pump motor, designed to operate safely while immersed in high-octane gasoline, has been developed by the General Electric Company.

The new motor was designed to help solve some of the problems attendant upon the growing use of high-octane gasolines, whose extreme volatility makes standard methods of pumping hazardous, expensive, and inefficient at varying altitudes and temperatures.

The result of thousands of hours of engineering research and field testing, the new motor has been slimmed down to fit inside a three and one-half inch gasoline pipe. Since it was early discovered that it would be impossible to keep gasoline from seeping into the motor, it is designed to be flooded with gasoline, the fluid acting as a coolant and bearing lubricant. The windings and stator core are protected from ill effects of the gasoline by being completely sealed in an impervious epoxy resin material.

The motor is rated 3/4 horsepower, 230 volts, 60 cycles, 3450 rpm. It will absorb a 50-pound thrust, according to G-E engineers, when the pump thrust is away from the motor.

TAPE-RECORDED COLOR TV PROGRAM TRANSMITTED OVER NETWORK FACILITIES BY RCA AND NBC

A color television program recorded on magnetic tape was transmitted over commercial television network facilities for the first time on May 22, 1955, by the Radio Corporation of America and the National Broadcasting Company.

The tape-recorded telecast, originating with the prototype RCA TV tape recorder installed for field testing at the NBC studios in New York, was transmitted over a closed circuit from New York to Saint Paul as part of the dedication ceremonies of the new research center of the Minnesota Mining and Manufacturing Company. Magnetic tape produced by Minnesota Mining and Manufacturing Company was used for the demonstration.

The pre-recorded program included remarks by Brig. General David Sarnoff, Chairman of the Boards of RCA and NBC, who hailed the opening of the new research center as a “historic occasion,” adding:

“It is most gratifying to all of us in RCA that the scientists and engineers in our laboratories have built and are now field-testing the first television magnetic tape recorder which brings this message and other portions of this program to you in Minnesota. . . . It is most fitting that you who developed and made the tape and we who developed and built the recorder should share in this great achievement.”

Program Recorded and Stored on Tape

In addition to General Sarnoff’s remarks, the program included a brief explanation of the system by Dr. Harry F. Olson, Director of the Acoustical and Electromechanical Research Laboratory, RCA Laboratories, and an entertainment program featuring Eddie Fisher, Bambi Linn, Rod Alexander, and Al Kelly. The entire program was recorded in advance on the developmental video tape system at the NBC studios and the tape was stored until the scheduled transmission time. The telecast was sent to Saint Paul over the microwave relay facilities used for NBC commercial network programs.

Dr. Olson, under whose direction the TV tape recorder was developed at the David Sarnoff Research Center of RCA, Princeton, N. J., told the Saint Paul viewers that the recorded demonstration was “in the form of a progress report” involving the new equipment installed at NBC.

“You are the first to witness the performance of this system,” he said. “Some problems remain to be solved. These involve both the machine and the tape. We are certain that these problems will be solved. We value the cooperation of the scientists of the Minnesota Mining and Manufacturing Company. We are confident that electronic photography will be an important tool first in television and later in industry and the home.”

Objectives of the TV Tape Recorder

The RCA TV magnetic tape recording system was first demonstrated under laboratory conditions on December 1, 1953, at the David Sarnoff Research Center. The system was described by General Sarnoff as the first major step into an era of “electronic photography,” in which motion pictures in color or black-and-white will be produced quickly and economically, eliminating most of the time and all of the chemical processing involved in photography.

It was pointed out at that time that RCA’s objective in developing such a system was to achieve a swift, economical and efficient means of recording color television programs for storage, playbacks or re-broadcast. A tape recorder capable of performing this function was requested by General Sarnoff in 1951 as a birthday present to mark his fiftieth anniversary in radio in 1956.
In addition to the value of video tape recording in the television industry, RCA has emphasized the future significance of the system as a convenient and versatile means for making electronic motion pictures, particularly in business and industry and in the home, in an all-electronic chain comprising portable television camera, TV tape recorder, and standard television receiver.

**How the RCA TV Tape Recorder Works**

The TV magnetic tape recorder is similar in its basic principles to the conventional tape recorders used today for sound. Electrical signals—the broadcast video and audio signals of television—are impressed through a recording head onto the magnetically treated surface of a plastic tape. As the tape is drawn across the recording head, the head continuously changes the magnetic polarity of the magnetic particles on the tape so that they become a compact code of the original signal. This pattern will remain indefinitely on the tape during subsequent playbacks, until it is desired to “erase” the signals electronically and use the tape again to receive another set of signals.

For playback, the tape is drawn across the same head or a similar one. The magnetic code on the tape causes an alternating current to flow in the windings around the reproducing head, creating a duplicate of the original signal.

While the principles are similar to those of sound tape recording, creation of a practical television tape recorder raised many complex engineering problems for whose solution no precedent existed. While sound tape recorders must accommodate signals in a frequency range of up to 20,000 cycles per second, the video signals of black-and-white television extend up to 4,000,000 cycles per second—200 times the frequency range of the familiar sound tape recorder. With the addition of color, at least twice as much pictorial information must be carried as is required for black-and-white television.

Other problems overcome by the RCA scientists and engineers included the design of circuits to feed the video signals into the recording heads and to carry the signals away during playback into monitors and transmitters, and the construction of a constant speed transport mechanism. The latter is essential to carry the tape at a uniform rate past the recording heads, since a variation of speed by as little as one part in 5 million will produce an appreciable jog in the picture on the face of a 21-inch TV picture tube.

Following the 1953 demonstration, a second television tape recorder was built at the RCA Laboratories for a field-test installation at NBC. This second model, incorporating several improvements over the system demonstrated at Princeton, operates at a tape speed of 20 feet per second and can accommodate a 15-minute TV program on a 20-inch reel, using tape approximately one mil thick. The tape itself, with a width of 1/4-inch, carries six recording channels to accommodate each of the three primary color signals of red, green, and blue, high frequency signals, the synchronizing signal, and the audio signal that carries the sound accompanying the picture.
it takes many engineering skill

McDonnell "Voodoo", the most powerful jet fighter ever built in America.

**MECHANICAL ENGINEERS** are concerned with many phases including experimental testing and development, mechanical design, stress and vibration analysis, combustion research, heat transfer and nuclear reactor development.

**AERONAUTICAL ENGINEERS** work on innumerable internal and external airflow problems concerned with design, development and testing of aircraft powerplants. Some who specialize in analytical engineering forecast engine-airplane combinations a decade in advance of design.

**ELECTRICAL ENGINEERS** directly contribute their specialized skills to the analysis and development of controls, systems and specialized instrumentation. An example is the "Plotomat" which automatically integrates and plots pressures, temperatures and air angles in performance testing.

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An aircraft powerplant is such a complex machine that its design and development require the greatest variety of engineering skills. Pratt & Whitney Aircraft's engineering team has consistently produced the world's best aircraft engines.

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WORLD'S MOST POWERFUL production aircraft engine. This J-57 turbojet is in the 10,000-pound thrust class with considerably more power with afterburner.
A Flashback to The Rose Campus of 1905

By Charles Tolson, sr., c.e.

Many a Rose sophomore or freshman of today prides himself in the moral if not physical victories that he has won for his class during the period of hazing. In this modern day of good roads and automobiles such "original" practices as road hikes are being used. There has been a great deal of talk that hazing is a part of the Rose tradition, one that is really enjoyed by the Rose men of today. At the same time some of our present day students seem to sneer at the Rose men in the past since they could not have possibly had such an extensive hazing program as is possible in this modern age. To find out the real truth concerning hazing in the past and past Rose traditions we must turn to the written word as found in the Technic.

The bound issues of the Technic from the 1905-06 school year bring to us accounts of campus life and activities.

Fifty years ago Rose was located in Terre Haute proper. The YMCA seemed to be the Rose dorm as a number of Rose men figured prominently in its activities. This year saw Rose winning the title of Champions of Secondary Colleges of Indiana by defeating DePauw, Franklin, Butler, and Earlham in football. State Normal (ISTC) and Hanover disbanned their teams before we could play them. It is interesting to note that one of the games with Butler was forfeited because the Butler coach took his team off the field in protest of a referee's decision. Classes were extended to five o'clock to allow more flexible scheduling. (And we complain about Saturday classes.)

The men of Rose presented an opera, Gilbert and Sullivan's, "H. M. S. Pinafore". The cast, which included feminine roles was filled entirely with men, which evidences the spirit of the Rose men of 1905-06.

While all of these events were going down in history, another group of events were receiving their share of attention from the Freshmen and Sophomores. In the account of these events one can see the resourcefullness of the Rose men reflected. As now, the Freshmen and Sophomores, urged on by the upperclassmen, started hostilities as soon as school opened. The first night a group of Sophomores went out on the prowl to find some poor unsuspecting freshmen. But, the freshmen were not so unsuspecting and soon a number of sophomores were accompanied on a walk in the country by accommodating freshmen. That same night, however, some of the freshmen were placed on the Clinton trolley car by some obliging sophomores.

The following night the freshmen met the Sophomores in a battle at eight on the Rose campus. At nine o'clock the sophomores were neatly packaged. Someone called for a special car, and soon the sophomore class was bound for Clinton. Saturday afternoon a baseball game was scheduled. It rained, but play went on. After two and one half innings the sophomores led 3-0, when a freshman appeared smoking a forbidden corn cob pipe. Immediately a fierce fight broke out, suspending the game. A whistle sounded, calling for a three minute truce. After the truce the classes lined up along the field 100 yards apart. A large pipe was placed in the middle of the field, and at the sound of the whistle both sides charged forward to gain possession of the coveted trophy. At first the sophomores captured the pipe, but before the ten-minute whistle, signifying the end of the contest sounded, the freshmen had made great gains. When the count was taken, the freshmen were found to be victorious, having 26 hands touching the pipe, while the sophomores had 11. Thus the members of the class of '09 gained the privilege of carrying pipes.

The tradition of the privilege of pipe smoking being denied the freshmen by the sophomores until it has been dutifully won has continued on until today. But just as important is the illustration of the resourcefullness of the men who preceded us by fifty years.

The past can teach us a lot as well as entertain us, and in the corner of the Technic office one can find a bookcase well stocked with the traditions, trials, successes, and humor that go together to make Rose the institution it is.
Dave Johnson asks:

What's involved in production work at Du Pont?

David L. Johnson, Jr., expects to receive his B.S.Ch.E. from the University of Kansas in 1956. He is very active in campus affairs, president of Alpha Chi Sigma and a member of several honorary engineering fraternities. Dave is interested in learning more about production work in the chemical industry.

JAMES L. HAMILTON is one of the many young engineers who have been employed by Du Pont since the end of the war. After service in the Navy, Jim got his B.S.Ch.E. from the University of West Virginia in June 1948, and immediately joined Du Pont's Repauno Plant at Gibbstown, N. J. Today, he is Assistant Superintendent of the dimethyl terephthalate area at this plant.

A MORE COMPLETE ANSWER to Dave Johnson's question about production work is given in "The Du Pont Company and the College Graduate." This booklet describes in detail the training, opportunities and responsibilities of engineers who take up this kind of work at Du Pont. Write for your free copy to E. I. du Pont de Nemours & Co. (Inc.), 2521 Nemours Building, Wilmington, Delaware.

Better Things for Better Living ... Through Chemistry

Watch "Du Pont Cavalcade Theater" on TV

November, 1955

Jim Hamilton answers:

Well, Dave, I've been doing production work at Du Pont for about seven years now, and I'm still getting involved in new things. That's what makes the work so interesting—new and challenging problems arise all the time.

To generalize, though, the duties are largely administrative. That's why effectiveness in working with others is one of the prime requirements. Teamwork is important in research and development work, for sure. But it's even more important in production, because you work each day with people having widely different skills and backgrounds.

A production supervisor needs a good understanding of engineering and scientific principles, too. He has to have that to get the best results from complicated equipment—but he doesn't necessarily need the specialized training that goes with research and development work. A real interest in engineering economics and administration is usually more helpful to him here than advanced technical training. The dollar sign's especially important in production work.

It all adds up to this, Dave. If you enjoy teamwork, and have a flair for large-scale, technical equipment, then you'll find production work mighty rewarding.
Fraternity Notes

Alpha Tau Omega

A.T.O.'s with tired, soggy, muscle aching bodies trudged home from victory on the evening of Saturday, October 22. The result of this victory more than compensated for the time and sweat which they donated in participating in Car Wash Day. From their endeavors that day, one hundred dollars was added to the Community Chest Fund Drive. Instigator and supreme strategist for the operation was Kenneth Hannum, and he received cooperation from an able army of Alpha Taus comprised of the entire chapter.

Rebounding with the elasticity of youth, a lively house dance spiced with colorful Halloween decorations was held October 29. The dance was directed by Ron Vahle and Jim Griffith, the new social chairmen.

Congratulations are due:

(1) Active Bob Hicks, who was formally initiated on October 16.

(2) Our new sophomore pledges, Tom Reed, Jack Hunt, and Bart Hartsock.

The chapter was shocked by the untimely passing of Ron Meredith's father. We all extend our sincerest sympathy to Ron and his family.

Jack Foltz.

Sigma Nu

Beta Upsilon welcomes six new brothers into Sigma Nu Fraternity. Jack Gaughan, Richard Weegrich, Robert McBride, Howard Knipple, Richard Irey, and Tom Clark were initiated on October 9, 1955 at the fraternity house. Jack Gaughan received the Outstanding Pledge Award while Dick Weegrich was the recipient of the Scholarship Award.

On Friday, October 14, the chapter held an Open House for the girls of St. Anthony's Hospital at the fraternity house. The chapter also held a New Actives Dance at the fraternity house on October 29. Jess Knowles provided the music and our pledges provided the entertainment with a skit.

Coming up on our social calendar is an Open House with the nurses of Union Hospital in November and an Open House with Zeta Tau Alpha Sorority probably in December.

The chapter now has won 2 games and lost 1 game in the Interfraternity League, and the team seems to be improving. Although the opposition is tough, we are hoping that we can come through and win the trophy again this year.

Congratulations are in order for Brother Birt Kellam who has pinned Miss Louise Jacobson and to Brother Donald Fordyce who has announced his engagement to Miss Marsha Watson.

George B. South, Jr.

Lambda Chi Alpha

Theta Kappa started off Homecoming by holding a buffet dinner for alumni, undergraduate members, and their dates, before the bonfire on October 7. Special guests at this supper were a number of close neighbors. After the bonfire a house party was held. After the Homecoming Dance, Theta Kappa celebrated its second straight victory in the house decoration competition with another house party. On October 12, the Delta Gamma sorority of Indiana State came to the house for an open house with the chapter. As usual, everyone was sorry when the clock put an end to this affair.

As the fall wears on, Theta Kappa is piling up an increasing number of victories in the I-F football league. The Purple, Green, and Gold now holds victories over Sigma Nu, 26-7, Theta Xi, 7-0 and 33-0, and ATO, 19-0, and a 7-0 forfeit over ATO. With the final game coming up against Sigma Nu, the team is hopeful of clinching the league championship with an undefeated season.

A number of the brothers of Lambda Chi are in line for congratulations this month as a result of the recent honors assembly. Gerry Rose and Fred Goetsch were tapped for Blue Key, and Rose, Paul Lewis, and Chuck Bruner were tapped for Tau Beta Pi. Jim Calabro and Harold Brown received honor keys.

Jack Shumate.

Theta Xi

In the last month the Kappa's have pledge eight more men, to make a total of ten men in the present pledge class. The new pledges include: Gordon Wolfe, Ernie Boodt, John Irvin, Bob Stearley, John Hornung, Henry Jackel, Byron Veir, and Joe Jackse.

To finish up a fine Homecoming weekend, we rode out to St. Mary's College to play an invitational field hockey game. The Coeds gave us a hearty welcome as we entered the field clad in Bermuda shorts, white shirts, ties, and caps. Although we played a superiorly experienced team, we managed to hold them to a 3-3 tie.

A dinner was given on October 23 to acquaint the members and pledges with the new chapter adviser Mr. Robert Roll, a Theta chapter alumni, who is associated with Twigg Industries. Also, to go with the spirit of the season, we had a Halloween Dance at the house on the 30th. Everyone present had a swell time, even Wally Schramm, Social committee chairman, said it was great.

Our IF football team, although we have yet to come out on top, have hopes, and they enjoy themselves in each game they participate. The team will have to play the remainder of the season without the assistance of Ted Solmundson and Gene Blastic who were minorly injured in the Faithful cause. Jerry Blickhahn.

Page 22 THE ROSE TECHNIC
Apart, they're liquid... together, they're solid
—and this strange reaction helps make parts for your car

... your television set ... and even your tableware

By THEMSELVES, these two liquids flow as freely as water. Yet when poured together they quickly turn into a solid—harder than many metals.

THESE AMAZING LIQUIDS which become a solid, without applying heat or pressure, are man-made chemicals—one called a resin, the other a curing agent. The chemists have coined the name, epoxy, for the resulting plastic.

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Dynel Textile Fibers  Electromet Alloys and Metals  Haynes Stellite Alloys  Union Carbide  National Carbons

November, 1955
MacNabb, Walter S., M.E., died at the age of 72 at his home in Crown Point, Indiana. Mr. MacNabb, a blast furnace specialist, had been retired since 1944. At the time of retirement, he was division superintendent of blast furnaces at Gary Works of Carnegie-Illinois Steel Corporation.

As an engineer, Mr. MacNabb made many trips abroad to serve as a consultant on blast furnaces. He helped establish a modern steelworks at Jamshedpur, India in 1915 and returned to India again in 1922. Following his retirement, he spent 4 1/2 months in Australia as a consultant and later went to Genoa, Italy, to supervise operation of a new blast furnace installation.

Mr. MacNabb started his long career with the Gary Works in 1910 when he became assistant superintendent of blast furnaces. In 1920 he was promoted to assistant superintendent of the open hearth department, and in 1936 he was named superintendent of industrial relations. He was made superintendent of cost planning in 1941, and in 1944 took over the position he held on retirement.

Bland, John O., M.E., died in Louisville, Kentucky. Mr. Bland was the owner of the Bland Electric Company in Louisville. He had been ill and was at the Kentucky Baptist Hospital at the time of his death.

Ray, Frederick B., A.E., has been named as Vice-President in charge of sales, research and development at the Insley Manufacturing Corporation. Mr. Ray is a 34 year veteran with Insley and previous to his promotion was Vice-President in charge of sales.

Sampson, Glenn J., M.E., has been appointed plant manager by the Toledo Edison Company of its new 30 million dollar Bay Shore generating station.

Before his promotion Mr. Sampson was chief construction engineer at Toledo Edison. His more than 25 years in the electric utility industry was started with the Public Service Company of Colorado in 1930. He was transferred to Toledo Edison a year later and became chief construction engineer when the Bay Shore station was started in 1953.

Stimson, Allen G., M.E., holds the position of Photometric Engineer in the Instrument Department in the Lynn Plant of General Electric. He is responsible for the design of all photometric products used in photography. Mr. Stimson has designed and made all his own equipment and has his darkroom in the basement of his home.

Quinn, John W., M. E., is now the Superintendent of Processing for the Moraine Products Division of General Motors. He previously held the same position at the Delco Products Division of General Motors.

Roberts, Clifford E., E.E., M.S. at Univ. of Wis., Lt. Colonel, Signal Corps, U. S. Army, has been transferred to the Office of the Chief Signal Officer, Department of the Army, Washinton, D. C. He was previously Chief, Communications Branch of the Communications and Electronics Service Test Division.

Feb. '43 Jessup, John W., C.E., has taken a position with Western Electric Company at Aurora, Illinois. He was formerly Chief of Party, Building Construction, of the George A. Fuller Co. in Olmsted Falls, Ohio.

Dec. '44 Manhart, Robert A., E. E., M.S. at Illinois '47, has joined the Department of Electrical Engineering of the University of Arizona, Tuscon, Arizona.

Aug. '50 Slagley, William E., M. E., has taken a position with Inland Steel in East Chicago, Indiana. He was formerly employed as a Foreman with Allis-Chalmers Manufacturing Company.

Holmes, John E., E.E., is with the International General Electric Company. He is presently stationed in Caracas, Venezuela as a Sales Engineer.

Pferrer, Daniel L., C. E., is now in Louisville, Kentucky, as a Senior Engineer, Maintenance Division, with the Indiana Ordinance. He lives in Charlestown, Indiana, across the river from Louisville. He had worked with du Pont Company on the Savannah River Project.

Herbst, Deward J., M.E., has taken a position as Assistant Production Supervisor for the Publicker Chemical Corporation in Louisville, Kentucky.

Rout, Glen A., E.E., a Test Engineer with General Electric Company, has been drafted. He has just completed boot camp at Fort Leonard Wood, Mo.

Toeppe, William J., Jr., E.E. was inducted and is now at Redstone Arsenal, Huntsville, Alabama. He was formerly Junior Engineer with the Ralph M. Parsons Company in California.

Green, Richard H., Ch. E., has been transferred to the Sylva Division of the Mead Corporation in Sylva, North Carolina, where he is Quality Control Supervisor.

Lewis, Don, M.E., has taken a job with the Minnesota Mining and Manufacturing Company, in St. Paul, Minnesota.

Three of Rose's class of '55 graduates have gone ahead to graduate school. Jim Lott, C. E., is at Illinois, Ralph Llewellyn, Ch. E., is at Purdue after spending a summer with General Electric in Cincinnati, and Ritchie Mikessell, Ch. E., is back at Rose after a summer with the Pure Oil Research and Development Division in Crystal Lake, Illinois.
WHY THIS SIGN
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FINER TELEVISION

RCA's 36 years' experience
is yours to share in TV—
black-and-white or color

To pioneer and develop television, in color as well as in black-and-white, called for a special combination of practical experience, great resources and research facilities in the fields of communications and electronics.

RCA was well qualified to do the job:

EXPERIENCE: RCA has been the recognized leader in radio communications since its formation thirty-six years ago. Its world-wide wireless circuits, established in 1919, and its development of electron tubes, laid the groundwork for radio broadcasting in 1920 . . . and the first nationwide radio network in 1926.

Radio broadcasting led to television—and in 1939 RCA made history by introducing black-and-white TV as a service to the public.

Dr. V. K. Zworykin of RCA invented the Iconoscope, or television camera tube, and he developed the Kinescope, now universally used as the picture tube.

RESOURCES: Pioneering and development of color TV has been one of the most challenging and expensive projects ever undertaken by private industry. To date, RCA has spent $50,000,000 on color TV research and development, in addition to the $50,000,000 previously spent in getting black-and-white TV "off the ground" and into service.

RESEARCH FACILITIES: RCA has one of the most complete, up-to-date laboratories in the world—the David Sarnoff Research Center at Princeton, N. J. It is the birthplace of compatible color television and many other notable electronic developments.

No wonder that you can turn to RCA to find all of the essentials of quality and dependability born only of experience.

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.
Daylight dims; on the darkening lawn a kitten leaps at living sparks that flare, go out, and flare again. More arise as shadows deepen, until the whole outdoors is dancing with the lights of love—fireflies flashing signals to their females in the grass. Down among the sprouting blades a momentary glimmer answers, not too soon and not too late. It seems to be a glow of pleasure, a thrill translated into light.

Scientists studying the fireflies’ strange cold light have found that the flash is caused by oxidation of a substance they call “luciferin”, from Latin words meaning “to bring light”. A second substance, “luciferase”, is an enzyme, or catalyst. Acting like a clergyman performing a wedding, it enables the luciferin and oxygen to unite. Both luciferin and luciferase are contained in the fireflies’ myriad microscopic cells, along with the necessary moisture and oxygen. Tiny tubes ventilate the living lantern. If you imitate nature by putting these substances together you get a flash, but only one. After that the mixture seems as dead as a burned out match. Yet the firefly lights again and again. Therefore, something must regenerate the luciferin. This something is energy in chemical form and is present in all living things. It is a high energy phosphate compound called adenosine triphosphate, or ATP for short. Vitamins in food help to make this energy which enables my fingers to type these words, a rabbit to jump, and a firefly to flash.

This then is the firefly’s secret. The chemical energy in its protoplasm revitalizes the luciferin after each flash and makes it ready to flash again. Luciferin and luciferase seem inexhaustible, never consumed. The powdered tails of some fireflies have been kept at a temperature of seventeen degrees below zero Centigrade for as long as three and a half years and will still glow.

Fireflies begin to twinkle at twilight. How do they know when it is time to light up? Laboratory experiments have shown that fireflies react to the degree of darkness and also to the passage of twenty-four hour periods of time, almost as if they were equipped with a photoelectric cell and a clock. The firefly will flash readily in dim light, not at all in bright light, and but rarely in prolonged total darkness. If favorable lighting conditions are provided continually, the periods of flashing recur at regular twenty-four hour intervals, beginning at exactly the same time other fireflies begin under natural conditions. If, however, they are exposed to twelve hours of bright light followed by dusk, they will begin to flash after twenty-four hours of the dim light, although it is now eight in the morning, instead of eight in the evening.

Science knows of more than 1,500 species of fireflies, and each has its own systems of signals. For instance Mr. Pyralis emits a lone, lingering, yellowish flash at intervals of about six seconds, usually on a short rising flight. Codes of some of the other kinds suggest series of dots or dashes. When the evening is warm, the living lanterns of both sexes shine at slightly shorter intervals than when the air is cool. Unduly high or low humidity may cancel the whole show.

Most spectacular is the rhythmic, synchronous flashing of hundreds, or even thousands of fireflies, as if some invisible hand were operating an electric switch. Many reports tell of thousands of fireflies in riverbank trees for a hundred yards or more flashing on and off in regular rhythm. What invisible cheerleader they follow, if any, is still the fireflies’ secret. “Look for the woman”, the French say. This has been advanced as a possible solution. A male gets a response from a female and several males wink back simultaneously, taking heir cue from her or from the one that found her first. Their lights together are bright enough to stimulate another female several yards away. Males near her answer with one accord and their flash ignites a third female, who in turn gathers her following of males. This chain goes on until many flying males are flashing on and off as one.

Females of at least one species are deadly sirens to the alien male, enticing him to his doom. Males of ‘Photinus scintillans’ will come to the flash of a female ‘Photuris pennsylvanica’, with the result that they are caught and eaten. She has quite a taste for suitors. This cannibalistic “Pennsylvanian” responds to potential mates or prey with a single somewhat subdued flash. If the flyer’s signal consists of two to five sharp greenish yellow flashes in rapid succession, the suitor is Mr. Pennsylvanian, acceptable as a husband. But if the light is short, orange tinted, and given at five-to-ten-second intervals, she may soon make a meal of luckless Mr. Scintillans.

Scientists will go on delving into the innermost secrets of the firefly. Thousands of the insects lose their lanterns yearly in the laboratory and become martyrs to science. (As adults they would die soon, anyway.) But always on a warm evening the dance of light and love goes on. Myriad mating flashes foretell that a new generation will carry the torch for love or for science.
Boeing engineers have a date with the future

Guided missiles like this Boeing Bomarc IM-99 are increasingly important in America's defense planning. Many kinds of engineers—electrical, mechanical, civil and aeronautical—play vital roles in developing it. The knowledge they are gaining will be priceless in producing the supersonic airplanes and guided missiles of the future. These men explore the frontiers of engineering knowledge in rocket and nuclear propulsion, in extremes of vibration, temperature and pressure and in many other fields.

Boeing engineers are members of aviation's top creative team. The aircraft they help develop will maintain the leadership and prestige established by the Boeing B-47, the present "backbone" of Strategic Air Command . . . the B-52, our giant new global bomber . . . the Bomarc IM-99 . . . and, most recently, the 707 and KC-135, America's first jet transport and tanker.

At Boeing, engineers' professional achievements are recognized by regular merit reviews and in other ways. The Boeing policy is to promote from within the organization. And Boeing is known as an "engineers' company." One out of every seven employees is an engineer! Among top management, the proportion is even higher.

Equipment at Boeing is superb: the latest electronic computers, a chamber that simulates altitudes up to 100,000 feet, splendidly equipped laboratories, and the new multi-million-dollar Flight Test Center. The world's most versatile privately owned wind tunnel, at Boeing, is soon to be supplemented by a new tunnel capable of velocities up to Mach 4.

Do you want a career with one of America's most solidly growing companies? Do you want a chance to grow, and to share in the challenging future of flight? Then plan your career as a member of one of Boeing's engineering teams in design, research or production.

For further Boeing career information consult your Placement Office or write: RAYMOND J. B. HOFFMAN, Admin. Engineer Boeing Airplane Company, Wichita, Kansas

November, 1955
Radiant baseboard heating with zone control, low ceilings, a centralized signal system, and built-in dressers with sliding mirrors, are only a few of the unusual qualities which enable the new dormitory to compare favorably with any collegiate housing unit constructed by any college in recent years. The half a million dollar, stone, brick and reinforced concrete structure is one hundred per cent fireproof. The building which faces east and has 67 rooms (65 double and 2 single) will accommodate 132 students.

A highlight of the dormitory is a guest lounge located on the first floor. A feature of this lounge is a ladies' powder room. A guest room on the first floor is equipped with a private bath and will probably be used as an infirmary. A typical room as shown in the sketch will contain two single beds and built-in desks and dressers. Above the dresser will be found a sliding mirror, behind which toilet articles can be kept. The ceiling is only seven feet seven inches high; thus offering more floor space per unit of volume.

Each floor has a conveniently located washroom which contains individual shower stalls. Storage space for the maids and janitors on each floor is merely a part of the wealth of storage space located in the building. A student laundry room will be located in the basement which will possibly be installed automatic washers. Also included in the basement is a 490 square foot hobby room which is to be furnished by the Dormitory Association as they see fit. Part of the basement will be left unfinished, but can be made into more rooms if further expansion is desired.

One of the features of the new dormitory is a large apartment for the dormitory supervisors, Mr. and Mrs. Ross. The apartment has five rooms which includes two bedrooms, a large living room, a kitchen and a dinette. Their old apartment did not include a kitchen; hence this feature will be a distinct advantage for them. Being located in a separate wing of the building, the apartment has no rooms above it; thus affording the Ross's less disturbance.

Just outside of the entrance to the apartment is an office. This office is for the use of the dormitory supervisors and also for the students. In this office will be located the centralized signal system for the dormitory. A quiet place to study for students assigned to phone duty as well as a headquarters for the officers of the Dormitory Association will be provided by this office.

The building will glow with bright colors. The halls will be vivid grey with the metal stairway rails a coral color. One third of the individual rooms are going to be painted a smooth suede brown, another third in a sparkling light green, and the rest in a cool grayish blue. The desks and dressers are made out of a brown colored material which is highly resistant to heat and stains.

According to all reports the dormitory will be finished by June 1, although occupancy will not be initiated until the fall term in September, 1956. As far as we were able to discern, the reaction of the students and faculty members on the dormitory in general may be summed up by two words—enthusiasm and anticipation!
FROM TALC TO TRAP ROCK...

Where uniform particle size is a must, industry uses wire cloth to screen materials. It may be an extremely fine wire cloth with 160,000 openings to the square inch... for talcum powder or for laboratory metallurgical analysis. Or it may have only four openings per square foot and be woven of heavy rods to withstand the constant pounding of crushed rock.

Between these extremes, the great variety of weaves, weights, meshes and metals makes possible 10,000 different specifications for screens designed to withstand abrasion, chemical corrosion and wide ranges in temperature.

In its hundreds of uses, wire cloth sizes, screens, filters, grades, cleans and helps process everything from paper to petroleum. It is indispensable to the food and chemical industries... to mining and manufacturing... to ceramics and construction.

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After you leave school, you will want to keep abreast of developments in your chosen profession. Then one of McGraw-Hill's many business magazines will provide current information that will help you in your job.

A CAREER FOR YOU...

To a few 1956 engineering graduates, "McGraw-Hill" will mean "writing" as well as "reading."

If you are interested in becoming an engineering editor, write our Personnel Relations Department—now—about your qualifications for an editorial career.
Mackinac Straits Bridge

(Continued from Page 11)

Major items in the fleet, valued at approximately 4 million dollars, range from 10 powerful whirlie der- ricks or bargemounted cranes to 5 work boats used, among other services, to shuttle workers to and from the construction sites in the straits. Other craft included 5 tugs and approximately 20 material and equip- ment barges especially equipped for concreting operations at the piers, two equipped for welding operations and two covered cement barges.

Traffic Across Straits
The bridge as designed has a road- way 48 feet wide, with four lanes for traffic. The opposing pairs of traffic lanes are separated by a center mall two feet wide. For emergency and maintenance use there is a three-foot wide sidewalk on each side of the bridge. The roadway of the bridge will be capable of handling 1500 vehicles per hour in each lane. The load limit of the bridge would not be exceeded if four lanes of heavy trucks 50 feet apart were to pass over the bridge. The outer lanes will be of concrete filled steel grid topped with asphalt. The inner lanes will be open steel grate to allow the ice and snow to fall through.

Highway traffic has been moving across the Straits of Mackinac by use of five ferries operated by the state of Michigan. The average time for crossing by ferry is 53 minutes, and this excludes waiting time and delays due to bad weather. On completion of the new toll bridge across the straits, traffic will make the crossing within 10 to 12 minutes. All tolls for the bridge will be collected at the St Ignace approach on the Upper Peninsula. The cost will be the same as is now charged on the ferries. The tolls will have to pay the whole cost of construction and maintenance of the bridge, since the state of Michigan did not guarantee the bonds. The experts predict that in 1958, the first full year of operation, 2,123,000 vehicles will use the Mackinac Straits Bridge. This represents an amount in tolls that will be more than adequate to fulfill the yearly obligations. More bonds than were necessary to finance the bridge were authorized. This will provide a cushion of approximately 10% of the cost for unseen emergencies.

The bridge construction has given the sister cities of Mackinaw and St. Ignace quite a shot in the arm. The huge influx of construction workers with their ready dollars has created a boom-town like atmosphere which has been to the advantage of the townspeople. It has also stimulated new construction in these cities because of the need for new housing and schools. The completion of the bridge will probably cause a slight letdown in the local economy, but this vacuum will soon be filled by the increased tourist traffic between the two peninsulas. It is the hope of the bridge planners that this structure will not only improve the economy of the adjacent communities, but also that of the whole state through increased ease of transportation and communication between the two peninsulas that are Michigan.

Traffic Insert
Design loading for the entire floor structure and the shorter main girdlers and trusses are the American Association of State Highway Officials' standard H20-S16-44 loadings. For the four-lane bridge design on the suspended portion, a live load of 2,000 lb. per lin. ft. of bridge was adopted. This represents a line of heavy trucks about 50 feet apart on each of the four lanes—a loading which will probably never be reached in actual conditions.
The steel that could take anything but a bath

In steel mills and warehouses, a roller leveler straightens wide sheets and heavy plates between powerful steel rolls.

Stress on the rolls is tremendous. To make them strong and tough enough, one manufacturer used an alloy steel, 52100. Then, to make the rolls hard enough, they were heated to a high temperature and quenched in a liquid bath. But the severe quench was causing many of the rolls to warp.

The roll maker took his problem to Timken Company metallurgists, asked if he could make rolls from 52100 steel that wouldn’t distort in quenching. They said yes—if the steel were uniform from lot to lot in analysis and hardenability.

TIMKEN® steel quality control solved the distortion problem

The roll maker switched to 52100 steel made by the Timken Company. He found the steel was uniform from lot to lot, heat to heat, year in and year out. Result: he was able to standardize heat-treating practice. Distortion was practically eliminated.

The Timken Company constantly solves steel problems like this one by furnishing steels to the most exacting specifications. Timken Company metallurgists are specialists in fine alloy steels. And they use the most modern quality control methods to assure uniformity, time after time after time.

Want to learn more about steel or job opportunities?

Some of the engineering problems you’ll face after graduation will involve steel applications. For help in learning more about steel, write for your free copy of “The Story of Timken Alloy Steel Quality.” And for more information about the excellent job opportunities at the Timken Company, send for a copy of “This is Timken”. Address: The Timken Roller Bearing Company, Canton 6, Ohio.
ROTC Student: “I haven’t pencil or paper for the examination.”
Sgt. Arthur: “What would you think of a soldier who went into battle without his gun or ammunition?”
ROTC Student: “I’d think he was an officer.”

Girlie: “Would you help a young woman in trouble?”
Engineer: “Sure, what kinda’ trouble you wanna’ get into?”

Platonic love is like being invited down into the cellar for a glass of ginger ale.

A frantic mother rushed into a doctor’s office, dragging a four-year-old boy by the hand. “Doctor,” panted the woman, “is this child capable of performing an appendectomy?”

“Why, my dear lady,” answered the doctor, “don’t be silly! Of course not!”

“In a night club one evening a very pretty girl was wearing, around her neck, a thin chain from which hung a tiny golden airplane. One of the young men in the party stared at it so that the girl finally asked him, “Do you like my little airplane?”

“As a matter of fact,” he replied. “I wasn’t looking at it, I was really admiring the landing field.”

A college freshman was being severely criticized by his professor.

“Your last paper was very difficult to read,” said the professor. “Your work should be written so that even the most ignorant will be able to understand it.”

“Yes, sir,” said the student. “What part didn’t you get?”

A tramp knocked on the door known as “George and the Dragon.” When the landlady opened the door the tramp asked:

“Could you spare a poor hungry man a bite to eat?”

“No!” said the woman as she slammed the door.

The tramp knocked again. As the woman opened the door he asked: “Could I have a few words with George?”

A young man took his city-bred girl friend into a night club that was decorated in cowboy style.

They were there a short time when the girl arose and excused herself to go and have her face made up.

She returned a moment later and her countenance was blushing red. “Ted,” she said, “you’ll have to help me. Am I a heifer or a steer?”

Wise Guy (Civil Engineer boarding the street car): “Well, Noah, is the Ark full?”

Conductor: “Nope, we need one more jackass: come right in.”

She was only a gearmaker’s daughter, but she could outstrip them all.

Professor (pointing to cigarette butt on floor): “Jones, is this yours?”
Jones (Pleasantly): “Not at all, Sir. You saw it first.”

Blue eyes gaze at mine—Vexation
Soft hands clasped in mine—Palpitation
Fair hair brushing mine—Expectation
Red lips close to mine—Temptation
Footsteps—DAMNATION!

Hello, honey, I could hardly wait to tell you what’s happened . . . Dad’s cut off my allowance, I had to sell the car and drop my fraternity, but we can still have fun just . . . Hello? . . . Ann? . . . Hello . . .
New Electronic "Engineer"
Solves Tough Refinery Problem

The men who design modern oil refineries need specific information about temperature distributions in different parts of pressure vessels. Such information, essential to safety and efficient operation, is often extremely difficult to obtain by conventional mathematical methods.

Scientists at Standard Oil's Whiting laboratories recently developed and built an electrical analogue capable of simulating specific conditions within a refinery unit still in the design stage. Using this device, they could determine in advance the temperature distribution in the joint between two pressure vessels having a common head. Thus they were able to duplicate in 20 seconds the heat stress picture within the unit during an 8 hour start-up to shut-down period.

Creative scientific thinking made possible this constructive achievement by engineers who have chosen to build their careers at Standard Oil.
A very rich deposit of oil was discovered on the farmer's land. Immediately he rushed into town to purchase a new car. An obliging salesman showed him a sleek roadster selling for $5,000.

“I am prepared to pay cash,” said the farmer. “Will I get a discount?”

“Why certainly,” replied the salesman. “We will give you 10% discount on a cash purchase.”

Not being confident of his ability as a mathematician, the farmer said he would think it over and return later.

He walked into a restaurant and over his coffee tried to figure what his discount would be, but to no avail. Finally, in desperation, he returned to the waitress and asked, “If I gave you 10% of $5,000, how much would you take off?”

Blushing prettily, the waitress whispered, “Would my earrings bother you?”

* * *

When a girl says she's got a boyish figure, it's usually straight from the shoulder.
Diversity of technical skills required by Allison in the design, development and production of turbo-jet and turbo-prop engines offers a wide range of opportunities to young graduate engineers.

And, the Advanced Educational Facilities help the young graduate find the work best suited to his academic training and liking.

For instance, there's Wayne McIntire (above) Mechanical Engineer, Purdue University, who came to Allison upon graduation in 1950. After completing the training program, Wayne now is doing the kind of work he wanted, and is technically qualified to handle. He is Project Engineer, mechanical design of gear boxes. He is shown making an adjustment on the propeller linkage control on the cutaway model of the Allison T56 aircraft engine. This, incidentally, is America's first production turbo-prop engine, and is used in the Lockheed C-130 Hercules, a 54-ton transport. The Allison Model 501, which is the commercial version of the military T56, is the powerful turbo-prop engine proposed for commercial airline use.

In his present job, Wayne works on initial design...helps decide what components—such as propeller brakes, accessory drives, oil pumps, etc.—are needed for the specific project.

The nature of Allison business continually presents a variety of interesting and challenging problems to the engineering staff, which—along with the Mechanical, Aeronautical, Electrical, Metallurgical, Chemical and Industrial Engineers—includes majors in Mathematics and Physics.

We'll welcome the opportunity of telling you more about the Allison Advanced Educational Facilities, and the benefits and advantages which can be yours at Allison. Arrange for an early interview with our representative when he visits your campus, or write for information about the possibilities of YOUR engineering career at Allison:

R. G. GREENWOOD, Engineering College Contact, Allison Division, General Motors Corporation, Indianapolis 6, Ind.
Nearly all guided missiles require specialized and highly advanced electronic systems of miniature proportions. These systems may include servo-amplifiers, microwave receivers and transmitters and extremely efficient though compact power supplies. The performance objectives for this equipment would be difficult in conventional engineering applications. At Hughes, the achievement of such objectives in the very limited space and under stringent environmental conditions of the modern guided missile provides an unusual challenge to the creative engineer. Positions are open for Engineers or Physicists with experience in systems analysis, electronic guidance systems, infrared techniques, miniature control servo and gyro systems, microwave and pulse circuitry, environmental testing, systems maintenance, telemetry, launching systems and flight test evaluation.

Scientific and Engineering Staff

HUGHES
RESEARCH AND DEVELOPMENT LABORATORIES
Culver City, Los Angeles County, California
In the Arma Visual Computer, a single control selects the desired chart from as many as 700 photo slides. Each slide contains punched code holes which automatically tune in the corresponding Omni Bearing Distance station. The image of the plane is governed by a combination of the radio signals and the plane's gyro instruments.

Photography teams with electronics and adds new certainty to flight

Now a visual computer pictures a plane's precise position and heading on projected photos of aeronautical maps.

Arma Division, American Bosch Arma Corp., working with the Air Navigation Development Board and C.A.A., has developed a valuable new aid in air navigation using photography.

With it the pilot, high above the weather, flicks a switch and before him appears a map of the area he's over. On the screen a tiny shadow of a plane moves and shows exactly where he is, where he's heading and whether he's on course.

This spells added certainty. Even more! It can mean savings in time and money, too. For the flight can proceed by plan rather than by dog-legs on the beams.

So again we see photography at work helping to improve operations—doing it for commercial aviation just as it does for manufacturing and distribution.

Photography works in many ways for all kinds of business, large and small. It is saving time, saving money, bettering methods.

This is why graduates in the physical sciences and in engineering find photography an important tool in their new occupations. Its expanding use has also created many challenging opportunities at Kodak, especially in the development of large-scale chemical processes and the design of complex precision mechanical-electronic equipment. If you are interested in these opportunities, write to Business and Technical Personnel Department, Eastman Kodak Company, Rochester 4, N. Y.

Eastman Kodak Company, Rochester 4, N. Y.
G-E manufacturing expansion offers you . . .

Challenging careers in manufacturing engineering, administration, quality control, supervision

General Electric's growth in the next 5 to 10 years presents outstanding opportunities to engineers in the fields of supervision, purchasing, manufacturing engineering, production, quality control, and the specialized administrative functions required to manufacture over 200,000 products for industry, the home, and defense.

G.E.'s manufacturing program builds professional careers through a series of working assignments geared to your interests and abilities. Career potential is varied. In this G-E Tri-Clad™ '55' motor factory, for example, Jim Olin, Cornell '43 (center, wearing safety glasses) is superintendent of one of the most modern manufacturing facilities in industry. Accelerated by the trend to continuous processing, facilities such as this at G.E. are raising the demand for qualified manufacturing personnel.

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