SPARTAN Engineer

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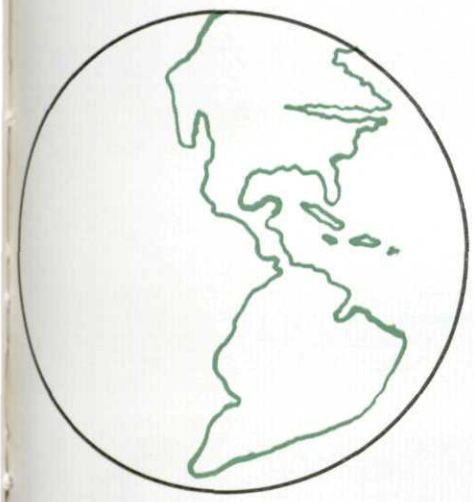
March, 1960



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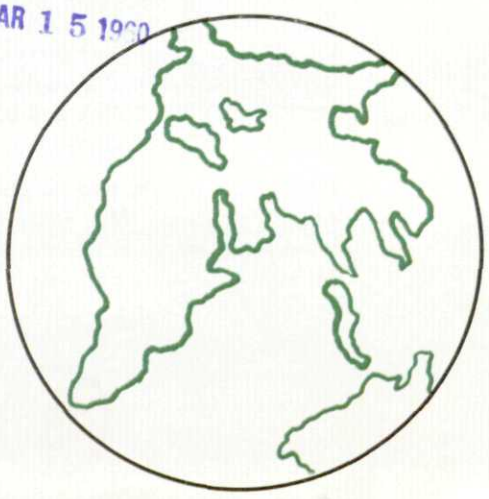

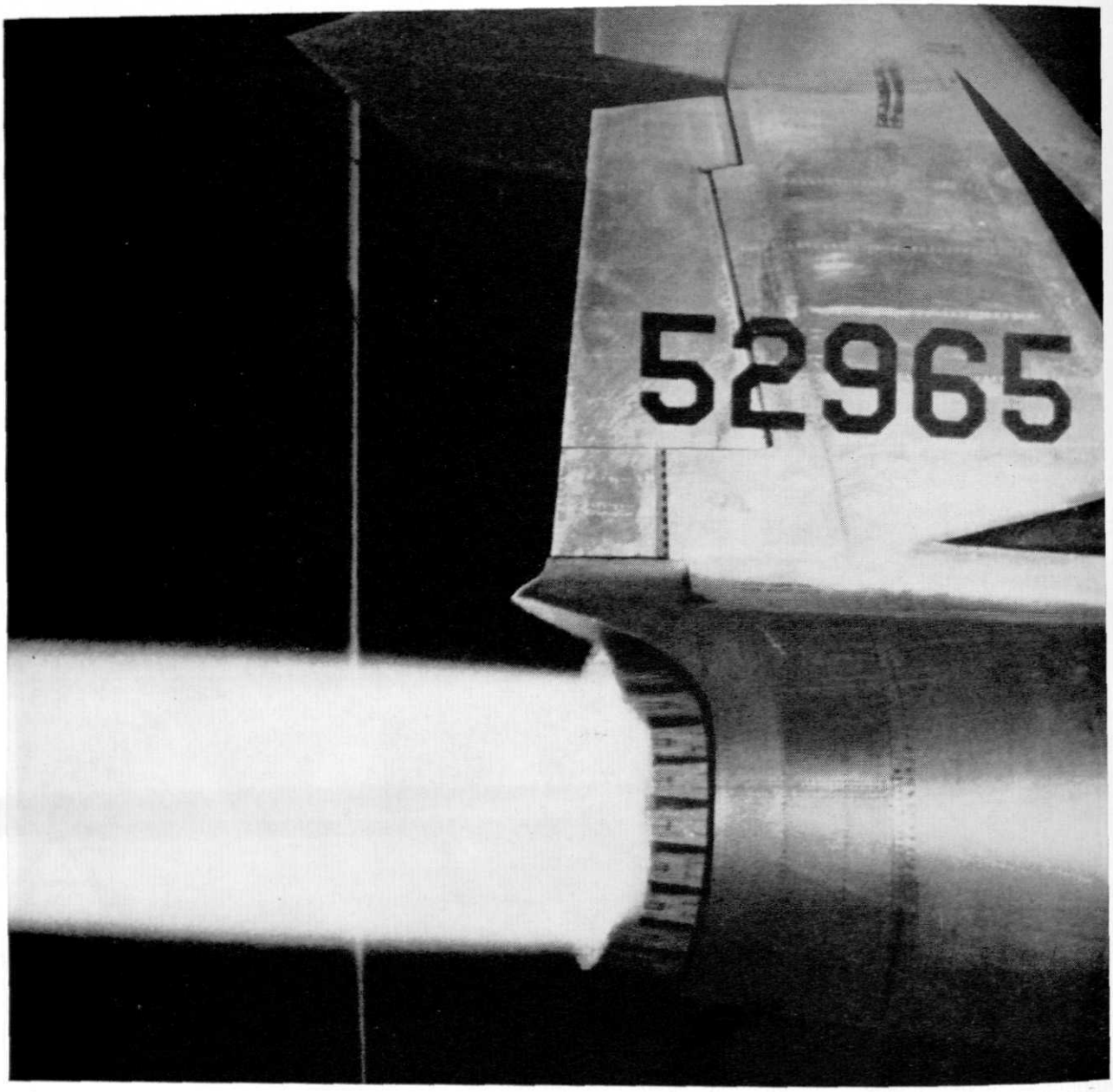

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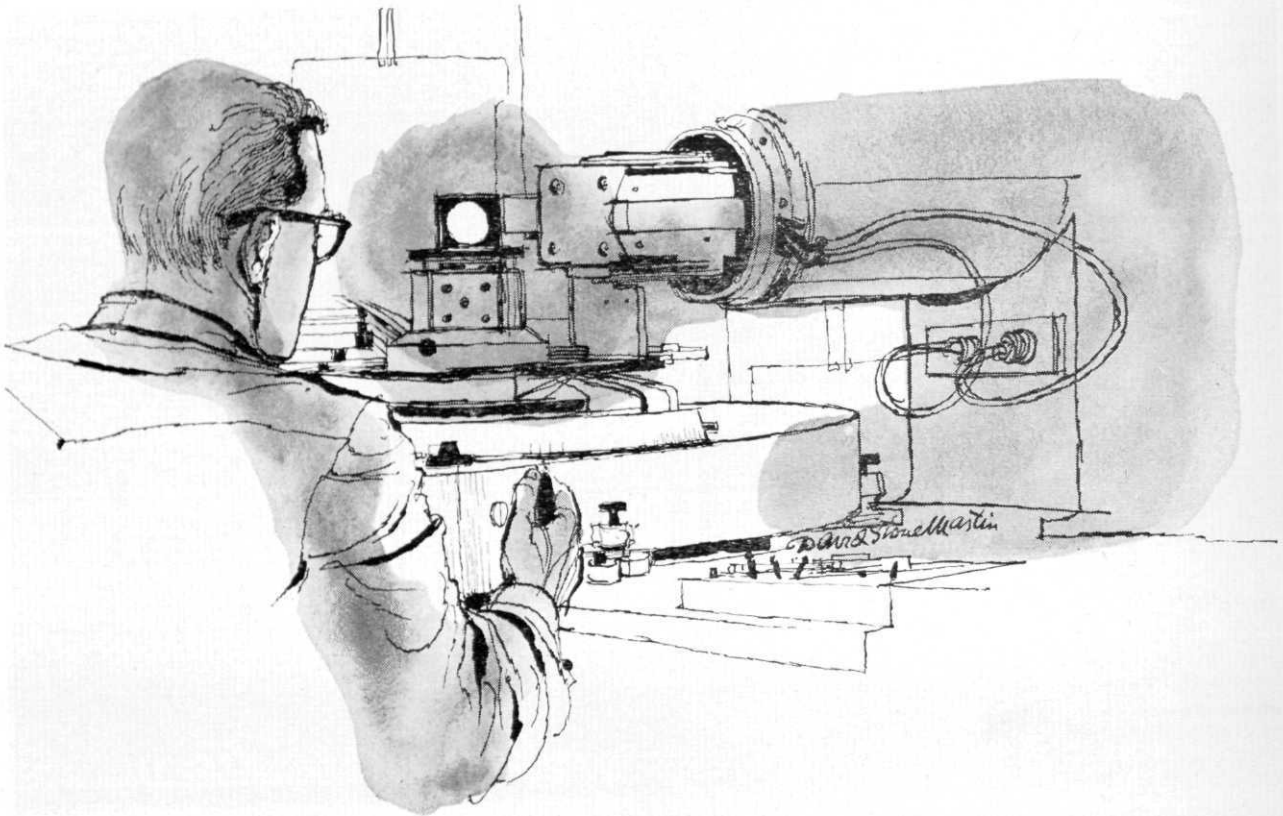

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Interior of Saran Wrap* plant.

DOW is tomorrow-minded

product

Publishing a *complete* list of Dow products—all 700 odd of them—is an elusive project. By the time such a list was off the press, new names would have to be added to bring the list up to date. The reason: development of new products is the order of the day at Dow, every day of the working year.

These new products are developed to meet the needs of the many industries Dow serves. *Today's* problems in manufacturing and processing must be solved, and, as these industries advance, new chemicals and materials will be needed to implement tomorrow's technology. At Dow, research and development aim at anticipating these future needs . . . thus a "tomorrow-minded" attitude toward products is always evident.

The product group of Dow Agricultural Chemicals, for example, has expanded manyfold in recent years through a vigorous research and developmental program. In the early '50's it consisted of two or three products. Today it includes many varieties of weed killers, fertilizers, fumigants, insecticides, feed additives and animal health aids. A new crab grass killer has recently made its debut, first in a series of new "ag chem" products slated for the homeowner market.

Dow's work in automotive chemistry is typical of the "tomorrow-minded" attitude. Dow currently supplies a number of chemicals and plastics materials to auto makers—latex-based metal primers, antifreeze, upholstery materials and brake fluids, to name a few. But a quick tour through Dow's two Automotive Chemicals Laboratories would reveal that Dow will be ready with the right chemicals and plastics for the job, no matter which way future automotive design goes! One under development, for example, is a chemical that cools the engine by continuous boiling.

One of the most outstanding success stories at Dow is that of Separan®, a product developed to fit into industry's future. This chemical is a flocculant, or "settler" of solids in solution. Perhaps "super flocculant" would be a better description because Separan takes minutes to do jobs that formerly took days. Introduced in 1955, it has gained widespread recognition in mining, pulp and paper and other industries.

In such a climate of creativity and tomorrow-mindedness, new opportunities at Dow are constantly opening up for people who have their eyes—and their thoughts—on the future. If you'd like to know more about the Dow opportunity, please write: Director of College Relations, Department 2426FW, THE DOW CHEMICAL COMPANY, Midland, Michigan.

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DOW

Dean's Letter

So much to know—so little time to learn! This seems a common theme of the freshman, sophomore, or junior in engineering. Many of the same students, as seniors, discover that in their cases the wording more adequately describes their situation if it is changed to: So much time—so little learned!

Our modern scientific and technical knowledge is built upon foundations laid by earlier investigators and discoverers, who in turn built on even earlier scientific and engineering discoveries. To encompass the foundations plus our modern accumulation of knowledge is obviously impossible—one engineering society last year published 18,000 pages of material in one engineering field alone.

How then do our leading engineers and technologists accumulate the vast knowledge of their technical areas required by their daily work? The answer is—only in rare cases do they have a detailed and intimate knowledge—but they do have a thorough understanding of the basic general principles of their field. They are able to develop a problem and its solution through application of general principles, rather than through application of special methods unique to that problem. They understand and rapidly apply the basic principles of engineering; conservation of energy, mass, and momentum, employ summations of forces, moments, currents, or voltages and a few others. They may not know the special method or short cut applicable to a particular problem, but they understand and can employ the mathematics and the basic methods of attack suited to a great many problems.

Understand the general method rather than trying to memorize the specific case. It may be more valuable to you to understand the basic definition of a derivative than to remember that the derivative of $d(1/x)/dx$ is $-1/x^2$. In your classes search for the basic principle which is applied in each subject area, and perhaps as a senior you can make your theme—"So much time—so much understood."

—J. D. Ryder, Dean

Spartan Engineer

of michigan state university

VOLUME 13 NO. 3 MARCH, 1960

FEATURES

DEPARTMENTS

COVER: The cover for this month's *Spartan Engineer* was designed by Reg Pilarski and LaVerne Root, members of the staff. It portrays the international recognition of our engineering program throughout the seventy-five years that engineering has existed at Michigan State University.

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* * *

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Student Frank G. analyzes the

Spectrum of skills built into Hamilton Standard products

Some engineering specialties that contribute to creating this engine control:

- FLUID DYNAMICS
- HYDRAULICS
- ELECTRONICS
- METALLURGY
- VIBRATION
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- CONTROL DYNAMICS
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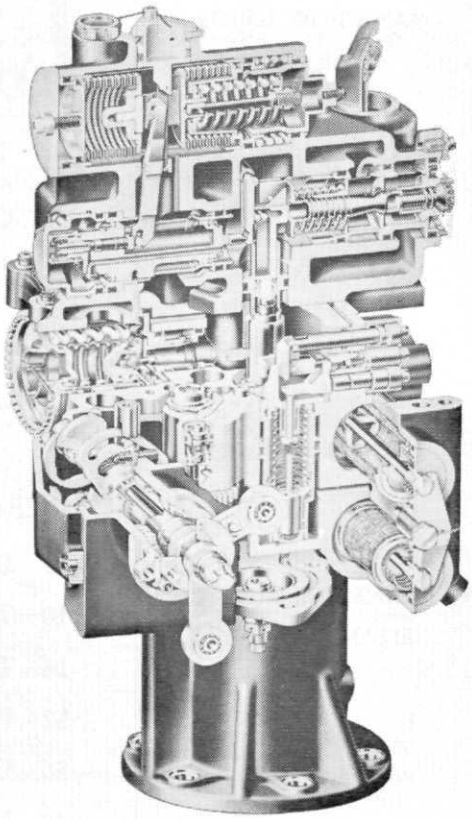
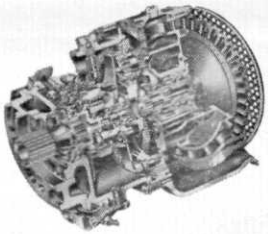
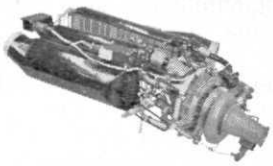


OTHER PRODUCTS DEVELOPED BY THIS INTEGRATION OF VARIED SKILLS:

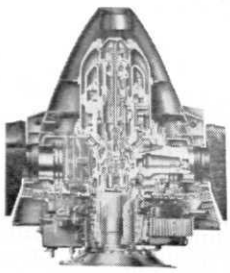


JET ENGINE STARTERS

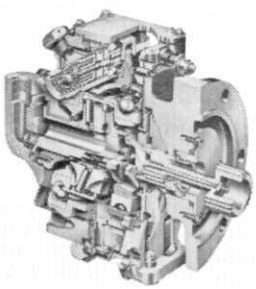
ELECTRONIC FLIGHT CONTROLS



ENVIRONMENTAL CONTROLS



TURBO PROP CONTROLS



HYDRAULIC PUMPS

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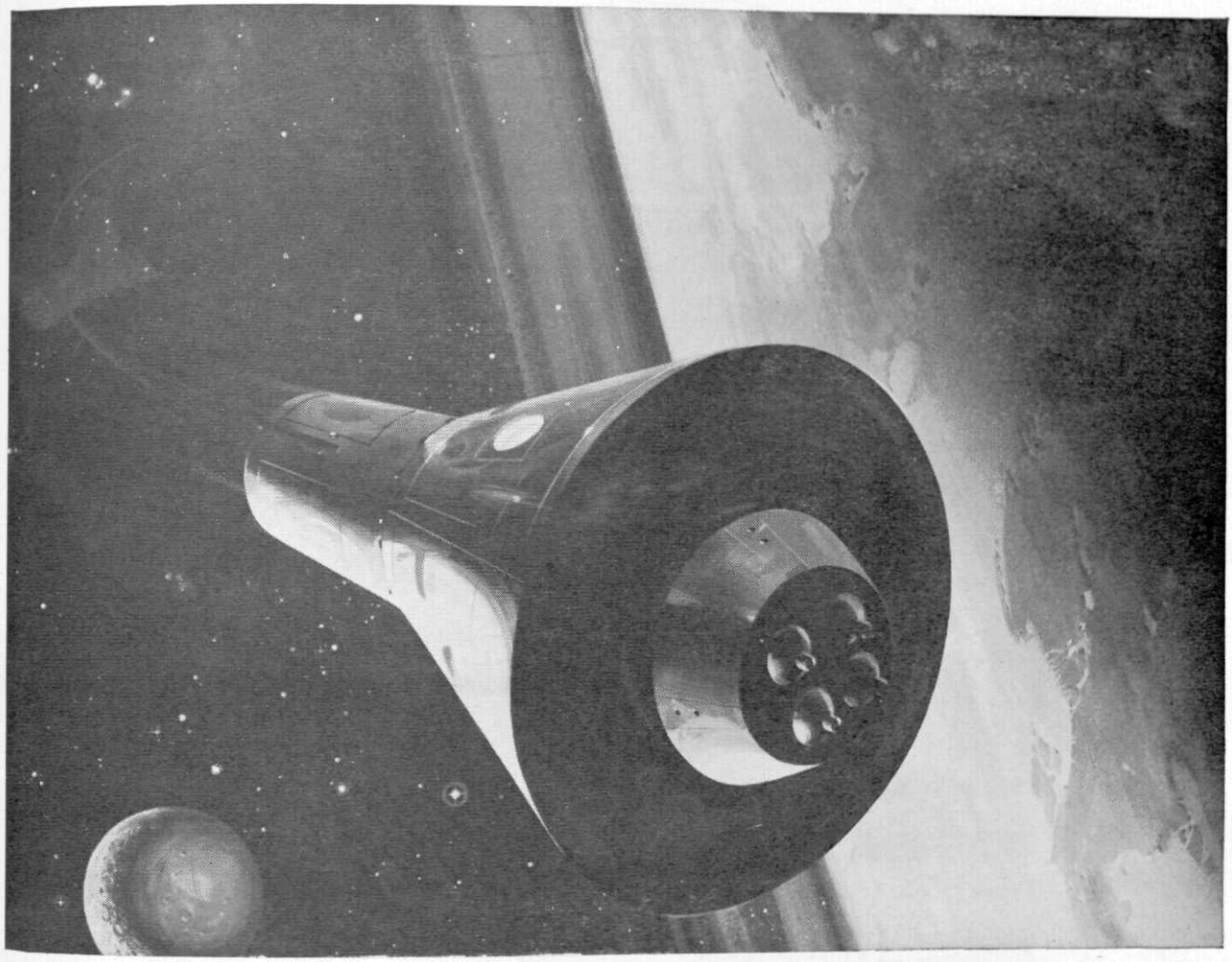

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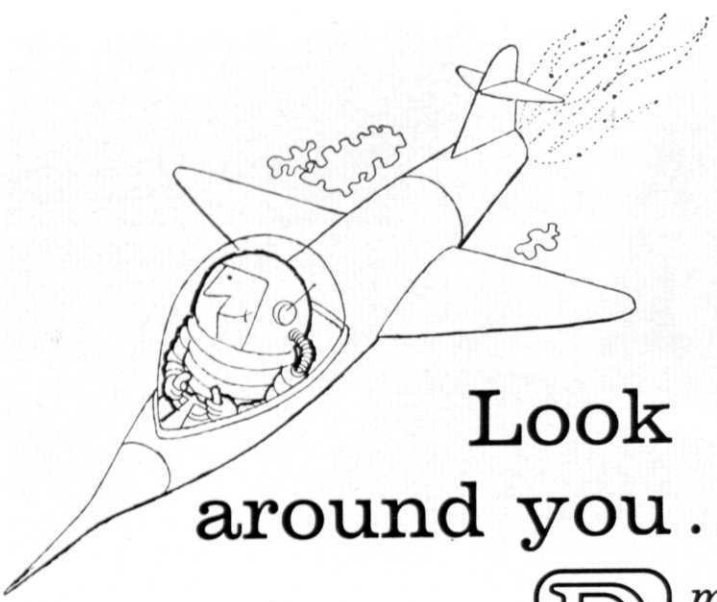

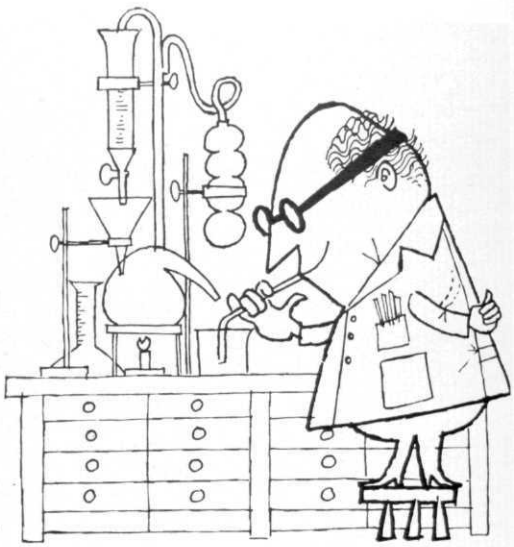

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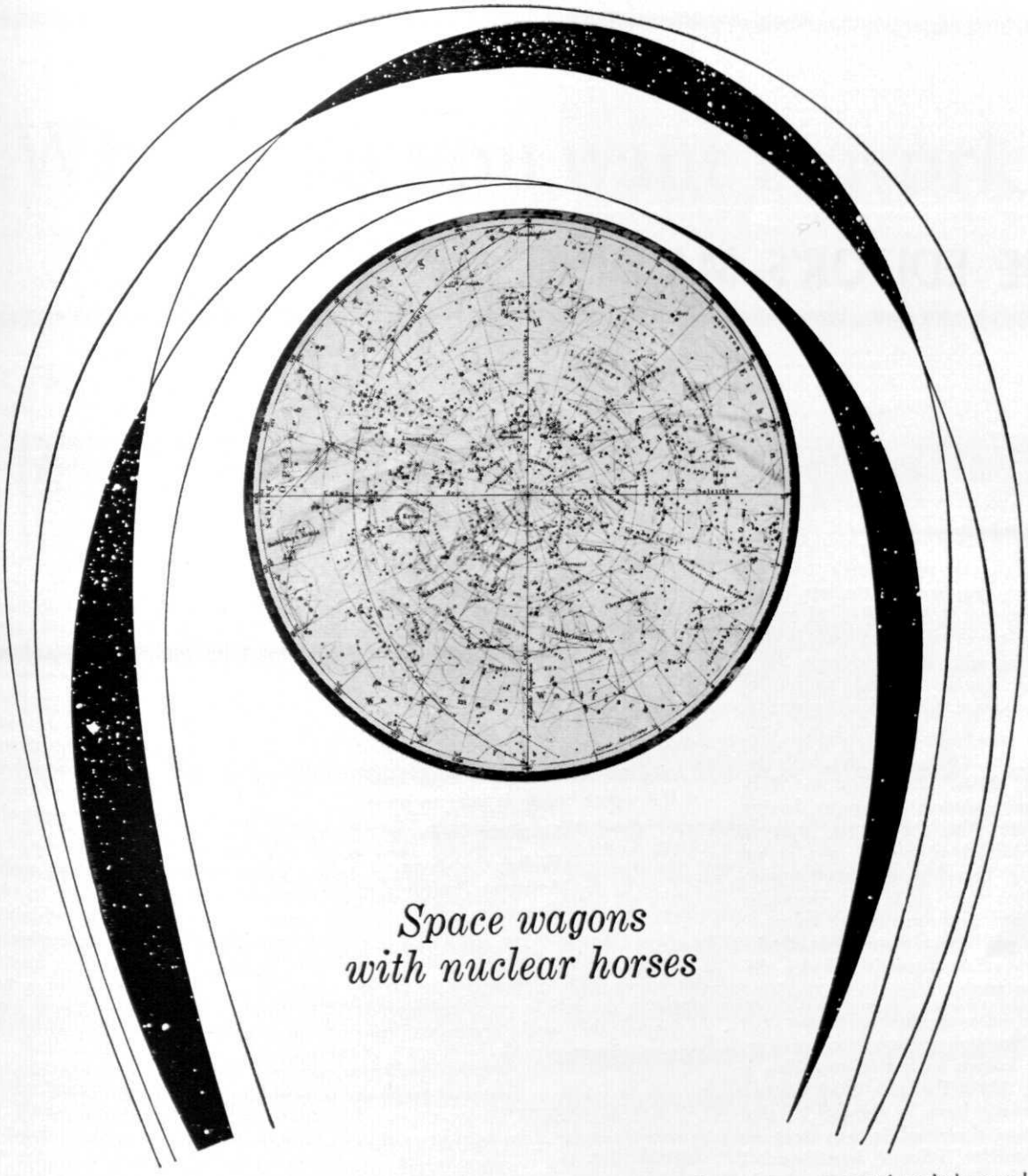


Space wagons with nuclear horses

Space exploration will really come of age when manned rockets can leave earth, accomplish their missions and return without disposing of parts of themselves en route. This breakthrough depends on the rapid development of both nuclear rocket engines and the space vehicles capable of using them. Douglas is putting forth a major research effort in the area of manned nuclear space ships. Every environmental, propulsion, guidance and structural problem is being thoroughly explored. Results are so promising that even if the nuclear engine breakthrough comes within the next five years, Douglas will be ready to produce the vehicles to utilize this tremendous new source of space power! Douglas is seeking qualified scientists and engineers for this and other vital programs. Write to C.C. LaVene, Box 600-X, Douglas Aircraft Company, Santa Monica, California.

Elmer Wheaton, Engineering Vice President, Missiles and Space Systems, goes over new space objectives that will be made possible by nuclear propulsion with Arthur E. Raymond, Senior Engineering Vice President of DOUGLAS

MISSILE AND SPACE SYSTEMS ■ MILITARY AIRCRAFT ■ DC-8 JETLINERS ■ CARGO TRANSPORTS ■ AIRCOMB ■ GROUND SUPPORT EQUIPMENT

THE EDITOR'S MAILBAG

Dear Editor:

Thank you very much for the complimentary copy of the last "Spartan Engineer." A number of rather serious errors were printed in the article on ultrasonics on page 24. I am referring to the section on research conducted in this University.

The article states that monochromatic light is broken up into its "component colors." According to Webster, monochromatic means having **one** color. Also, the primary purpose of a diffraction grating was stated wrongly. Therefore, a diffraction grating does not split monochromatic light into its component colors—it simply produces a series of bright interference lines, usually called a diffraction pattern.

The write-up goes on to say that this diffraction pattern is more commonly known as a rainbow. This is wrong. About the only thing the two phenomena have in common is that both are explained in any text on optics—under different headings. I don't see how a number of bright straight lines even reminds anyone of a rainbow.

The article then states that with the method mentioned it is possible to investigate the "characteristics of the velocity of **light.**" This is wrong again; one measures the velocity of **sound.** I am also very unhappy with the statement that the "sound waves take the place of a raindrop or any other prism," not only because I feel that a raindrop is not a prism.

I have no idea how the application of the phenomenon described can be useful in investigating the "action of light passage through lenses and crystals." I cannot even correct that statement because it is a senseless combination of nice words.

With the exception of the first two paragraphs, the write-up concerning my own research is so much in error that I have to ask you what you intend to do about it. It seems to me that this article could be damaging to the reputation of the publishers, not to mention the impression readers will get when they hear about such fantastic research activities at MSU.

Why doesn't one get a rough draft of the report before it goes to press?

Sincerely yours,

Walter G. Mayer
Assistant Professor of Research

Editor's Note: Both the editor and the author wish to apologize for errors made in the article on ultrasonics. It is hoped that such errors will not occur in future articles.

Dear Editor:

The Spartan Engineer has stressed the importance of taking part in the activities of the College of Engineering, but no one has taken time to list some of these activities or how one might benefit from them. I would therefore like to say a few words about the value of membership in the professional societies for the engineering students.

Practically all of the technical societies organized by engineers for the collection and dissemination of technical information in a particular field encourage affiliated membership in their ranks by students in engineering colleges.

Why should an engineering student be a member of a professional society student group? Student membership labels him as a person interested in obtaining professional stature as an engineer. Student membership indicates he has sufficient interest in his chosen profession to train himself to meet its qualifications, and hopes to create for himself a career in this field which will earn the respect of his colleagues and the commendation of his employers. Student membership, especially active membership, indicates to a prospective employer a healthy interest in professional development.

Other benefits of student membership are the opportunities to obtain copies of the society's publications, to participate in student meetings and in the local senior-member meetings, and in some societies the opportunity to convert his membership to regular membership without the usual initiation fee.

Every engineering student who has chosen his professional study area should seriously consider joining and becoming active in one of the engineering societies represented on our campus by student member groups. At Michigan State these are ACS, AIChE, AIEE, AFS, ASAE, ASCE, ASM, ASME, IRE, SAE.

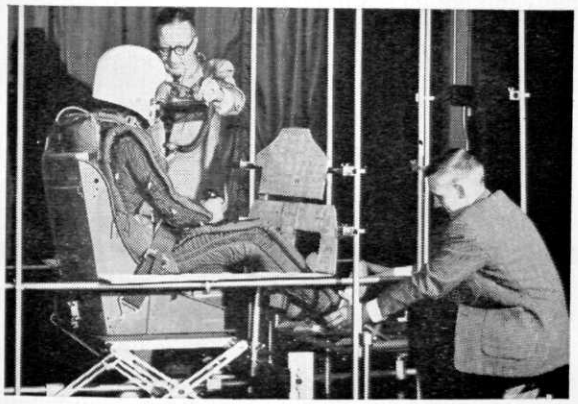
Respectfully,

Louis L. Otto,
Head of Mechanical Engineering Dept.

The Spartan Engineer welcomes letters from its readers, so break out that scratch pad and let us know what you're thinking. Perhaps someone would like to pick up where Dr. Otto left off and tell the reader about some of the other types of organizations for the engineering students.

Where do you want to work?

These 2 answers may shape your future



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RADIOPLANE DIVISION, creator of the world's first family of drones, produces and delivers unmanned aircraft for all the U.S. Armed Forces to train men, evaluate weapon systems, and fly surveillance missions. Today Radioplane is readying the recovery system for Project Mercury.

NORTRONICS DIVISION is a leader in inertial and astronertial guidance systems. At Hawthorne, Nortronics explores infrared applications, airborne digital computers, and interplanetary navigation. At Anaheim, Nortronics develops ground support; optical and electromechanical equipment; the most advanced data-processing devices.

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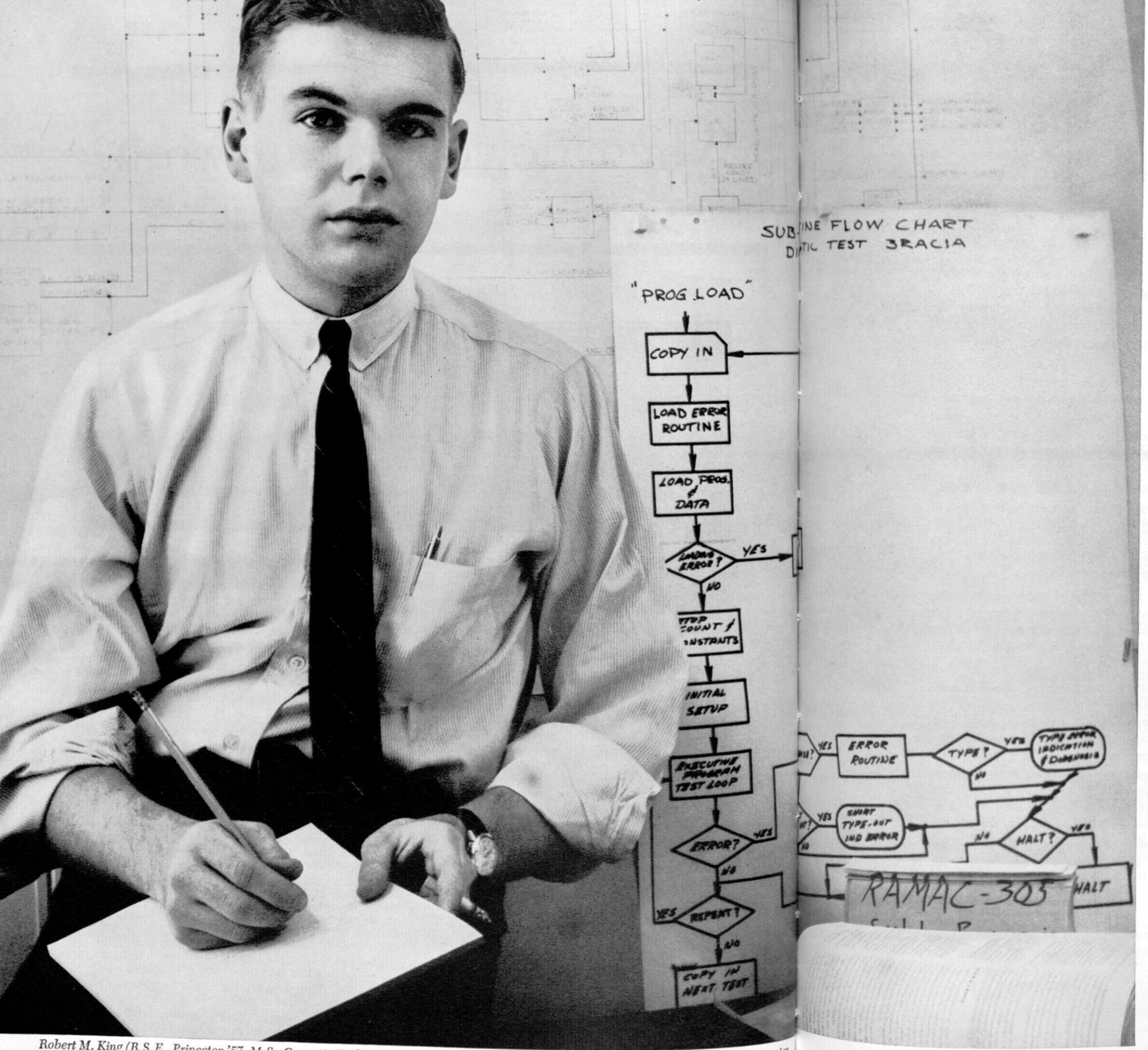

Robert M. King (B.S.E., Princeton '57, M.S., Carnegie Tech) is investigating applications of the electronic computer in advanced computer design. A skilled computer programmer, he has done original work in organizing programs that make possible computer self-diagnosis.

HE GETS COMPUTERS TO DIAGNOSE THEIR OWN FAULTS

With the increasing size and complexity of modern computers, one of the most interesting problems that engineers face is the rapid and efficient location of failures within the system.

The method which they have found most practical is to use the speed and logical abilities of the computer itself to make the diagnosis. Programming computers to perform this function is the job of Robert M. King.

The Diagnostic Technique

He prepares programs for the computer which actually simulate the deductive processes of a man investigating the faults of the machine. Each program instructs the computer to exercise various segments of its circuitry in a logical order.

The result of each test is checked against the correct result, stored in the computer memory, of previous tests of the same circuitry when in proper working order. If the results do not agree, a message is automatically typed which indicates the failure and which component caused it.

A computer is particularly adept at this job. It can take into consideration simultaneously a large number of factors. It can also work at very high speeds. Once a program is properly written, the computer makes no errors. Appropriately enough, diagnostic programming often aids in designing better computers.

A Programmer's Background

Computer programs are the result of ingenious applications of many intellectual qualities. Computer design and language are based on sound laws of logic. Therefore an important prerequisite is the ability to analyze complex problems and to deduce from them useful methods of solution consistent with machine requirements.

If you think you might be interested in working in one of the many fascinating areas of computer programming, you are invited to talk it over with an IBM representative. The future can be as unlimited as the future of the computer itself.

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Editor's Corner

If you aren't participating (actively) in at least one extracurricular activity, you should be. No doubt you've read this before! Don't think that editors of college publications and faculty members write articles and editorials of this nature just to fill empty space; participation in extracurricular activities is highly stressed because it's an important part of your college education.

I was out in the "cruel" world for seven years before starting college. I drove a truck, worked in a steel mill, and was a flying officer for the United States Air Force. In these occupations I found that the two most important qualities employers look for are leadership and sociability (I'm sure you'll find this is true for most jobs). These qualities will not be ascribed to you on the day of your graduation; they must be inherent within you—a part of your personality.

Getting your college degree doesn't necessariy mean that you'll be a success. You're in college to learn as much as you can about your chosen field of endeavor, but many other persons before you have done the same. Job knowledge is important but you will have to have that extra something if you wish to stand above the ordinary. That extra something boils down to being willing to accept responsibility and being able to get along with others.

The best way to prove yourself better than ordinary is by participating in as many extracurricular activities as you can without having them interfere with your schoolwork. However, don't rationalize your way out of it by telling yourself that you couldn't possibly spare any time lest your grades fall a point or two!

I'm a third term freshman who started last Summer term. I gained a position with the Spartan Engineer at the beginning of the Fall term and later in the same term, I was appointed to the Engineer Council. I participated in both activities—had fun while doing so—and my grade point average increased during the Fall term. You may be surprised to discover just how little time is required for such activities. Participation in an extracurricular activity looks good on your academic record but more than that, it is usually a lot of fun. You'll find that most organizations are more than willing to help you help yourself by participating in their activity.

If you're interested in working on the staff of a magazine or newspaper, come to the Student Services building. The State News, Spartan, Wolverine, and Spartan Engineer offices are located on the third floor. I'm sure any member of these publications would be glad to talk to you, and answer any questions you may have.

We of the Spartan Engineer invite you to come up to room 346 in the Student Services building and make any inquiries you wish. We would be happy to help you help yourself!

REG PILARSKI

FOLLOW THE LEADER is no game with Delco. Long a leader in automotive radio engineering and production, Delco Radio Division of General Motors has charted a similar path in the missile and allied electronic fields. Especially, we are conducting aggressive programs in semiconductor material research, and device development to further expand facilities and leadership in these areas. Frankly, the applications we see for semiconductors are staggering, as are those for other Space Age Devices: Computors . . . Static Inverters . . . Thermoelectric Generators . . . Power Supplies.

However, leadership is not self-sustaining. It requires periodic infusions of new ideas and new talent—aggressive new talent. We invite you to follow the leader—DELCO—to an exciting, profitable future.

If you're interested in becoming a part of this challenging DELCO, GM team, write to Mr. Carl Longshore, Supervisor—Salaried Employment, for additional information—or talk to our representative when he visits your campus.

DELCO RADIO DIVISION OF GENERAL MOTORS

KOKOMO, INDIANA

IT'S LITERALLY ALL AROUND YOU!

The word *space* commonly represents the outer, airless regions of the universe. But there is quite another kind of "space" close at hand, a kind that will always challenge the genius of man.

This space can easily be measured. It is the space-dimension of cities and the distance between them . . . the kind of space found between mainland and offshore oil rig, between a tiny, otherwise inaccessible clearing and its supply base, between the site of a mountain crash and a waiting ambulance—above all, Sikorsky is concerned with the precious "spaceway" that currently exists between all earthbound places.

Our engineering efforts are directed toward a variety of VTOL and STOL aircraft configurations. Among earlier Sikorsky designs are some of the most versatile airborne vehicles now in existence; on our boards today are the vehicles that can prove to be tomorrow's most versatile means of transportation.

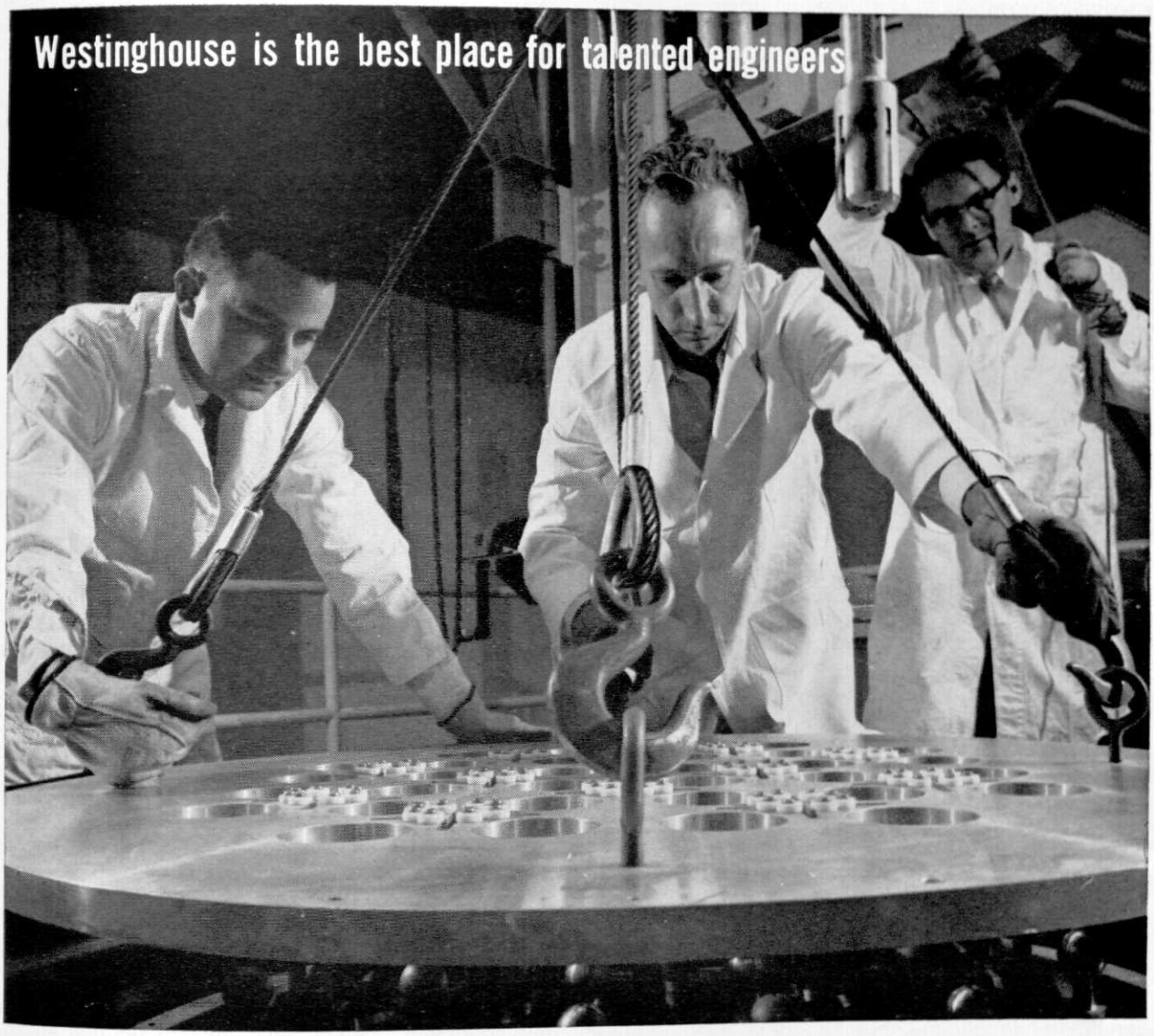
Here, then, is a space age challenge to be met with the finest and most practical engineering talent. Here, perhaps, is the kind of challenge *you* can meet.

SIKORSKY AIRCRAFT

One of the Divisions of United Aircraft Corporation

STRATFORD, CONNECTICUT

For information about careers with us, please address Mr. Richard L. Auten, Personnel Department.



F. Kelly, W. J. Miller, and J. P. Tobin of the Westinghouse Atomic Power Department lift the "core plate" off the nuclear core for the first U.S.-built power reactor designed for use abroad (Mol, Belgium).

Waltz Mill Experimental Reactor helps Westinghouse engineers solve problems

The new Westinghouse Testing Reactor at Waltz Mill, Pa., provides engineers with complete facilities for analyzing the effect of nuclear radiation on various materials, processes and designs. If a Westinghouse engineer is working on development of atomic fuels or the design of reactor components for an atomic power plant, he can count on help from the men at Waltz Mill.

The Westinghouse Testing Reactor is one of only two such privately owned reactors in the country. It provides a high radiation field comparable to that of a working reactor, and in addition has special controlled environment loops for the study of radiation effects at high temperatures and pressures. Work presently being carried out here for other departments of the company includes studies of thermionics, crystal structure, and thermoelectric effects as well as the work on atomic reactor designs and fuels.

The young engineer at Westinghouse isn't expected to know all the answers . . . our work is often too advanced for that. Instead, his abilities and knowledge are backed up by specialists like those at Waltz Mill.

If you have ambition and ability, you can have a rewarding career with Westinghouse. Our broad product line, decentralized operations, and diversified technical assistance provide hundreds of challenging opportunities for talented engineers.

Want more information? Write today to Mr. L. H. Noggle, Westinghouse Educational Department, Ardmore & Brinton Roads, Pittsburgh 21, Pennsylvania.

YOU CAN BE SURE...IF IT'S

Westinghouse

Thermoelectricity:

The direct conversion of heat energy to electrical energy leads to new concepts in energy generation and environmental control.

by NEWT BLACK, Tech. Writing '60

BEFORE 1970 you may be able to heat your home in the winter, cool it in the summer, and provide your own electricity, all with one device having no moving parts and under the control of a single set of dials.

This prospect flows from the now-rapid advance of thermoelectricity: the direct transformation of heat energy into electrical energy and the reciprocal transformation of electrical energy into heat.

It could permit the direct generation of electricity from a coal fire, nuclear reactor, or other heat source without the need of intermediate apparatus.

Inversely, it could make possible refrigeration and air conditioning directly from the flow of an electric current.

Thermoelectricity is not new. It is, in fact, just as old as the electromagnetic effects upon which electrical technology is based.

The history of electromagnetism began in 1820, when Hans Christian Oersted reported his observation that a magnetic needle is deflected by the flow of current in a nearby conductor.

A year later Thomas Seebeck announced his observation that a magnetic needle held near a circuit made up of two different conductors is deflected when part of the circuit is heated.

Unfortunately this promising discovery was obscured by Seebeck's own misjudgment. He thought he had shown that magnetic effects may be caused by a difference in temperature.

But his error had an important consequence. Seebeck's ignorance of the fact that his effect was electrical rather than magnetic in origin probably changed the history of electrical engineering and electronics.

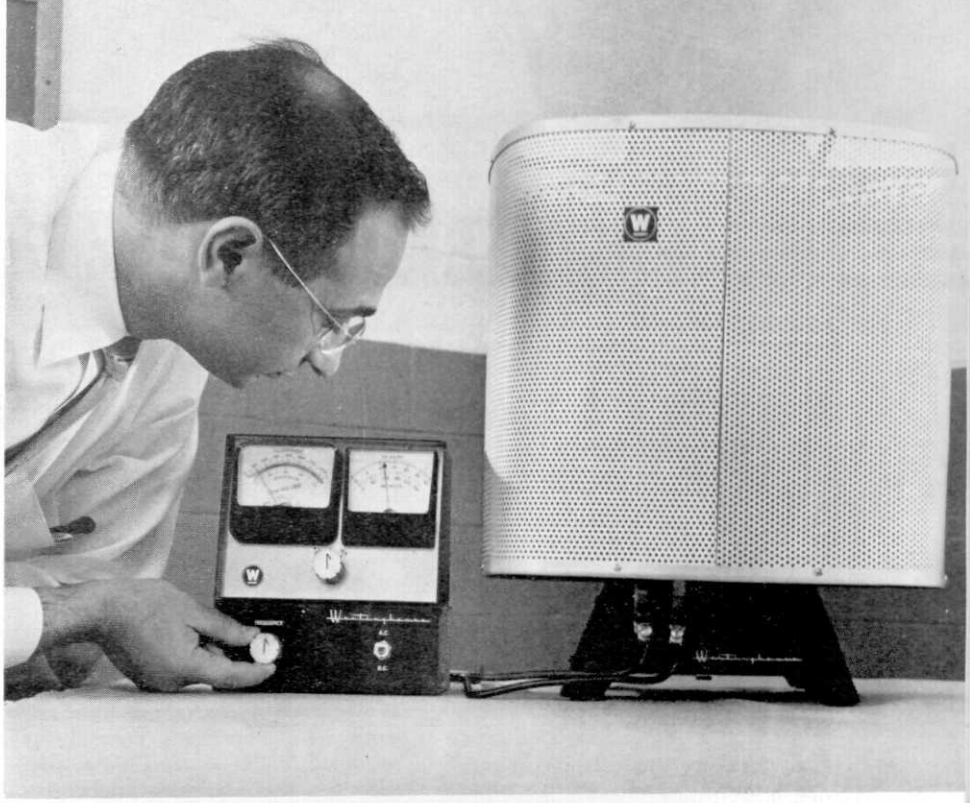
For a long time thermoelectricity would have provided the best source of electrical energy since the only machines for producing electric current were extremely weak generators.

But this was not what happened. The rapid development of electromagnetism diverted the interest of succeeding generations of physicists away from thermoelectricity.

Metals offered no significant thermoelectric effects, and metals were the only conductors used in electrical engineering for the next 100 years.

Seebeck's mineral semiconductors, which we use today in thermoelectric generators, were ignored throughout this period. The Seebeck effect be-

(Left) This full-scale panel promises to light as well as heat and cool the home of the future. The panel combines the latest advancements in electroluminescent lighting, and thermoelectric cooling and heating.



(Photos—Courtesy of Westinghouse)

(Above) At least ten times larger in electrical output than any similar device ever constructed in the United States, this new 100-watt generator is known as TAP-100 (terrestrial auxiliary power, 100 watts).

came a curiosity, relegated to the last pages of physics text books.

For a century the marvelous possibilities of thermoelectricity remained asleep. But in 1926 a U. S. engineer named Lars O. Grondahl showed that an oxidized copper plate conducts an electric current easily in one direction, but offers a very high resistance in the other direction.

Thus, if an alternating current is passed through such a plate, the current will flow, for all practical purposes, only in one direction. In effect the plate becomes a rectifier.

Soon afterward it was found that when such a plate is heated, a current is produced. This discovery attracted the attention of physicists to the large class of materials with low electrical conductivity which we now know as semiconductors.

Investigation soon disclosed that such substances possess many other

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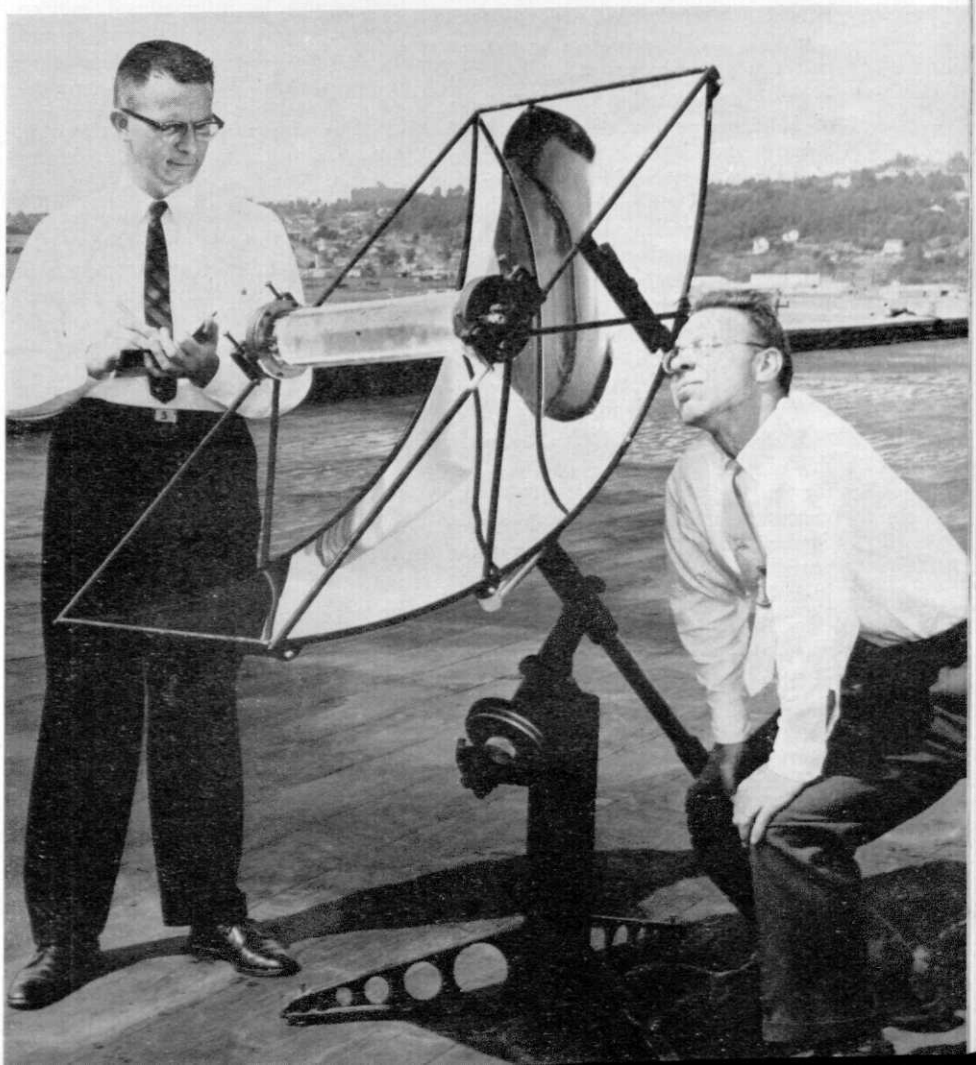

(Right) Long-mission satellites and manned space vehicles of the future will be able to tap a limitless supply of electrical energy by means of a solar-powered thermoelectric generator.

A model of a solar-powered thermoelectric generator, designed by a Boeing and a Westinghouse engineer, indicates the system is a practical source of electrical power in outer space.

The generator weighs three pounds and measures 20 inches in length. It is capable of converting the energy of the sun into 2.5 watts of power—enough to operate a radio transmitter.

ENGINEERING CAREERS ABROAD

New MSU program provides opportunity for travel and responsibility

by HERB HARMAN, E.E. '60

ONE of the many questions an engineering student asks himself just prior to graduation is: Am I adequately prepared for the technical job of my choice? Another—will I be able to find work in the geographical location which I desire? Still another—are there any jobs available in foreign lands? The answer to all of these questions is probably yes if that student is enrolled in the Engineering Program for International Service at Michigan State.

The program started at M.S.U. in the Fall of 1959 after considerable research and planning by the College of Engineering and the College of Science and Arts. It is designed to give the student wishing overseas assignment, and an engineering education, the opportunity to have **both** in a minimum length of time. A graduate of this program will receive a Bachelor of Science degree and a Bachelor of Arts degree, the combination of which will adequately show his potential of being a good engineer in a foreign land.

Basically, the curriculum follows the normal engineering requirements for the first two years, providing the necessary mathematics and science fundamentals. The following three years, the student takes electives in liberal arts along with the courses in his particular field of engineering.

Another big question which arises at this time concerns the necessity for taking all "those extra courses"—Why must a person spend time to learn customs, traditions, and history? Of what value are they?

One must remember that when he is outside the United States, he is a guest of the country he is in and must comply to rules, customs, and traditions which may be considerably different from those he is normally accustomed to. He is not just an engineer in a new environment, but is a representative of a country as well as an industry and a profession. It is most important that excellent relations are maintained at all times, not only for international reasons, but also for maximum efficiency in the primary job of being a good engineer.

The program for providing the background in international service depends much upon the student and his advisor. The choice is made as to the geographical area of employment some time during the first two years at M.S.U. The course of study following depends upon this choice, whether it be Arabia, Japan, India, Spain, Latin or South America, or some other distant land. During the third year, a basic understanding of particular foreign cultures is obtained, along with the first of two years of language.

The fourth year, nine credits of history are taken in order to gain an adequate understanding of how a particular country of people have progressed through the years. The major portion of the fifth year is spent studying social, economic, political, geographical, and/or religious conditions. All of the courses combine to give the engineer the means for effective communication which is even more important in a foreign land, than right here at home. Every course in addition to the specific field of engineering which is taken will help to make the man more adaptable and more ready to accept the challenges which he will encounter.

A true story is told of a group of engineers who returned to a Pacific island soon after World War II to show modern techniques of home construction to the so-called "backward people." These natives lived in thatched huts and shanties made of paper and wood which the engineers proceeded to demonstrate were far inferior to the solid American homes, not only in construction but in cost and beauty. Although not completely sold, the natives had several of these homes built, which they promptly agreed were something they had never seen the likes of before. All was perfect, until the first typhoon struck; the thatched huts and inferior shanties swayed in the wind, while the beautiful American-style homes were leveled and the modern equipment demolished. Perhaps a little foresight on climatic conditions or education in a way of life might have prevented embarrassment and considerable loss.

Opportunities overseas for good technical personnel are unlimited as every field of engineering is in great demand, whether it be with the United States Government or an American corporation. Large petroleum industries are constantly looking for all types of engineers with sufficient background in foreign languages and customs to cope with the never-ending problems in locating, building, and maintaining petroleum companies in the Middle East and South America. American automobile industries are found in almost every country in the world with engineering challenges similar to those found in the United States. Research and development in electronics is growing rapidly in Europe in conjunction with concerns both here and abroad. One of the greatest demands for engineers is with the construction industry; building highways, airports, dams, power generating stations, ships, hospitals,

(Continued on Page 44)

PROBABILITY: DIMENSION OF REASON

by RAOUL LEPAGE, Math. '61

MEN reason more than they read, yet they choose to teach their children the intricacies of written language while very young, and leave them to the uncertainties of experience to develop reason.

It is a moot question whether the incubation period of young minds should be allowed to extend beyond the grade school years. Certainly no one can deny that many high school seniors lack the power to reason effectively. Perhaps those who draw up the secondary school curricula are fearful of handling such subjects as Logic, Probability, Examination Of Meaning, and others for which the homework is primarily mental gymnastics. They may feel the students to be incapable of handling these ideas, but I suspect their greater fear is that they could not properly handle the student's ideas, as a result.

The question of how soon young people should be confronted with some of the tools of decision, they will need for the rest of their lives, is one very pertinent to our discussion, though I will abandon it immediately after pointing out that probability analysis is applicable to question, and indeed, is **implicit** in any decision which can be made concerning it.

The point being that probability concerns more than dice, coins, and billiard balls (though it is often discussed with these as models). Indeed, its study is undertaken because it is so pertinent to the pre-occupations of mankind, and because it is so descriptive of the very reasoning process by which man makes his decisions among the infinite alternatives open to his every act.

Can you see probability situations at work in questions of human morality, and political theory? That great genius and mathematician, LaPlace, understood many. Reflect for a moment on the import of his statement: "Doubtless it will be seen here with interest that in considering, even in the eternal principles of reason, justice, and humanity, only the favorable chances which are constantly attached to them, there is a great advantage in following these principles and serious inconvenience in departing from them: their chances, like those favorable to lotteries, always

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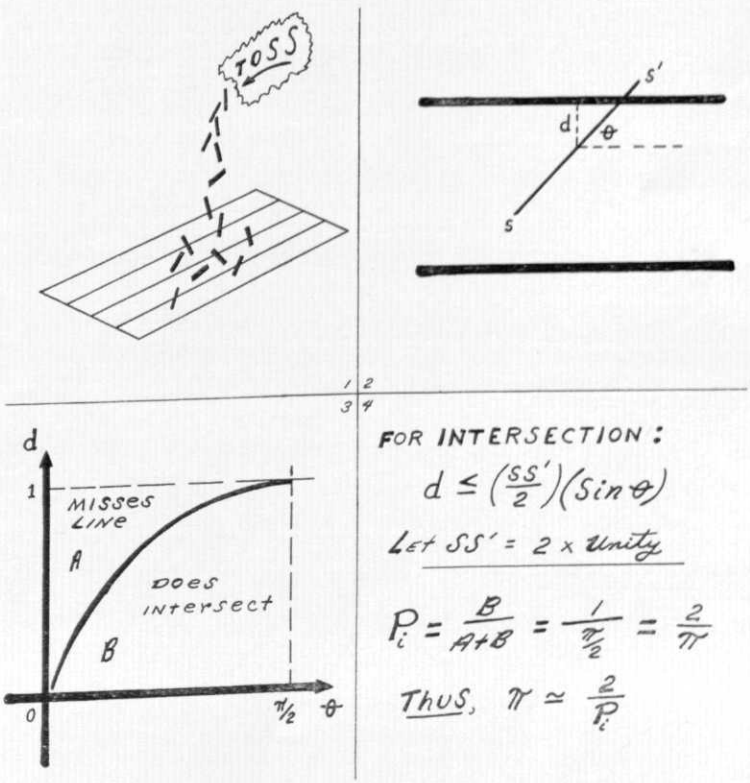


Depicted above is a determination of the probability that a stick tossed carelessly on a striped plane surface (with the stick equal in length to the width of the stripes) will fall across one of the dividing lines.

P_1 is the probability of intersection. Thus, by using for P_1 the ratio intersections to total tosses (from an actual trial), the value of 'pi' may be empirically determined.

ENGINEERING EXPOSITION MAY 1960

by REG PILARSKI, M.E. '63

(Photos by Norm Hines)

TWELVE years ago, a group of enterprising engineering students organized the first engineering exposition held at Michigan State University, which was then Michigan State College. Needless to say, the exposition was a success and has become an annual affair. It is the largest free, annual engineering exposition in the midwest and attracts an estimated 20,000 visitors each year.

An emphasis is placed on student participation and the feature of the exposition is the student exhibit. This gives students an opportunity to exhibit the projects which they have developed and attempts to accomplish two things: 1) to honor those who have created the projects on exhibit; 2) to motivate others to explore the methods of science. Student exhibits in the past have been comprised of things such as radio transmitters and receivers, miniature assembly lines, plastic sports car body, etc. An electronic brain which plays tic-tac-toe and a wrist watch size FM transmitter are but a few of the expected student exhibits for the coming exposition.

Prizes are awarded for unique exhibits and any club, society, or individual may enter the competition. For further details, contact Rodger Winn at ED 2-8611 or Ed Daniels at ED 2-3563.

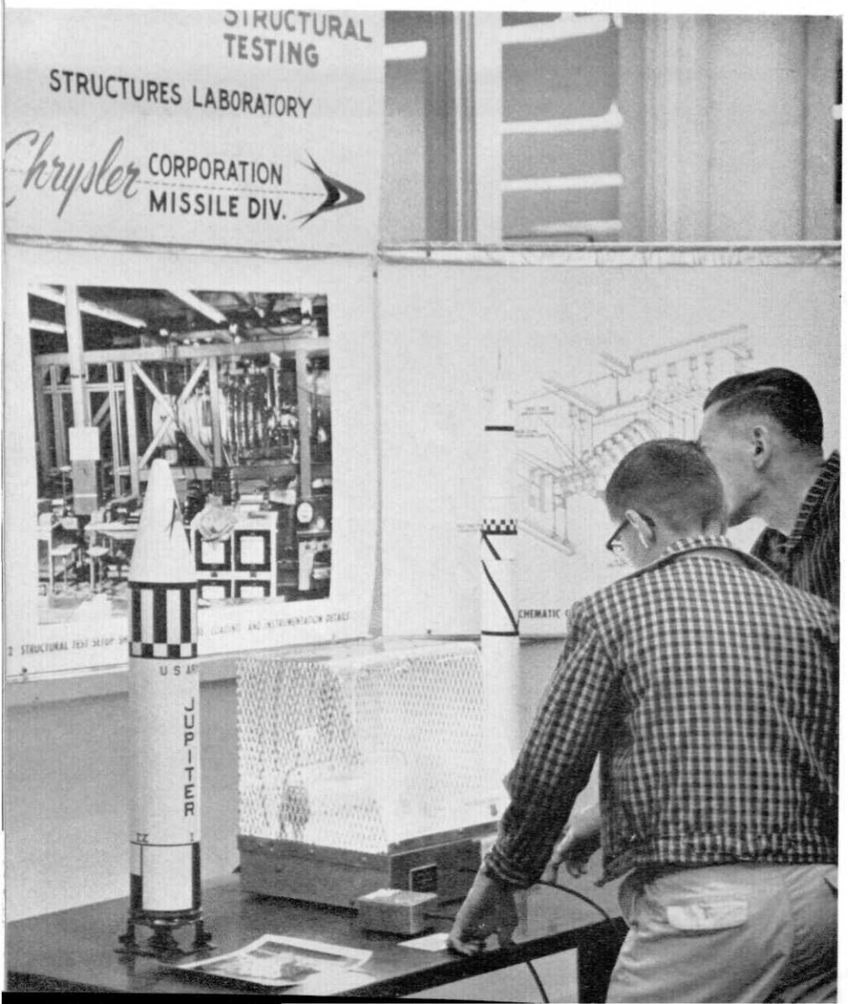
The industrial exhibits are planned to show some interesting engineering accomplishments which have come about recently. In the past, there have been such things as rockets, missiles and computers on display. The plans are just in the making for this year but some proposed exhibits are a fighter plane or rocket from the Air Force and the experimental "air car."

All the engineering departments, including applied mechanics, get into the "act." The MISTIC computer is to be displayed and demonstrated, which should be of interest to everyone. One of the departmental exhibits last year was a radar speed and car volume recorder.

The midget auto race is popular with both the youngsters and the oldsters. Hand built midget racers with 2½ horse-power engines are entered in the race by eligible organizations. The first driver to complete the 50 laps around the course receives a trophy and sometimes a kiss from the Engineering Queen. The queen of the exposition is chosen by the engineering students from a field of five finalists selected by Knights of Saint Patrick. She is crowned at the midget auto race and her court is also presented.

All good things must come to an end and the Engineering Exposition comes to an end in the best of fashion with the May Hop. During this gala event, there will be the presentation of the outstanding senior awards, the dubbing of new Knights of Saint Patrick, and the presentation of prizes to student exhibitors.

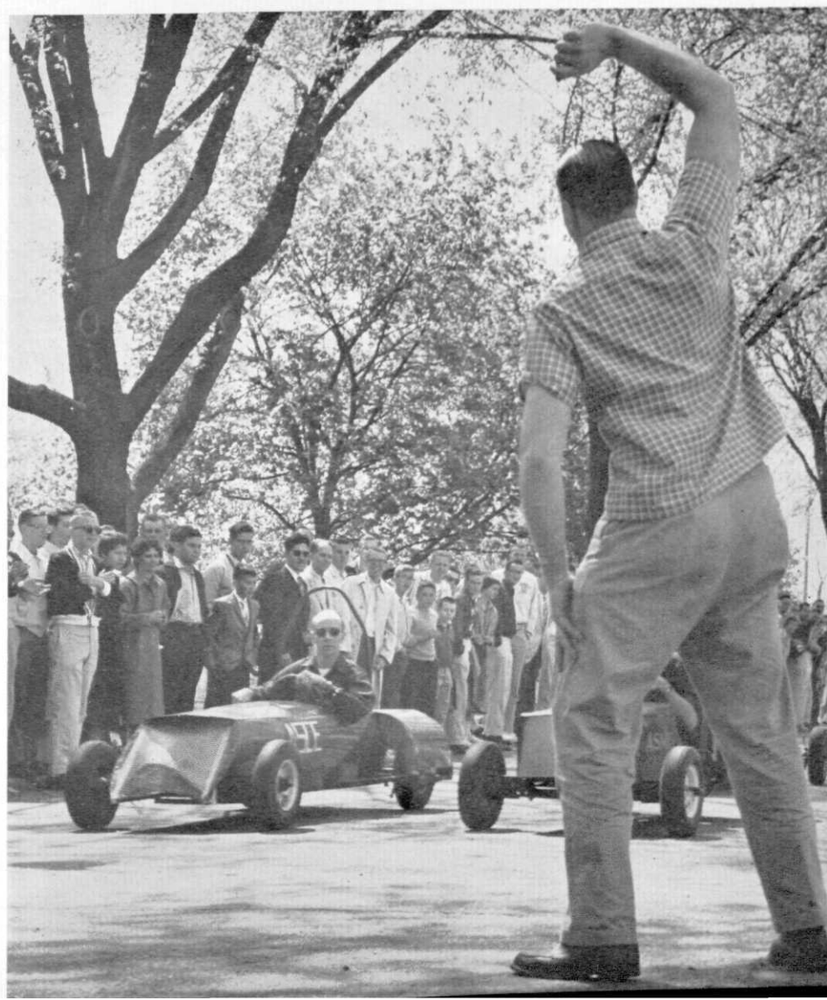
The dates for this year's Engineering Exposition are May thirteenth and fourteenth. Plan to put your books in "mothballs" for those two days and go to the Engineering Exposition and enjoy yourself.



(Left) One of the industrial exhibits sponsored by the various engineering departments. Several such exhibits are expected for this year's exposition in May.

(Below) The JETS exhibits are very popular. These exhibits are planned and built by JETS Club members (High school and Jr. High students).

(Right) Dr. L. L. Otto, may be seen in the thick of the activities. He acts as official starter, chief mechanic and advisor for the race crews. All cars have identical engines, so the skill of the driver and race crews are important. A.S.M.E. went on to win the race.



(Above) Last minute preparations are made on the Triangle car.

(Below Left) The driver of the winning car receives a well earned kiss from the engineering queen.

(Below Right) As a climax to an exciting weekend, the engineers hold a semi-formal dance on Saturday evening. During intermission, new members of the Knights of Saint Patrick are knighted by the queen.

RUNNING SCARED

Presented at Students Night of the Pittsburgh Section, American Institute of Chemical Engineers.

by EVERETT P. PARTRIDGE

AS you go about prospecting for a job, many interviewers will inquire, "What are you?" What they mean of course, is, "Have you completed certain prescribed courses in a formal curriculum which will lead people to think of you as a chemical engineer—or a mechanical or an electrical engineer or a chemist or a nuclear physicist?"

A much more significant question is, "What are you trying to become?" This is important, because all your life you will keep on becoming.

In doing this, you of the present generation will have to struggle against a particularly serious handicap. I don't mean a recession in business, for the economists' graphs for the future all zoom upward. By 1965 we shall have 25 million more people, $100 million more gross national products, 115 million more kilowatts than we had in 1955.

Any one of you can have your choice of at least ten jobs now and for some years to come.

You can expect your wife to work, too, so that your combined income will allow you to have two cars, even if no babies.

You need take no thought for the future, for you will be protected by:

1. medical, surgical and hospitalization insurance
2. unemployment insurance
3. severance pay
4. profit-sharing
5. pension
6. Social Security

You have it made. Why worry about anything?

This is a truly serious handicap. I think you go farther and have more fun if you run scared.

By running scared I don't mean a state of panic. I do mean a state of mind which keeps saying to others of your own performance, "I should have thought of that," instead of "Well, you didn't tell me to."

If you do accept responsibility, inevitably you will feel the weight of it on your mind. You will worry about making the right decision, you will wonder afterwards if you did. You will feel uncomfortable.

Nobody likes to be uncomfortable. So the majority of men, including, unfortunately, some who call themselves engineers, seek security rather than responsibility. Their ideal job is one where everything that goes well is obviously a result of their good work, but everything that goes wrong is the fault of someone else—an incompetent boss or a stupid assistant.

Perhaps you have seen the early stages of this mental disease already in some classmate or even—perish the thought—in yourself. Whose responsibility was it that you didn't get much out of that course in English or differential equations or heat transfer? Was it actually the fault of that lousy instructor . . . or of the classmate who wouldn't lend you his notebook the night before the exam? Or could it just possibly have been your own shying away from the responsibility of disciplining your own mind to work at the problem day after day?

When I was a student chemical engineer at Syracuse University, one of the courses required in the senior year was economics. It was taught by a professor from the College of Business Administration who came over to the College of Applied Science on Monday, Wednesday and Friday at 10 A.M. for an hour that he must have dreaded.

As engineers we were proud of our carefully nurtured cult of uncouthness. We also looked down on Business Administration because that was where all the boys who flunked out of engineering went. So we had the usual unthinking, undergraduate fun with this utterly humorless professor of economics.

One item was the fictitious student we registered under a name I wish I could remember. Anyway, every time the solemn professor called the roll, there was laughter. After some five weeks during which we used all the usual ruses to report our imaginary classmate present—in the infirmary with sleeping sickness, or on his honeymoon—the professor realized that he had been taken. He stormed down to the Dean, shouted that he had never been so insulted in his life and refused ever to teach that course in economics again.

We barely cared. What did economics have to do with engineering anyway? We rather congratulated ourselves on having eliminated a dusty nuisance from our solid 8 A.M. to 5 P.M. schedule. I suspect, however, that my classmates have had to study economics quite a bit over the thirty years since.

I have a responsibility right here that I want to fulfill. If I fail, I could say, "Well, after all, what can you expect of young folks today? They have been spoiled by lack of discipline at home and in school. They just don't give a damn." What I actually should say to myself would be something like this, "Partridge, why didn't you get across to those students? Perhaps you weren't using their language. Perhaps you couldn't get inside their minds."

That attitude might well be considered by some instructors who take their own responsibilities too lightly.

Because I feared I might not be tuned to the proper wave length for reception by you, I asked the last three recruits to our training course for field engineering services to sit down with me one afternoon some weeks ago. They suggested several little messages I might transmit. They say that out on the job:

1. You can't just "cut classes" when you feel like it.
2. You can't depend on your roommate to carry you through some

(Continued on Page 44)

HEY READERS!!

The *Spartan Engineer* would like you to express your opinion on this and previous issues. We want to know what you feel this magazine should contain, what features or departments should be added or dropped, whether you desire more articles on local engineering activities. *Those persons returning this ballot or reasonable facsimile within thirty days will receive their next issue free of charge.*

What is your favorite department? (number in order of your preference)

Dean's Letter
Editor's Corner
Over the Transom
Miss Engineer of the Month
Placement Directory
Sidetracked
Alumni Notes
Letters to the Editor

What type of articles are you interested in? (number in order of preference)

Engineering Research Projects
Research Projects from other Colleges at MSU
Technical Articles
Semi-technical Articles
Engineering Activities
All Campus Activities
Faculty Sketches
Features on Prominent Alumni
Articles on other Disciplines such as Management
Articles on Placement Bureau, Scholarships and other campus services
Local Engineering History

Are there any of the types of articles or recurring features (p. 26) which you feel should be dropped? If so list them below.

What is your opinion of the current articles?

GOOD FAIR POOR

What specific types of articles or subjects would you like to see included in future issues?

What are your suggestions for improving the *Spartan Engineer?*

Name_____

Address_____

Major, Dept., or Curriculum_____

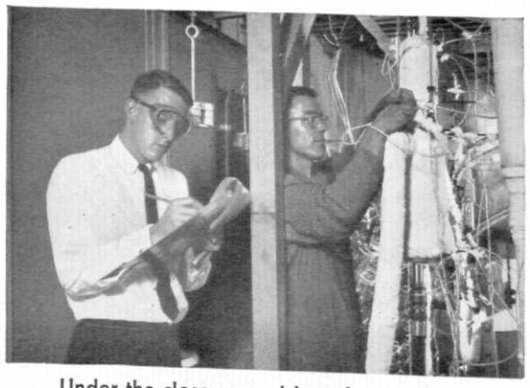
I would like to hear from readers of the various groups which we reach (University Students, Faculty, Alumni, High School Students, High School Instructors, and Staff Members of other E.C.M.A. Magazines reading this). I also welcome letters making specific comments or criticisms which you are not able to cover in the above ballot. Letters received in time will be printed in the next issue. Ballots and letters may be sent to the *Spartan Engineer,* 346 Student Services Bldg., Michigan State University, East Lansing, Mich.

engineers

and what they do at Pratt & Whitney Aircraft...

Automatic systems developed by instrumentation engineers allow rapid simultaneous recording of data from many information points.

Frequent informal discussions among analytical engineers assure continuous exchange of ideas on related research projects.



Under the close supervision of an engineer, final adjustments are made on a rig for testing an advanced liquid metal system.

The field has never been broader
The challenge has never been greater

Engineers at Pratt & Whitney Aircraft today are concerned with the development of all forms of flight propulsion systems—air breathing, rocket, nuclear and other advanced types for propulsion in space. Many of these systems are so entirely new in concept that their design and development, and allied research programs, require technical personnel not previously associated with the development of aircraft engines. Where the company was once primarily interested in graduates with degrees in mechanical and aeronautical engineering, it now also requires men with degrees in electrical, chemical, and nuclear engineering, and in physics, chemistry, and metallurgy.

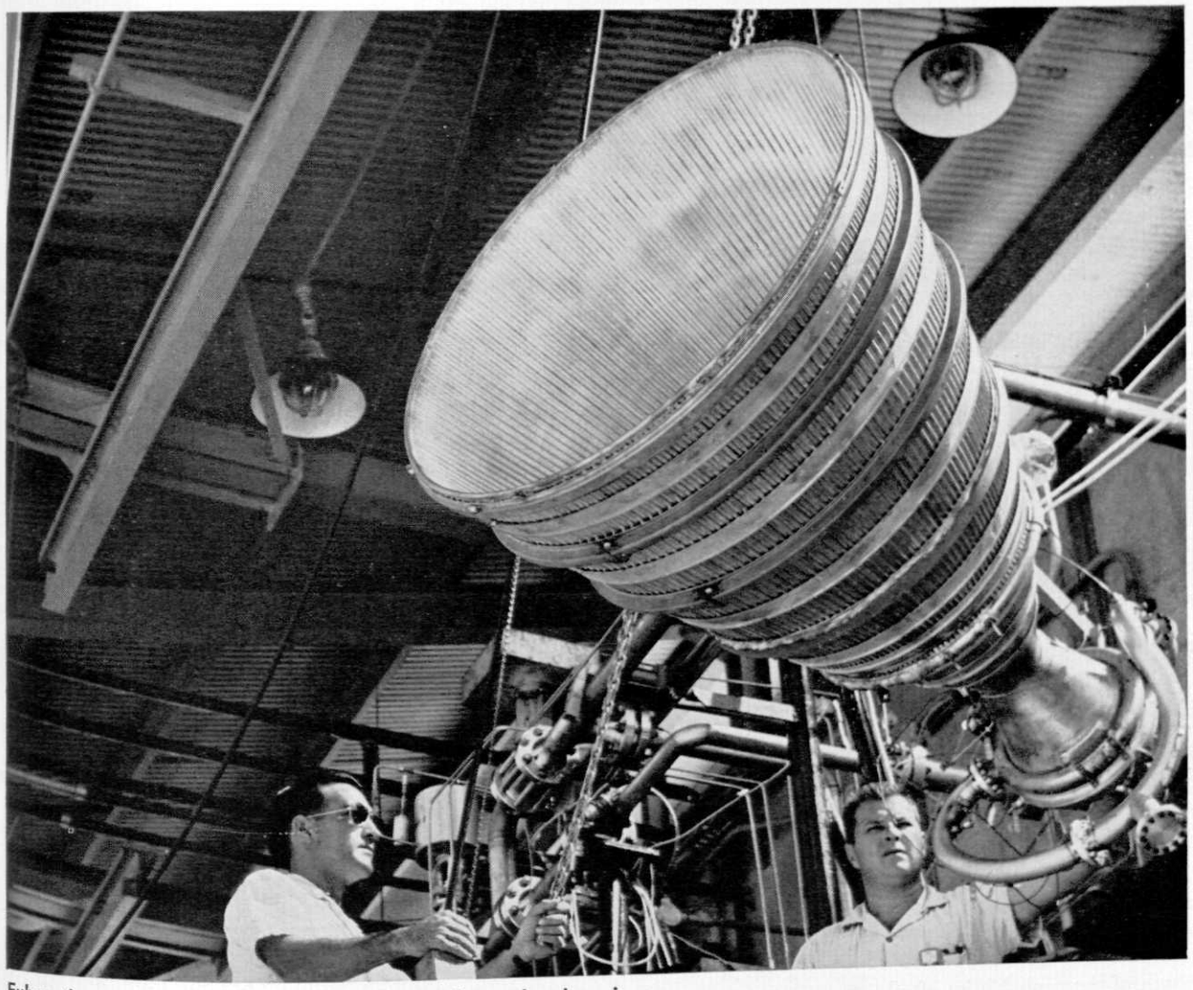
Included in a wide range of engineering activities open to technically trained graduates at all levels are these four basic fields:

ANALYTICAL ENGINEERING Men engaged in this activity are concerned with fundamental investigations in the fields of science or engineering related to the conception of new products. They carry out detailed analyses of advanced flight and space systems and interpret results in terms of practical design applications. They provide basic information which is essential in determining the types of systems that have development potential.

DESIGN ENGINEERING The prime requisite here is an active interest in the application of aerodynamics, thermodynamics, stress analysis, and principles of machine design to the creation of new flight propulsion systems. Men engaged in this activity at P&WA establish the specific performance and structural requirements of the new product and design it as a complete working mechanism.

EXPERIMENTAL ENGINEERING Here men supervise and coordinate fabrication, assembly and laboratory testing of experimental apparatus, system components, and development engines. They devise test rigs and laboratory setups, specify instrumentation and direct execution of the actual test programs. Responsibility in this phase of the development program also includes analysis of test data, reporting of results and recommendations for future effort.

MATERIALS ENGINEERING Men active in this field at P&WA investigate metals, alloys and other materials under various environmental conditions to determine their usefulness as applied to advanced flight propulsion systems. They devise material testing methods and design special test equipment. They are also responsible for the determination of new fabrication techniques and causes of failures or manufacturing difficulties.



Exhaustive testing of full-scale rocket engine thrust chambers is carried on at the Florida Research and Development Center.

For further information regarding an engineering career at Pratt & Whitney Aircraft, consult your college placement officer or write to Mr. R. P. Azinger, Engineering Department, Pratt & Whitney Aircraft, East Hartford 8, Connecticut.

PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation

CONNECTICUT OPERATIONS — East Hartford

FLORIDA RESEARCH AND DEVELOPMENT CENTER — Palm Beach County, Florida

PROBABILITY

(Continued from Page 21)

end by prevailing in the midst of the vacillations of hazard."

Our present day sociologists can do no more than observe and correlate events, with a view to discovering empirically these respective favorable probabilities, though they are never assigned a numerical value.

It is my hope that this presentation will stimulate your interest in probability. The calculus of it is worthy of your inspection; the associated philosophy has the power of reason itself, and is an unfailing weapon against the confusion of our time.

It might be well to define "probability" as being synonymous with "the fraction whose numerator indicates the number of SPECIAL outcomes to an event, and whose denominator indicates the number of all different outcomes possible."

Of course, this is the probability of the SPECIAL outcome, subject to the interaction of all possible outcomes considered. Thus if, for example, the probability of a shotgun pellet striking a mallard duck at 40 yards (assuming perfect shooting) were 3/71, it would be most probable that a load of over seventy pellets would be sufficient to kill the duck. If, in the course of his flight south, the duck could expect to be fired upon by twenty expert gunners, his chance of completing the trip would be very slim indeed (roughly 11/25). In the terms of our definition, roast duck would be a SPECIAL outcome to the last perfect shot.

Probability is a restricted ratio, the value of which must not be less than zero (impossibility) and not more than one (certainty). Negative probability is meaningless, and a probability greater than unity would indicate that you were interested in possible outcomes to an event which were more numerous than **all possible** outcomes, which is clearly fallacious reasoning.

The sum of the probabilities of all mutually exclusive outcomes to a particular event will be unity. This indicates that you expect the event to have **some** outcome of the ones you have considered. In this respect it may be easily observed that failure to include all possible outcomes to an event may well render the computed probabilities incorrect.

It is a curious fact that the analysis of probability theory begins with what may be called an "Argument from Ignorance." The reasoning of such an argument hinges upon the supposition that, in dealing with events so complex as to be without the power of examination by scientific methods designed to predict with certainty their outcome, it may be assumed that the infinite variables at work nullify their effect on each other, so that no particular one of the total possible outcomes, to the event, is more likely than any other. Thus, it would be absurd to take, as a general expectation, the tendency for a tossed coin to turn up heads always, **unless** the coin were heavier on the tail's side.

With the aforementioned thoughts in mind then, my reason for denoting the fundamental concepts of probability theory by the titles ARGUMENT 1, ARGUMENT 2, etc., will be made clear. The analysis of any problem in probability theory ultimately falls back upon this most basic theme to the entire study, namely that: "we assume that all forces at work in the determination of the outcome of an event are devoid of any tendency to resolve themselves to a favored single outcome, as regards those non-composite outcomes of the simplest nature." These **simple** outcomes might be the side turned up on a tossed coin, or die, or perhaps the disorderly changes in direction of the path of a water molecule. **Composite** outcomes might include pairs of sides turned up in the throw of two dice, or the finite sequence of changes in a molecule's path of motion.

It is interesting to note that the principle of the "Argument from Ignorance" has been extended, as a separate discipline, to probability considerations of a highly involved nature. Its sole use often results in very good approximations to the probabilities of events, as determined by more rigorous and extensive methods. The success of this method is limited, however, by the twin facts that its application is highly intuitive and is not consistent in its application by even so few as two individuals skilled in its use.

Now that we have touched upon a few of the more critical notions of the theory, it is likely that an examination of the probability Arguments, mentioned earlier, will at once bring the substance and power of our study into sharp focus.

ARGUMENT 1

Probability of a Simple Outcome.

Definition: The probability of an event, of **b** different outcomes, having outcome **a**, where **a** comprises a portion of all outcomes **b**, is equal to the fraction **a/b.**

Example: The town in which you live has three local newspapers. One day you are in a hurry, and instead of asking for your favorite publication, you tell the newsboy: "Give me a local." Clearly, your probability of receiving your favorite is 1/3. Your probability of **not** getting your favorite is the difference 1-1/3 = 2/3. In general, unity minus the probability of an outcome represents the probability of not realizing that outcome.

ARGUMENT 2

Probability of a Choice of Outcomes.

Definition: If the probability of realizing outcome A equals **p,** and that of B equals **r,** then the probability of realizing **either** A or B, but not both, is equal to **(p+r).**

Example: Suppose the probability of a bonded plant guard lying is thought to be 1/307, from previous experience. In addition, the probability of his being asleep on the job is 1/262, also from previous experience. Then the probability that he will be guilty of **either** of these errors of judgment, and thus be worthless as a protector of plant property, is equal to the fraction 1/307 + 1/262. This is a risk incurred by the plant.

ARGUMENT 3

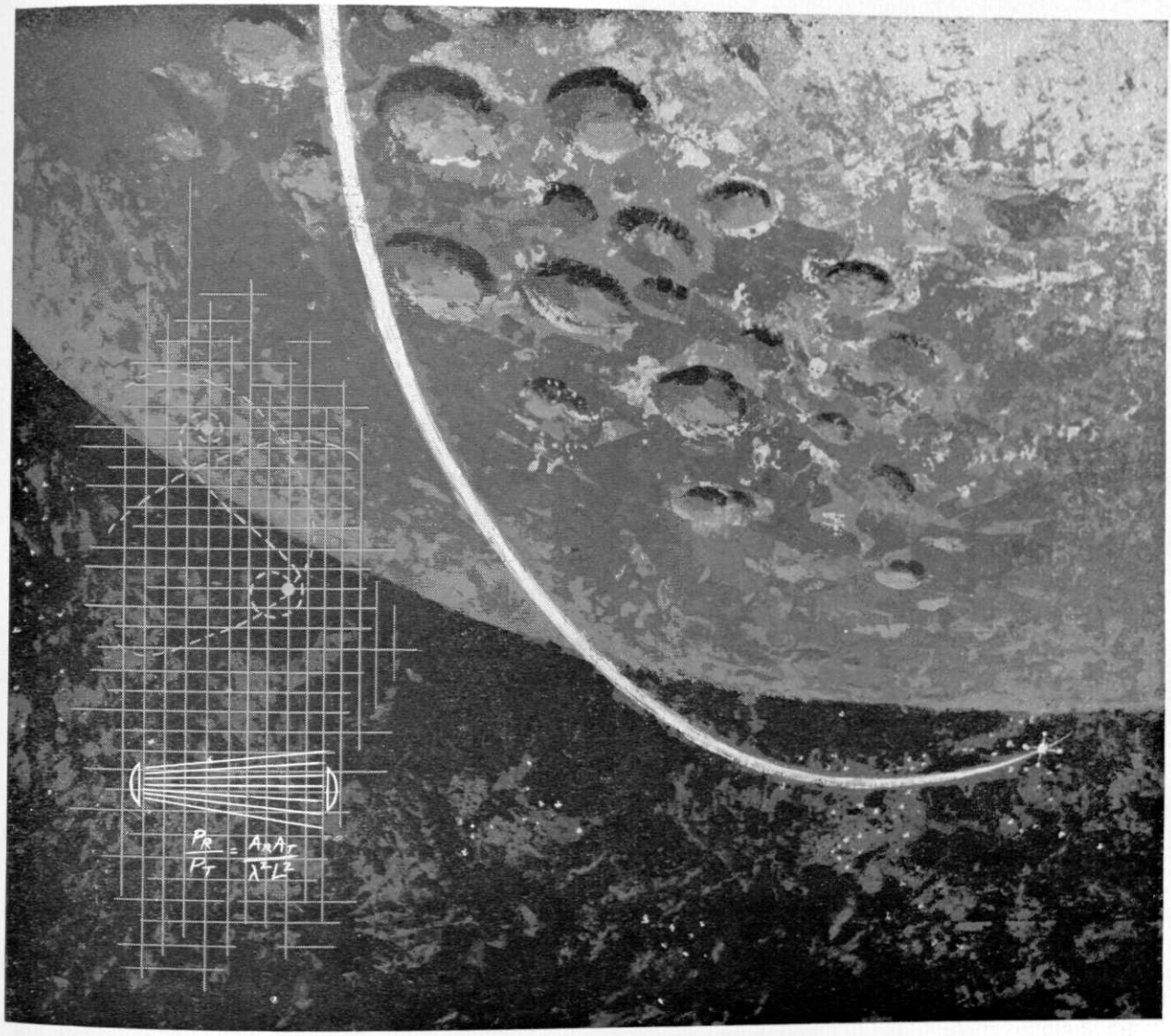
Probability of a Compound Outcome (of independent simple outcomes).

Definition: If the probability of outcome A, to an event, equals **p,** and that of B equals **r,** and if the taking of either A or B will not alter the probability of the other, then the probability of realizing **both** A and B equals **(p) (r).**

Example: Consider the uneasy thought that there exists a probability of 1/17 that I am in serious error in some part of this analysis. Let us further assume that the probability that the editor also holds a similar misconception about the **same** point is 1/83. The probability that the error will get into print is then 1/(17) (83). However, the probability of our being speedily informed of the same, in the next mail, is much, much higher—to be sure!

A very striking example of the rapid diminishment of the probability of a compound event is that encountered in the determination of the probability of a **repeated** event. A simple extension of the Definition of Argument 3 yields the formula for

(Continued on Page 38)



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PLACEMENT DIRECTORY

March 14

Gen'l Motors (summer)
Jet Propulsion Lab.
Cooper Bessemer Corp.
Plax Corp.
Radiation Inc.
White Plains Public Schools

March 15

Gen'l Motors (summer)
Jet Propulsion Lab.
Philco
Industrial Research Products
Sears, Roebuck & Co.

March 16

Procter & Gamble (summer)
Coast & Geodetic Survey-U.S. Dept. of Commerce
Texas Co.
Gen'l Motors (summer)
Northrop Corp.
Sears, Roebuck & Co.
UARCO
Detroit Public Schools
Foof Mach. & Chem. Corp.
Eaton Mfg. Co.

April 6

Moore Business Forms
Caterpillar Tractor
S. S. Kresge
Proctor & Gamble
Ernst & Ernst
U.S. Army Audit Agency
Pontiac Public Schools
Gary, Indiana Public Schools
Lamphere Public Schools
Oakland, Calif. Public Schools
Carson Pirie Scott
Marshall Public Schools
Duncan Hines
Birmingham Public Schools
Davison Community Schools

April 7

Lybrand Ross Bros. & Montgomery
Herpolsheimer's
Bank of America
Caterpillar Tractor
Harris Trust & Savings Bank
Arthur Young & Company
Fields - Jackson
Firestone Tire & Rubber Co.
Battle Creek Public Schools
Kalamazoo Public Schools
Chevrolet Gear & Axle Div.
Burroughs - Research Center
Parma Public Schools
Lansing Public Schools
Allied Chem. (summer)
Birmingham Public Schools

April 8

Grosse Pte. Public Schools
Lansing Public Schools
Dearborn Twp. School Dist. #3
Wyandotte Public Schools
Kovtan & Ristou

April 11

Peat, Marwick & Mitchell
Hilton Hotels
Oscar Mayer
U.S. Gen'l Acct'g
Aetna Casualty & Surety Co.
General Elect. Credit Corp.
Warren Consolidated Schools
Zurich American Ins. Co.
Royal Oak Public Schools
Jefferson Schools - Monroe
Travelers
Lake Odessa Community Schools
Armstrong Cork

April 12

Hess & Clark (summer)
Alexander Grant
Cadillac Motor Co.
Seidman & Seidman
Zurich American Ins. Co.
Hilton Hotels
Oscar Mayer
Michigan Bell - Women
U.S. Gypsum
Johnson & Higgins Ins.
Touch, Ross, Bailey & Smart
Arthur Andersen
Kordite Co.
Employers Mutual Ins. Co.
Warren Consolidated Schools
Armstrong Cork
Kenosha Public Schools

April 13

Haskins & Seels
Stouffers
Lever Bros.
Michigan Bell - Women
Colgate - Palmolive Co.
Upjohn Co.
Montgomery Ward
Price Waterhouse
Perfect Circle
Utica Public Schools
Burrough's
Fraser Public Schools
Armour & Co.
General Electric
East Ohio Gas

April 14

Westinghouse
Stauffer's
Shell Oil Co. - Marketing
Dow Chemical
Lever Bros.
Federal Reserve Bank of Chicago (Detroit Branch)
Associates Investments
Equitable Life Assurance Co.
Chevrolet
Walled Lake Public Schools

April 15

Dow Chemical
Glidden Co.
P. R. Mallory
Michigan State Hwy. Dept.

April 18

Lu C. Moore Co.

April 19

Hot Shoppes
Liberty Mutual Ins. Co.
Union Carbide Consumer Prods. Co.
General Motors

April 20

Grand Rapids Public Schools
Hot Shoppes
Cleveland Public Schools
General Motors

April 21

Corning Glass
Northwestern Mutual Life Ins.
Potlatch Forests, Inc.

April 22

Northwestern Mutual Life Ins.
Roseville Public Schools

April 25

Royal Oak Public Schools

April 26

Godwin Hts. Public Schools
Scotts

April 27

Transitron Electronic Corp.
Rochester, N.Y. Public Schools

April 28

Stouffer's
Battle Creek Public Schools

April 29

Stouffer's

May 2

Y.M.C.A.

May 3

Detroit Public Schools

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Electronics
Reactors
Kilns
Crushers
Tractors
Earth Movers
Motors
Control
Pumps
Engines
  Diesel
  Gas

Fields

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Stress Analysis
Process Engineering
Mechanical Design
High Voltage Phenomena
Nucleonics
Electronics
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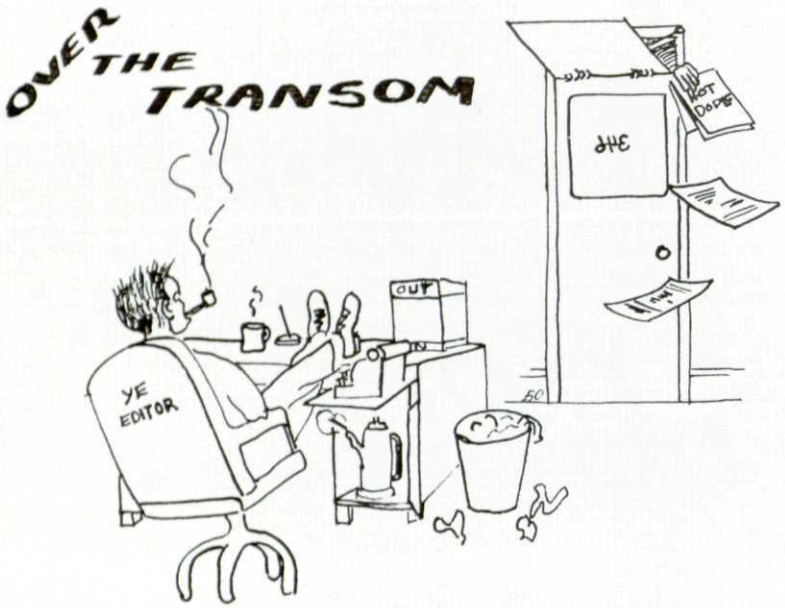
PUBLICATIONS



A liberal arts education won't produce any better executive than other types of education. In fact, another kind may provide the best training for a career in management.

"The problem of the manager," said O. S. Carliss, director of engineering for the Yale and Towne Manufacturing Company, "is to obtain group success in a field where the individual and his contributions are paramount." The best way to develop the executive judgment, foresight and objectivity to bring this about is through an engineering education.

Education is an inward matter. Formal training only points the directions for further study. However, the study of science, which is an integral part of an engineering education, and the basic humanities background which an engineering school provides, gives the prospective manager a start in knowledge of people, of communicating with them and in the discipline of thought necessary to plan and complete projects.

Decisions which must be made today are, in many cases, technological. "It is possible to invest as much as a billion or more dollars on a single missile before it has even been reduced to successful practice." If we are going to use efficiently the results of basic scientific data, we need men of vision who also have a basic understanding and appreciation of these data.

"The engineering school draws together science in its pure and elemental form, the liberal arts in their best forms, and combines them into a cohesive working facility for the training and discipline of the students."

"It is my firm conviction," Mr. Carliss concluded, "that in a world where scientific achievements exceed the wildest imaginings, the engineering school provides the young men with the wealth of experience they need to manage—for the best use of mankind—the developments yet to come."

ENGINEERING MANPOWER AND THE NATIONAL INTEREST—As anticipated undergraduate engineering enrollment registered a decline in the fall of 1959, for the second consecutive year. Data from the Office of Education reveal a 5.4% drop to 234,000; freshmen down 3% to 68,000. Graduate enrollment increased 7.5% (to 35,000), compared with an increase of 17.5% in 1958.

The implications of this enrollment trend are reviewed in a report just released by the Engineering Manpower Commission. Because of the enrollment drop and lower retention rates, the graduating classes for the next five years will average 37,500 compared with pre-1958 predictions of 43,000.

Against this supply trend, EMC points to trends of increased demand for engineers: increasing population; startling growth of technical manpower during the 1950's, and projections of continued growth in the 1960's; rising industrial recruiting goals; projections of rapidly rising Gross National Product and its close relationship to increases in productivity, which depend on adequate supply of engineers; development of new fields of engineering and technology.

The increasing demands for high intellectual capacity in many professions, coupled with national emphasis on science, raises questions of the availability of sufficient quantities of highly qualified manpower for engineering.

The report concludes that two objectives must be sought: available manpower must be utilized effectively and the future supply made sufficient for expanding needs. EMC advocates several more specific objectives: better utilization of engineers and technicians; improved education at all levels and teachers' working conditions; increased recognition of engineers at the national level; permitting engineers to discharge their service obligation as either civilian or military as the publice interest may require; improving public relations of engineering through students, parents, counselors as well as government and industry; intensifying support of major guidance programs of the Engineers' Council for Professional Development and the Junior Engineering Technical Society.

Congratulations to the following fall term four-pointers in engineering:

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James Eagan
Roy White
Harry Richter
Robert Harger
John Niehoff

JUNIORS

Kenneth Drake
Leonard Grantner
Elizabeth Buschlen
Alvin Bailey
Charles Hansen
John Sargent
William Podoba

SOPHOMORES

Wayne Granfors
Stanley Steinberg
Donald Shirey
Gerald Hopkins
Larry Kirkby
Larry Osterink
Everett Moore
Charles Murphy
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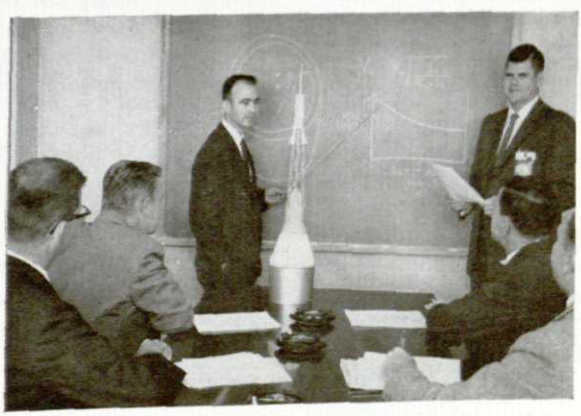


John H. Suchan, BSCE, Iowa State U., '51, Supervisor Strength Engineering, standing to the left; and Floyd J. Smith, Jr., BSME, U. of Illinois, '49, Project Mercury Test Coordinator, are seen here discussing orbit velocities required for Project Mercury, manned space capsule.

McDONNELL Aircraft

PROBABILITY

(*Continued from Page 30*)

the probability of an **outcome of probability p** being repeated "n" times. The probability of this repetition equals $(p)^n$.

Suppose, for instance, that everyone on the M.S.U. campus is completely faithful in accurately passing on to one individual what they have learned from talking with another, with a probability of 99/100. How many persons would have to pass along a particular message before it would most likely be incorrectly passed to the next? Since the thing we are after is the number of persons required to reduce the probability of correct passage of the message below 1/2, clearly the equation $(99/100)^n = 1/2$ will yield the results.

How many persons would you suppose could pass on the message before the probability of its being altered rose to greater than one-half? Would you judge that number to be one thousand, three hundred? Our ears might not be so susceptible to rumors circulated among large groups of people when we learn that 69 is the number of persons most likely to honor the accuracy of an idea, while more than 69 would be increasingly probable to err in the passing-on of the same.

Keeping in mind that the probability of an individual **not** being born on a specified day of the year equals 364/365, you might use the ideas of Arguments 2 and 3, to discover the number of persons required to comprise a group, such that the probability of two of them being born on the same day is greater than 1/2.

ARGUMENT 4

Probability of a Compound Outcome (of interdependent simple outcomes).

Definition: If the probabilities of events A and B are so related as to cause us to infer from the occurrence of one of them that a change has resulted in the probability of the other, then the probability of **both** events A and B occurring together, is the probability of the first-taken, multiplied by the probability newly assigned to the second-taken (as a result of the taking of the first).

Example: Let us assume that you have on your bookshelf a matched set of like-bound "Harvard Classics." These total 12 volumes in all. Two of these volumes are Part I and II of a particular work. It is required to determine the probability of selecting at random the two-volume work, if only two books are to be taken from the shelf. The probability of this outcome is, by the above, equal to the product of the probability of choosing Part I on the first try (1/12), by the probability that Part II will be chosen on the second try (1/11). This equals the fraction (1/132). But, just a minute! We could just as well have chosen Part II first, and then Part I, for our problem was to determine the probability of **getting both,** regardless of order. This second alternative, for choosing the volumes, has a probability of 1/132 also. Thus, applying Argument 2, we arrive at a probability of 2/132 or 1/66 for the choice, and this is the probability of getting **both** Parts I and II. We could have computed this result directly by taking the product of 2/12 by 1/11, as this would be the probability of each selection from the shelf being one of the part-volumes.

ARGUMENT 5

Probability of an event whose cause is suspected to be among several, but has not been ascertained, as evaluated from available evidence.

Definition: Here, suppose that all possible causes to event Z are A, B, C, and D. Then note that **certain events** have occurred which lead us to suspect unequally the existence of causes A, B, C, and D. We deduce that these **certain events** had a probability **a** of being caused by A, **b** of being caused by B, **c** of being caused by C, and similarly for D.

Then, the probability that A **was** the cause for these **certain** events equals $a/(a+b+c+d)$, and similarly for B, C, and D. Further, we observe that the probability that a new event Z would occur under A alone equals **a'**, and under B alone equals **b'**, etc.

These conditions being known, the probability of event Z occurring as a result of eihter A, or B, or C, or D, is equal to the fraction whose numerator equals $(a)a'+(b)b'+(c)c'+(d)d'$, **and** whose denominator equals $a+b+c+d$.

Example: Suppose you are shown two rings which appear to be exactly the same. Perhaps both are glass, or one is glass and one is a diamond, or both are diamonds. You are invited by their owner to inspect one more closely. You do so, and discover that it is indeed a diamond. You pass the ring to its owner, who admires it himself before replacing it in a box with the other. Some moments later, you again have occasion to examine one of the rings (not knowing whether it is the same one or not) and this too is a diamond. Still later, a thief is surprised in the house, who escapes capture. A quick check discloses the theft of one of the rings. What is the probability that the thief has made off with only a glass imitation?

Since we know at least one of the rings was a diamond, we know that either **both** rings were diamond, or **one** was diamond, and the other glass. In two previous drawings we had drawn a diamond each time. The probability of this occurring under the first assumption (both diamond) is unity, since we then had no alternative but to draw a diamond. This same probability under the assumption that only **one** ring was a diamond is equal to 1/2 times 1/2, or 1/4. Thus, by the above, the probability that both rings were diamond equals $(1)/(1+1/4)$ or 4/5. The probability that only one was a diamond equals $(1/4)/(1+1/4)$ or 1/5. These of course total to unity, as they cover all possible cases.

The probability that the thief would have drawn a diamond, under the first assumption, equals unity (1). His probability of such a draw, under the second assumption, would be 1/2 (as he is drawing one special object from a group of two objects). His probability of drawing a diamond would then be equal to $(4/5)(1)+(1/5)(1/2)$ or 9/10. The probability that he stole only a glass ring is then a slim (1−9/10) or 1/10.

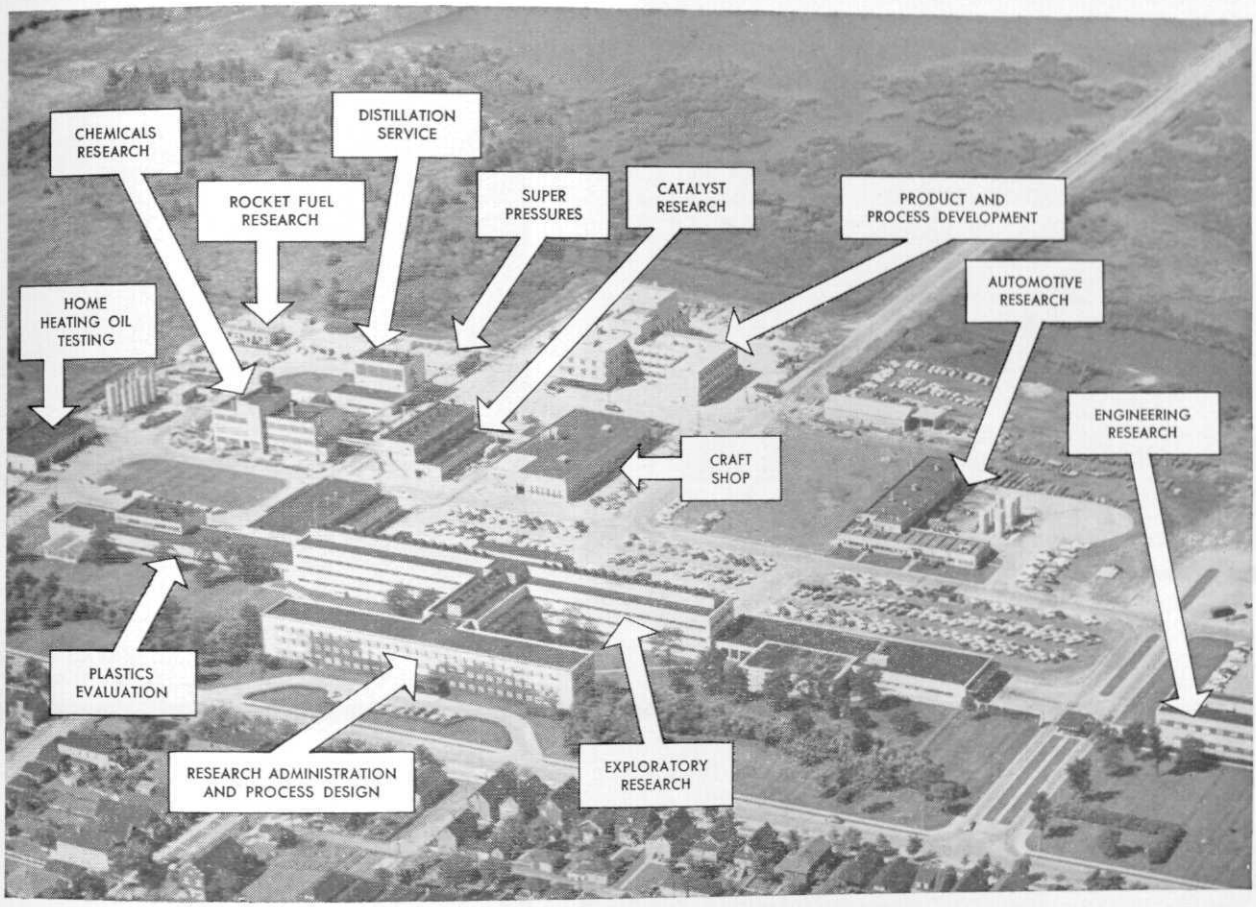
ARGUMENT 6

Probable Advantage.

Definition: The probable advantage of acting in expectation of a certain event of probability **p,** in hope of a reward **r** should the event occur, is equal to $(p)(r)-(1-p)(L)$, where **L** is your loss as a consequence of the event failing to occur as hoped. This should total zero in a fair game.

Example: You and I are to take turns at throwing a pair of dice, with the stakes determined as follows: I shall agree to pay you 25¢ for every total of two that you throw, and you have agreed to pay me 5¢ for every total of seven, with no loss to either of us, should we fail to make our totals in turn. Thus, my expectation in the game minus yours will be my probable advantage. You want this to be negative, or at the most, zero. Arranging the numbers 1 thru 6 in the following fashion will point up the fact that of the 36 combinations in which the dice may

(*Continued on Page 48*)



This huge research center at Whiting, Indiana, is only part of Standard Oil's research facilities. A recently completed technical service and quality control laboratory, not shown here, is the largest laboratory of its kind in the country. In addition, large research laboratories are operated by several affiliates.

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Since our first research laboratory opened 69 years ago, research scientists of Standard Oil and its affiliated companies have been responsible for many major petroleum advances —from making a barrel of oil yield more gasoline to discovering a way to revive almost-dry wells. Each process had the effect of adding billions of barrels to America's oil reserves.

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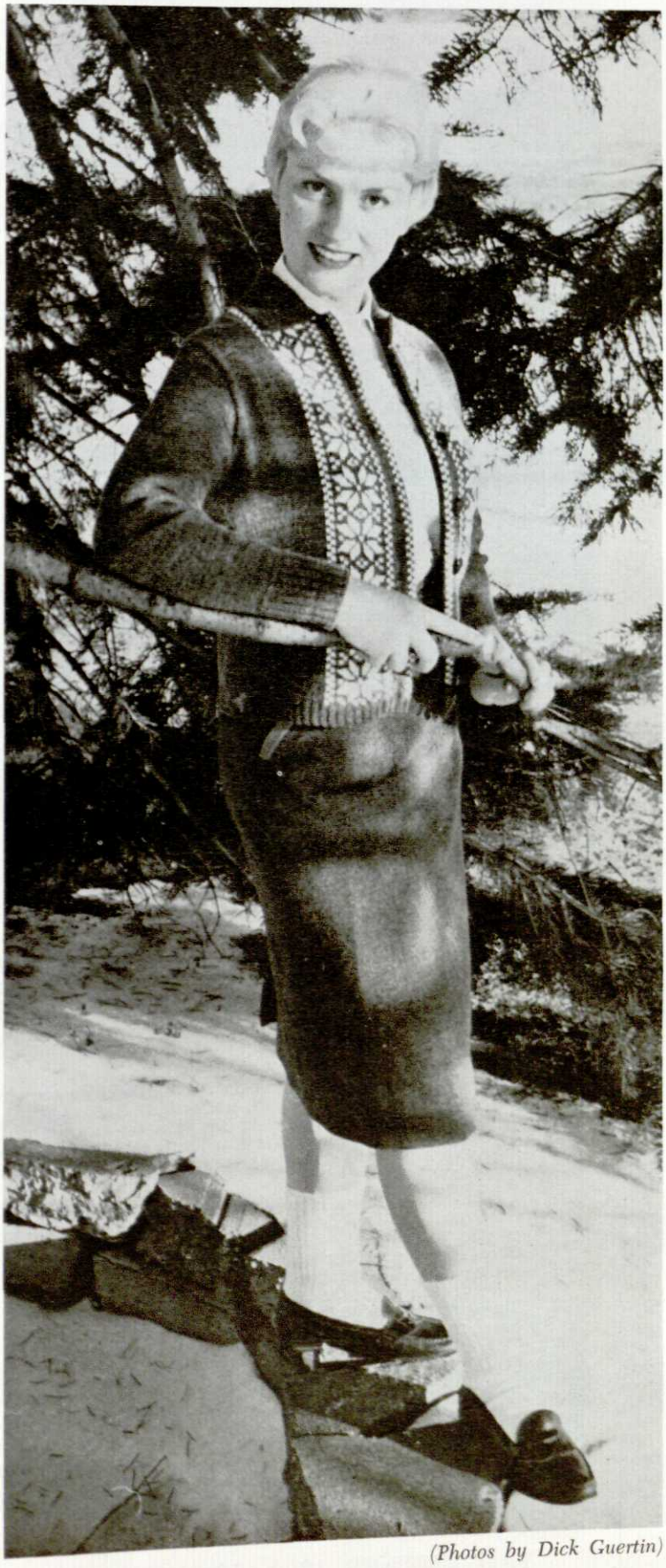
Age 19

Dorm: East Yakeley

Specs: 5′ 6″
Blond Hair
Brown Eyes
39 - 26 - 38

Major: Speech Correction

Hobbies: Music, plays accordian, piano, and trombone



(Photos by Dick Guertin)

THERMOELECTRICITY

(Continued from Page 19)

remarkable properties unknown in metals. Upon these properties are based the transistor, and the solar battery.

But semiconductors have the disadvantage that their efficiency drops off at high temperatures. Therefore, they do not appear practical for use at the very high temperatures needed to attain efficient thermoelectric power generation.

Recently scientists have discovered a previously unexplored class of materials which offers promise for thermoelectric power genertaion at high temperatures. They are known as mixed valence compounds.

Essentially a thermoelectric conductor is an electron pump which uses heat energy as its driving force. Heating one end of thermoelectric material causes the electrons within it to crowd to the cool end, where they build up as an electric charge or voltage.

Joining together two materials which differ in the magnitude of this effect, and heating their junction, causes a continuous flow of electrons through an electrical device connected to the cool ends of the pair of materials.

In order to obtain electrical energy from a steam engine, one must construct a furnace, a condenser, a steam boiler, the steam engine, and a dynamo. This is complex and expensive equipment.

Today, for small power requirements when one needs only small amounts of electricity, thermoelectric generators can compete with steam engines. And for very low power requirements (as in radar, telegraph, and telephone communications) thermoelectric generators provide the best solution.

In U.S.S.R. thermoelectric generators are rendering effective practical service in many places that otherwise would not have electric power.

The Russians use the generator to obtain from the heat of an ordinary kerosene lamp enough electrical energy to power a radio set. Such thermoelectric lamps are produced by the tens of thousands in the U.S.S.R., and are in wide use.

Of course our greatest source of heat now going to waste is the sun

(Continued on Page 46)

. . . a hand in things to come

Reaching into a lost world

. . . *for a plastic you use every day*

Massive creatures once sloshed through endless swamps, feeding on huge ferns, luxuriant rushes and strange pulp-like trees. After ruling for 100 million years, the giant animals and plants vanished forever beneath the surface with violent upheavals in the earth's crust. Over a long period, they gradually turned into great deposits of oil and natural gas. And today, Union Carbide converts these vast resources into a modern miracle—the widely-used plastic called polyethylene.

Millions of feet of tough, transparent polyethylene film are used each year to protect the freshness of perishable foods such as fruits and vegetables. Scores of other useful things are made from polyethylene . . . unbreakable kitchenware, alive with color . . . bottles that dispense a fine spray with a gentle squeeze . . . electrical insulation for your television antenna, and even for trans-oceanic telephone cables.

Polyethylene is only one of many plastics and chemicals that Union Carbide creates from oil and natural gas. By constant research into the basic elements of nature, the people of Union Carbide bring new and better products into your everyday life.

Learn about the exciting work going on now in plastics, carbons, chemicals, gases, metals, and nuclear energy. Write for "Products and Processes" Booklet H, Union Carbide Corporation, 30 E. 42nd St., New York 17, N. Y. In Canada, Union Carbide Canada Limited, Toronto.

UNION CARBIDE

. . . a hand in things to come

CAREERS ABROAD

(Continued from Page 20)

bridges, and schools. The United States Government, without a doubt, hires the greatest number of qualified engineers for placement with Nato and Seato allies in just about every phase of engineering imaginable.

The opportunities for technical experience, travel, and positions of high responsibility are there for the person with adequate education in both engineering and foreign studies. Another big advantage in accepting an overseas assignment is the attractive remuneration received for the sacrifies made in some of the geographical locations. Despite all the glamour, there are some places where living conditions are extremely difficult, and a person must know what to expect.

Those willing to accept the challenges of foreign employment in engineering must seriously consider the new program for international service. The benefits received will be rewarding in experience, travel, responsibility, and money.

Any inquiries regarding the program should be directed to: J. D. Ryder, Dean of Engineering at Michigan State University.

RUNNING SCARED

(Continued from Page 25)

problem on which you are stuck.

3. Everything isn't in the books.
4. Don't expect things to happen overnight.
5. A training program isn't just a necessary evil to be gotten over as quickly and painlessly as possible.
6. You don't have to compensate for your inferiority complex by telling the boss the first week what to do and how to do it.
7. The shortage of engineers doesn't guarantee a good, continuing job with a future.
8. You have to assume responsibility.

How much can be expected of an engineer is illustrated by the experience of a man, now retired, who worked for many years for one of the large steel mills in the Pittsburgh area. As a young engineer in the utilities department, he was made responsible for all plant water. Full of vim, he checked the entire complicated distribution system, discovering, to his horror, that if one pump taking water from the river went out of service, the entire plant operation must inevitably be shut down. He convinced his boss and his boss's boss and so on all the way up the line to the president of the company that a second big pump should be purchased. But the president took a long look at the cost and said "No." Not many months later the critical pump failed. The mill shut down.

The young engineer was promptly called to the president's office to explain why the water supply had failed. As tactfully as he could, he pointed out that he had warned against the precarious dependence on one pump, had even argued with the president himself for the purchase of a spare, and could therefore scarcely be blamed for the catastrophe. "Yes," roared the president, "but if we needed that extra pump, it was your job to convince me!"

When I stated in my thesis that you go farther and have more fun if you run scared than if you feel secure, I mean both points. Let's consider why you go farther.

Here is an equation attributed to Dan McQuaid, who calls himself the cowboy engineer:

$$V = A - S$$

In words this reads: "The value of any position is equal to the ability of the individual to produce, minus supervision."

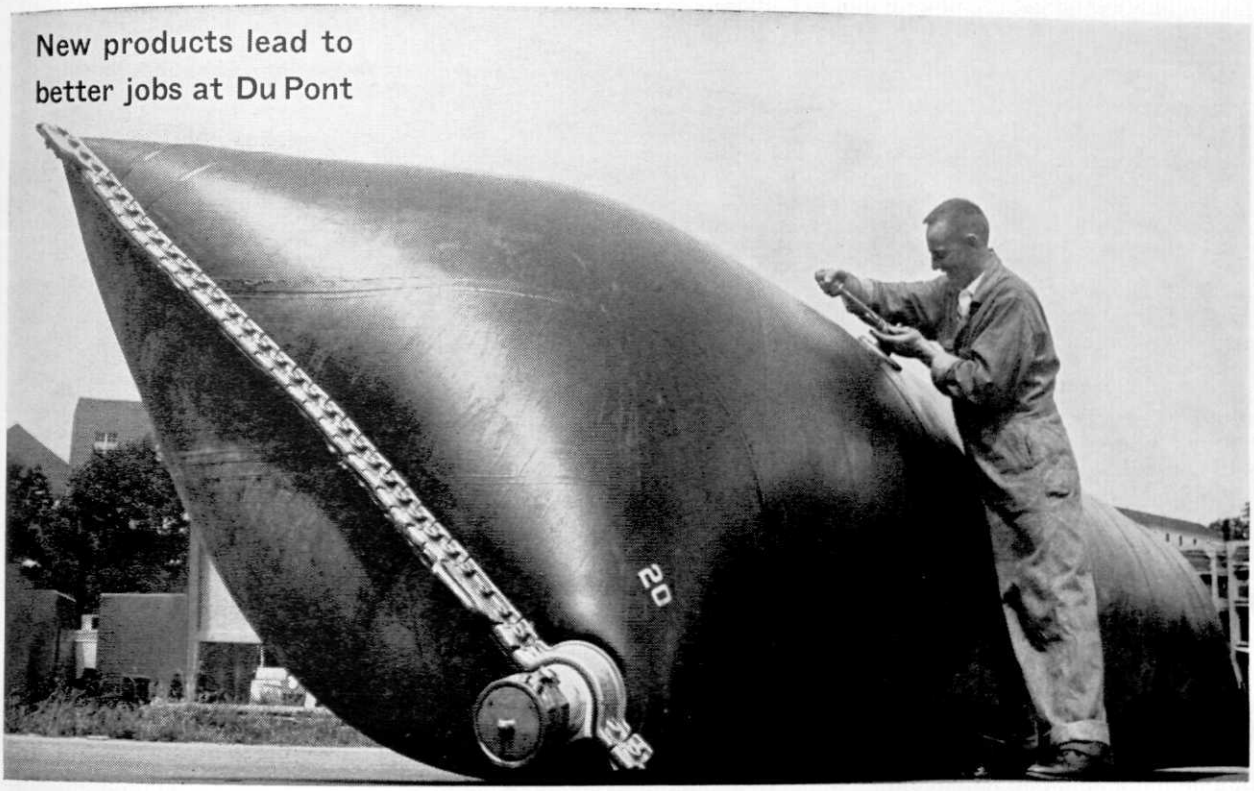
Strangely enough, industry is always looking for men to whom it can pay more money. Such men must have a value for $A - S$ that causes them to stand out from their fellows. Sometimes an individual who does not have exceptional ability to produce goes ahead of an inherently more able man simply because the average fellow requires so much supervision that he is actually less valuable.

Do you know what happens then, even in some cases after the supervisor or manager has carefully explained the whole situation? The inherently more able man who has been bypassed goes around muttering under his breath about eager beavers who spend all their time trying to make themselves look good to the boss!

My second point was that it is more fun to run scared than to feel secure. Let's not interpret that as a plea that you develop ulcers at thirty. But if you feel responsible, you will feel that you really count for some-

(Continued on Page 46)

New products lead to
better jobs at Du Pont



BLUBBER OR RUBBER?

It looks like a whale, but it's actually a king-size collapsible container for carrying liquids and powders. Bags like this are made of fabric woven with Du Pont "Super Cordura"* high-tenacity rayon yarn, coated with Du Pont neoprene synthetic rubber; capacity: 3,000-20,000 gallons. They are among the most dramatic and practical advances in industrial packaging.

Du Pont has made many contributions to this field and to practically every kind of business or industry you can name. Naturally, all this diversified activity creates many interesting jobs. Jobs in research. Jobs in production. And jobs in sales and marketing. *Good* jobs that contribute substantially to the steady growth of Du Pont and the people who are the company.

For qualified bachelors, masters and doctors, career opportunities are today greater at Du Pont than ever before. There is an interesting future in this vigorous company for metallurgists, physicists, mathematicians, and electrical and mechanical engineers, as well as for chemists and chemical engineers.

If you join Du Pont, you will be given a project assignment almost at once, and you will begin to learn your job by doing it. Advancement will come as rapidly as your abilities permit and opportunities develop. Du Pont personnel policy is based on our belief in promotion from within the company on a merit basis.

If you would like more information about opportunities at Du Pont, see your placement officer or write E. I. du Pont de Nemours & Co. (Inc.), 2420 Nemours Building, Wilmington 98, Delaware.

* *"Super Cordura" is Du Pont's registered trademark for its high-tenacity rayon yarn*

DU PONT
REG. U. S. PAT. OFF.

Better Things for Better Living . . . *through Chemistry*

ALUMNI NOTES

Daniel Johnson ('58) is assistant engineer for the City of Albert Lea, Minnesota. His wife, Sylvia Bates, is teaching kindergarten in the local school system. Their address is 819 Bridge, Albert Lea.

° ° °

Clifford Holforty ('50) is a consulting engineer in the Oakland County area. He lives at 2783 Hillendale Dr., Rochester, Mich. Prior to opening his own office, he was chief structural engineer with Linn Smith Associates, Inc., and before that he was assistant chief structural engineer with Eberle M. Smith Associates, Inc. He also worked for Victor Gruen Associates. Some of the projects he has worked on include the Ford assembly plant at Manwah, N.J.; the Northland Shopping Center; the Wiley Groves High School in Birmingham; Pontiac Northern High School and housing projects in Benton Harbor and Kalamazoo.

° ° °

Ward R. Shedd ('02) writes from 719 Ashland Ave., Rockford, Ill.

° ° °

Lee O. Benner ('12) lives at 615 Riley St. in Lansing, Michigan.

° ° °

W. R. Collinson ('18) has retired from his construction company in Midland and lives on a farm. "Never miss a football game," he writes.

° ° °

L. L. Beltz ('21) is chief engineer for the Ford Motor Company. He lives at 26721 Meadowbrook Way, Lathrup Village, Michigan.

° ° °

Forest McFarland ('21) is executive assistant chief engineer for Buick Division of GM. He lives in Flint at 3000 Westwood Pkwy.

° ° °

Harold J. Plumb ('21) is an engineer for the Consumers Power Company in Jackson. He and his wife, Florine (Folks), ('20) live at 210 N. Durand St.

° ° °

Avery J. Reading ('24) is employed by the Nalco Chemical Company in Western Springs, Illinois. He was recently elected president of the Association of Track & Structure Suppliers, an organization composed of 140 firms supplying products to railroads in the U.S. and Canada. He and his wife, Marie (Tracy), ('26) live at 4609 Woodland Ave.

° ° °

H. C. Rockwell ('25) is president of the Row Motor Sales Company in Grand Rapids. His address is 265 Manhattan, S.E.

Herbert E. Ziel ('15) is hospitalized at the present time, but says that he expects to be around again very soon. He lives at 694 Glynn Ct., Detroit 2, Michigan.

° ° °

Arnold M. Hopperstead ('20) is busy helping to produce better concrete and also running a concrete laboratory. He lives at 418 Huron St., Lansing, Michigan.

° ° °

John E. Dean ('30) is head of the electrical engineering department at Colorado State University. He has been granted a year's absence to work for General Electric in light military electronics in Utica, N.Y.

° ° °

William A. Beck ('39) lives in Hudson, Ohio, at 7602 Sugarbush Trail. He is working for Dow Chemical and Magnesium and describes Hudson as "More like a New England village than anything in New England." He is now a commander in the Naval reserve.

° ° °

M. H. Dennos ('43) is a salesman for the Schenectady Varnish Company, and lives in Glenrock, N.J., at 133 E. Gramercy Place. His family includes daughters Anne 13; and Mary Christine, 10.

° ° °

William Gokay, Jr., is gas distribution engineer for the Consumers Power Company in Lansing. He and his wife Nancy, ('52) and their two children live at 341 Clement Rd., Lansing 17, Mich.

° ° °

Edward Umiker ('50) is chief planning engineer for the New York State highway division. He lives in Kenmore, New York, at 497 Traverse Blvd.

° ° °

Floyd I. Backus, Jr., ('53) is senior dynamics engineer for Convair Astronautics in San Diego, California. He and his wife Gloria (Wieland) live at 3284 Mobley St., San Diego. Their first child—a son was born this year.

° ° °

John O. Cheney ('54) is an electrical engineer for the Alpha Corporation in Richardson, Texas. His address is 1212 Ashland Dr.

° ° °

Karl Kraub ('58) is an assistant engineer in transmission engineering for American Telegraph and Telephone Company at Cincinnati, Ohio. His address is 6409 Heitzler Ave.

(Continued on Page 50)

RUNNING SCARED

(Continued from Page 44)

thing. That is a way that most of us humans need to feel.

If you feel responsible, it helps to fix your thoughts on the thing for which you are responsible, which makes for mental health. The man who shuns responsibility easily gets to thinking about himself more and more, so that he enjoys life less and less.

It has always seemed to me that there was an impressive psychological truth behind the Biblical statement that, "He who loses his life shall gain it." I would paraphrase this as: "He who loses himself so completely in living that he identifies himself with what he is trying to accomplish, really lives."

THERMOELECTRICITY

(Continued from Page 42)

itself. If we could effectively harness all of the sun's heat that strikes the earth, we could produce over a million times more power than all of the electrical power produced today in the entire world.

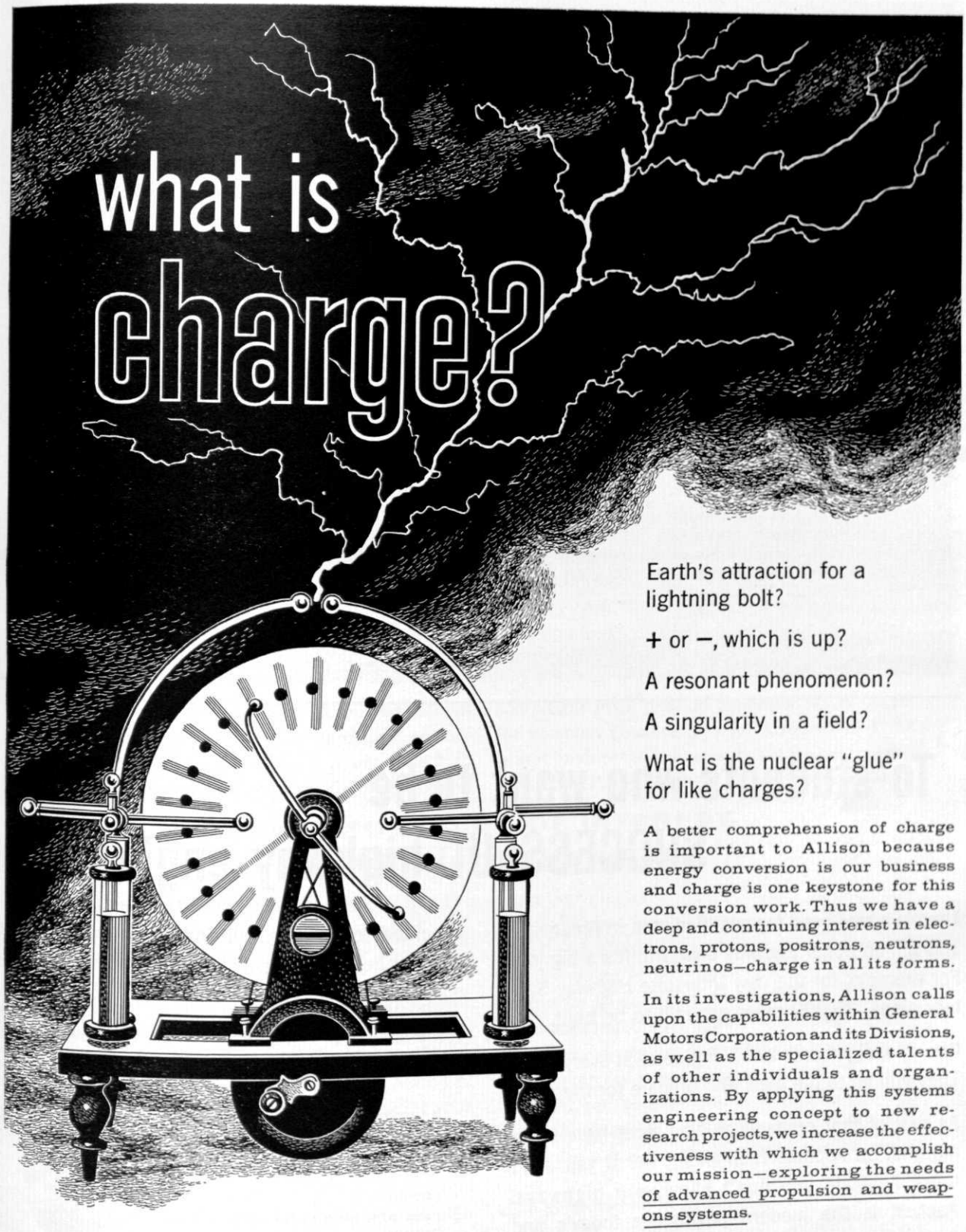
Let us consider thermoelectric solar generators. Preliminary experiments indicate that small thermoelectric units are entirely feasible, even allowing for the cost of large steerable mirrors necessary to concentrate the sunlight.

Such units could be used to pump water from underground wells and irrigate desert land. This possibility is important: irrigated deserts are the world's best gardens.

The transformation of heat into electricity is only half of the story of the thermoelectric cell. It can also transfer energy the other way and, serve to either heat or cool.

Now thermoelectricity is unfolding before our eyes. It is only in the last few years that we have recognized the significance of this method of energy conversion. Recently, developments in the U. S. have been rapid and are thought to have outpaced foreign progress.

In both industrial and consumer applications experts believe that thermoelectricity will have its greatest impact in making possible new and different products, rather than in replacing existing items already well established in the factory, business establishment, or home.



Earth's attraction for a lightning bolt?

+ or −, which is up?

A resonant phenomenon?

A singularity in a field?

What is the nuclear "glue" for like charges?

A better comprehension of charge is important to Allison because energy conversion is our business and charge is one keystone for this conversion work. Thus we have a deep and continuing interest in electrons, protons, positrons, neutrons, neutrinos—charge in all its forms.

In its investigations, Allison calls upon the capabilities within General Motors Corporation and its Divisions, as well as the specialized talents of other individuals and organizations. By applying this systems engineering concept to new research projects, we increase the effectiveness with which we accomplish our mission—exploring the needs of advanced propulsion and weapons systems.

Want to know about YOUR opportunities on the Allison Engineering Team? Write: Mr. R. C. Smith, College Relations, Personnel Dept.

Energy conversion is our business

ALLISON

Division of General Motors,
Indianapolis, Indiana

PROBABILITY

(Continued from Page 38)

fall, six of these will yield a seven, whereas only one will yield a deuce.

1 2 3 4 5 6 first dice may fall
6 5 4 3 2 1 second dice may fall
7 7 7 7 7 7 the dice may total

The probability of my getting a seven in any throw equals 6/36. The probability of your getting a deuce in any throw equals 1/36. My probable advantage is then (1/6(5)−(1/36)(25). Clearly, I have a slight edge. You would do well to demand 30¢ for each deuce that you throw, in which case (1/6)(5)−(1/36)(30)=0, and neither of us has unfair advantage.

All of the six Arguments have been concerned with an analysis of the structure of simple, simultaneous, sequential, and finally profitable events, as regards the probability of their occurrence. The last of these leads to interest in such topics as quality control, and profit control, whereas some of the former ideas lend themselves to game theory. Of course all of these provide the basis upon which the business of selling insurance for profit has flourished. This is one example of a case in which unfair advantage may take on very favorable consequences, for all concerned.

All of this leaves untouched the vastly important study of the probability of measure, from which we get the important "probability curve" so well liked by students generally. Yet, while we don't wish to immerse ourselves in this expansive topic so late in the discussion, it may serve our purpose here to prove the fact that the arithmetic mean of several measurements on a quantity is indeed the most probable true value of the quantity. The proof is simple, uses an idea we have already discussed, and points up the basic similarity of all probability problems.

Suppose our measurements on a quantity, of true value Z, are designated by A, B, C, . . . Let A be in error, from Z, by an amount a', B by b', and so on. Let there be (n) measurements on Z.

Then, $(Z-a')+(Z-b')+(Z-c')+\ldots=A+B+C+\ldots$

Thus, $(n)Z-(a'+b'+c'+\ldots=A+B+C+\ldots$

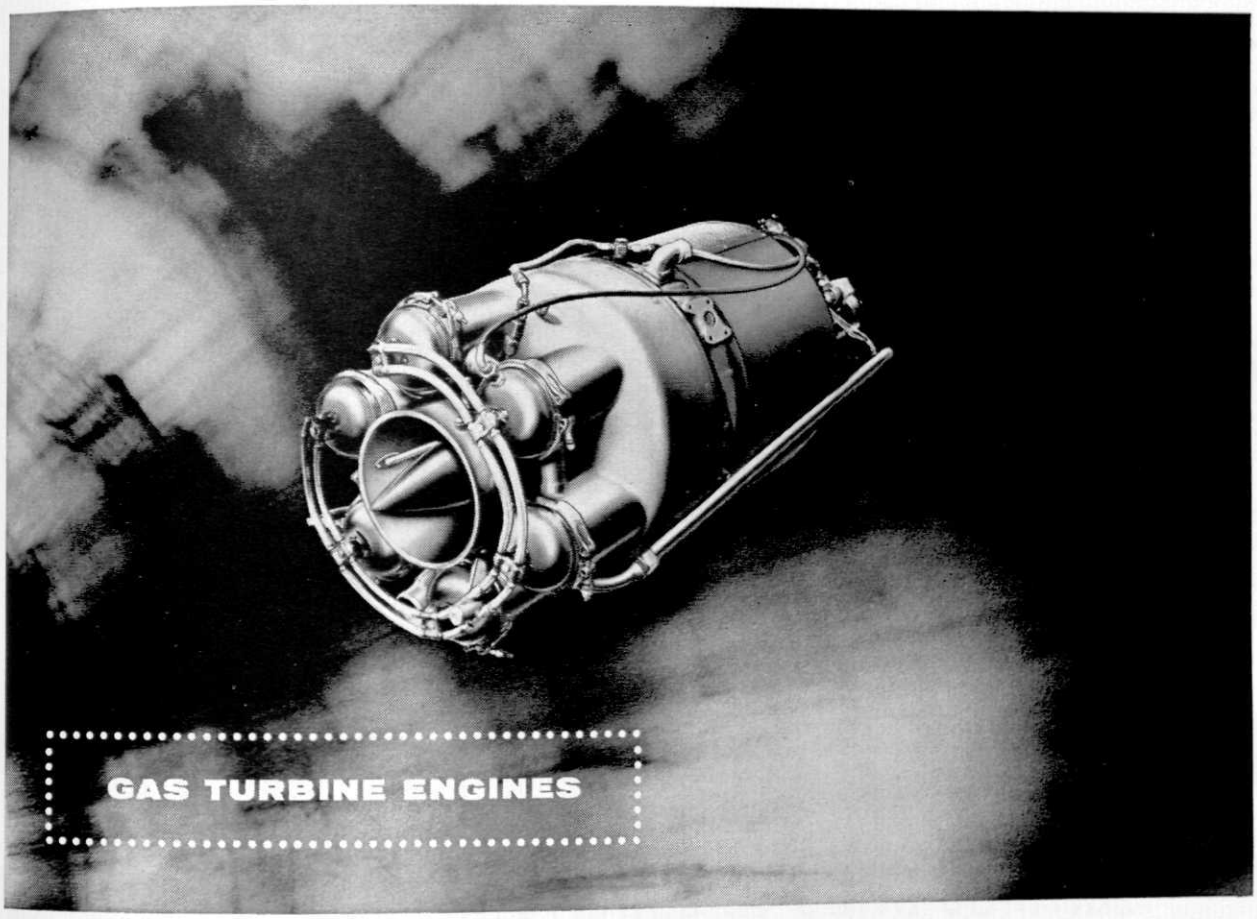
But, if these errors are equally probable in magnitude, and equally probable as they are plus or minus, then their sum is zero.

Then, $(n)Z=A+B+C+\ldots$

So, $Z=(A+B+C+\ldots)\div(n)$ is the most probable value.

It is my feeling that we never know anything perfectly, least of all probability. There are problems using only these basic ideas that would probably be incorrectly evaluated nine times out of ten (figuratively speaking, of course). If we are very skilled in the basic ideas, however, and can see a pattern to the whole body of general probability situations, we are less likely to mis-apply the theory on the basis of this, than if we had spent our time investigating a few problems of an isolated nature.

Those of you who are really interested in this topic would do well to elect either the 201 or 301 course in statistics. Each of these serves a different interest in the subject, while either will provide you with a good understanding of the same.



• The small gas turbine is an important aircraft support item used primarily for starting jet engines and providing on-board auxiliary power. The high compressed air and shaft outputs for its small size and weight mark it as an important power source for common commercial use. AiResearch is the largest producer of lightweight gas turbines, ranging from 30 H.P. to the 850 H.P. unit pictured above.

EXCITING FIELDS OF INTEREST FOR GRADUATE ENGINEERS

Diversity and strength in a company offer the engineer a key opportunity, for with broad knowledge and background your chances for responsibility and advancement are greater.

The Garrett Corporation, with its AiResearch Divisions, is rich in experience and reputation. Its diversification, which you will experience through an orientation program lasting over a period of months, allows you the best chance of finding your most profitable area of interest.

Other major fields of interest include:

• **Aircraft Flight and Electronic Systems**—pioneer and major supplier of centralized flight data systems and other electronic controls and instruments.

• **Missile Systems**—has delivered more accessory power units for missiles than any other company. AiResearch is also working with hydraulic and hot gas control systems for missile accessory power.

• **Environmental Control Systems**—pioneer, leading developer and supplier of aircraft and spacecraft air conditioning and pressurization systems.

Should you be interested in a career with The Garrett Corporation, see the magazine "The Garrett Corporation and Career Opportunities" at your College placement office. For further information write to Mr. Gerald D. Bradley...

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Systems, Packages and Components for: AIRCRAFT, MISSILE, NUCLEAR AND INDUSTRIAL APPLICATIONS

ALUMNI NOTES

(Continued from Page 46)

Eddy J. Gunnison ('05) is past 82 years old, retired, and "enjoying very good health." He has a large yard with lots of flowers and does fancy wood carving as a hobby. He lives at 527 Cedar St., N.E., Grand Rapids 5, Michigan.

° ° °

Arthur D. Peters ('05) has retired after more than 46 years in the railroad service. He and his wife Cornelia (Fisher), (w'07) live at 1180 Summit Ave., Lakewood 7, Ohio.

° ° °

Grover C. Dillman ('13) is in Florida for the winter. His address in the Sunshine State is 120 63rd Ave., S., St. Petersburg, Fla.

° ° °

Walter H. Niedermeier ('35) is manager for industrial products of the Shell Oil Company. His address is 11739 Serama Drive, St. Louis 31, Missouri.

° ° °

Mark Frank ('27) and his wife, Esther (Samson) (w'28) live at 440 Chesterfield in Birmingham, Mich. He is an engineer for the Pontiac Motor Division of GM.

° ° °

John Boyko ('37) is celebrating the 10th anniversary of the founding of his engineering consulting company, dealing in industrial equipment. He is also active in church work, and is on the Christian Business Men's National Board, the board of Christian Service Brigade National Camping Association, the board of directors of the Detroit Bible Institute, sponsors committee of the Youth for Christ and vice president of World Wide Christian Literature, Inc. Professionally, he is a member of the Society of Mechanical Engineers, and has presented technical papers in Detroit before the Society. His address is 10238 Beaconsfield, Detroit 24. His oldest son, William, is attending State.

° ° °

Lt. Col. Donald P. Appling ('37) is education services officer at Oxnard AFB, Calif. He lives at 90 Leman Dr., Camavillo, Calif.

° ° °

Adelbert H. Zink ('38) is a project engineer for the Dow Chemical Company in Midland, Mich. His address is 707 Ashman St., Midland.

° ° °

Matt E. Nuttila ('25) is supervisor of motor vehicles for Cities Service Oil Company. He lives at 109 85th Avenue, Richmand Hill, New York.

The Indispensable Man

SOMETIME WHEN YOU'RE FEELING IMPORTANT
SOMETIME WHEN YOUR EGO'S IN BLOOM

SOMETIME WHEN YOU TAKE IT FOR GRANTED
YOU'RE THE BEST QUALIFIED IN THE ROOM

SOMETIME WHEN YOU FEEL THAT YOUR GOING
WOULD LEAVE AN INFALLIBLE HOLE

JUST FOLLOW THESE SIMPLE INSTRUCTIONS
AND SEE HOW IT HUMBLES YOUR SOUL

TAKE A BUCKET AND FILL IT WITH WATER
PUT YOUR HANDS IN UP TO YOUR WRISTS

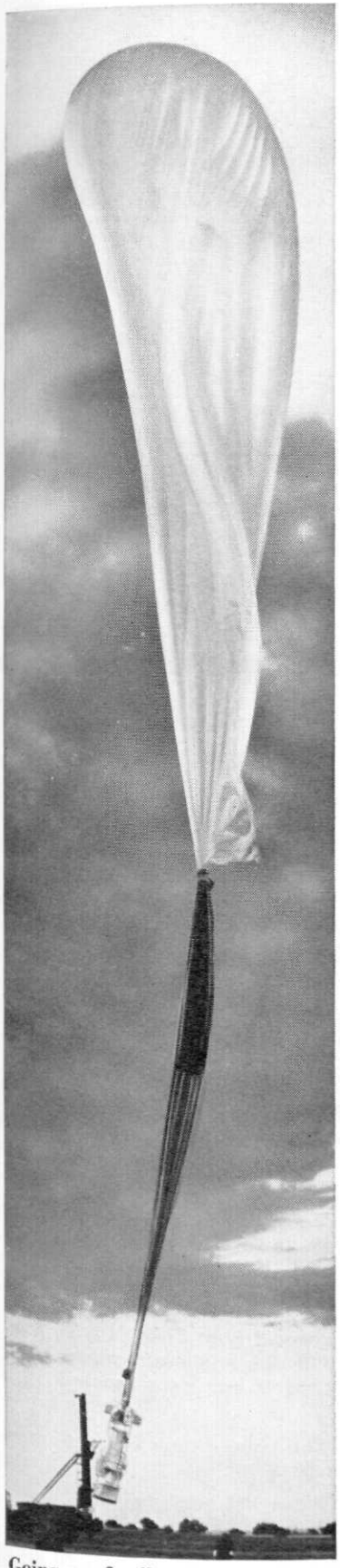
PULL THEM OUT AND THE HOLE THAT REMAINS
IS A MEASURE OF HOW YOU'LL BE MISSED

YOU MAY SPLASH ALL YOU PLEASE WHEN YOU ENTER
YOU MAY STIR UP THE WATER GALORE

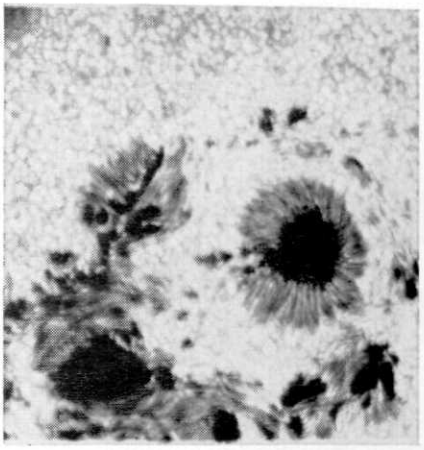
BUT STOP AND YOU'LL FIND IN A MINUTE
THAT IT LOOKS JUST THE SAME AS BEFORE

THE MORAL OF THIS IS QUITE SIMPLE
DO JUST THE BEST THAT YOU CAN

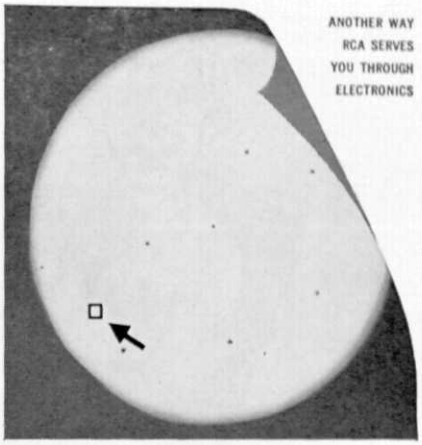
BE PROUD OF YOURSELF BUT REMEMBER
THERE IS NO INDISPENSABLE MAN!



Going up for "good seeing." Unmanned balloon-observatory starts its ascent to take sunspot photos. "Project Stratoscope" is a continuing program of the Office of Naval Research and the National Science Foundation.



One of the sharpest photos ever taken of sun's surface. It, and hundreds of others taken by stratoscope, may answer mystery of violent magnetic disturbances on earth.



Exact position of photograph in relation to the total sun surface is shown here. Plotting and photography of precise areas was made possible by airborne RCA television.

RCA REPORTS TO THE NATION:

REMARKABLE NEW PHOTOS UNLOCK MYSTERIES OF SUN'S SURFACE

Special RCA Television, operating from stratosphere, helps get sharpest photos of sun's surface ever taken

Scientists recently took the first, sharp, searching look into the center of our solar system. It was achieved not by a missile, but by a balloon posted in quiet reaches of the stratosphere.

The idea was conceived by astronomers at the Princeton University Observatory. They decided that a floating observatory—equipped with a telescope-camera—would offer a stable "work platform" from which sunspots could be photographed free of the distortion caused by the earth's atmosphere.

But "Project Stratoscope" encountered an unforeseen and major obstacle on its initial flight. A foolproof method was needed for aiming and focusing the telescope of the unmanned observatory. Princeton asked RCA to help.

A special RCA television system was devised which enabled observers on the ground to view exactly what the telescope was seeing aloft. This accomplished, it was a simple matter to achieve precise photography—directed from the ground by means of a separate RCA radio control system.

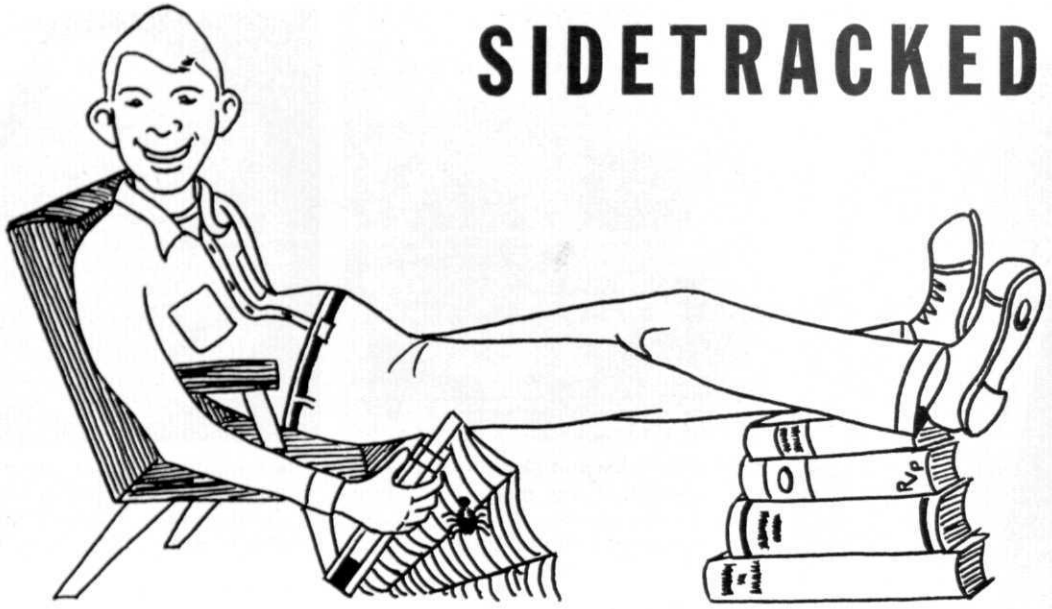
The resulting pictures reveal sunspot activities in unprecedented detail. They provide the world with important information regarding the magnetic disturbances which affect navigation and long-range communications.

The success of "Project Stratoscope" is another example of RCA leadership in advanced electronics. This leadership, achieved through quality and dependability in performance, has already made RCA Victor the most trusted name in television. Today, RCA Victor television sets are in far more homes than any other make.

RADIO CORPORATION OF AMERICA

THE MOST TRUSTED NAME IN ELECTRONICS

SIDETRACKED



Then there was the ill-humored civil engineer who always built cross roads.

° ° °

I like an exam
I think they're fun
I never cram
I never flunk one
I'm the professor

° ° °

They say that girls are minors until they are 18; then they are gold-diggers.

° ° °

One oil man to another: "Hear you brought in a dry hole last week."

Second Oil Man: "Please! Let's just say I brought in a long, thin swimming pool."

° ° °

Prof: "Well, what did you think of the course?"

C.E.: "I thought it was very well covered. Everything that wasn't covered during the semester was covered on the final!"

° ° °

Young man transferring from Engineering to Journalism would like to trade in good study lamp for comfortable bed.

° ° °

Johnny hopes to make the news.
He wants to fill his father's shoes.
Mary hopes to do much better—
She wants to fill her mother's sweater.

An ROTC officer approached a young man sporting a neatly fitting green uniform and asked, "What's the eighth general order?"

"I don't know," the fellow admitted.

"Have you ever been out for drill?"

"Nope."

"Don't you know enough to say 'sir' either? What outfit are you in?"

"Me, I'm the Coca-Cola man."

° ° °

Girls are just like cigarettes—a fact you must admit—You can't enjoy them fully until you get them lit.

° ° °

What They Mean When They Say:

See me after class—(it has slipped my mind).

Pop Quiz—(I forgot my lecture notes).

I will derive—(formula has slipped my mind).

Closed book quiz—(Memorize everything including the footnotes).

Open book quiz—(Oil your slide rules and wind your watch).

Honor system—(alternate seats).

Do odd numbered problems—(the even numbered problems will be on test).

Briefly explain—(not less than 1000 words).

He kissed her in the garden,
It was a moonlight night,
She was a marble statue,
He was a little tight.

° ° °

"Do you neck?"
"That's my business."
"Ah—a professional."

° ° °

Dean: "Didn't you get the letter we sent you?"

Frosh: "Yes, sir. I read it inside and out. On the inside it said you are expelled; and on the outside it said 'return in five days'; and here I am."

° ° °

There are only two kinds of parking left on the campus—illegal and no.

° ° °

Recent tests in the physics department prove that grasshoppers hear through their legs. When a tuning fork was placed near a grasshopper, it was found that in all cases the insect would hop. There was no reaction to this stimulus, however when the insects legs were removed.

° ° °

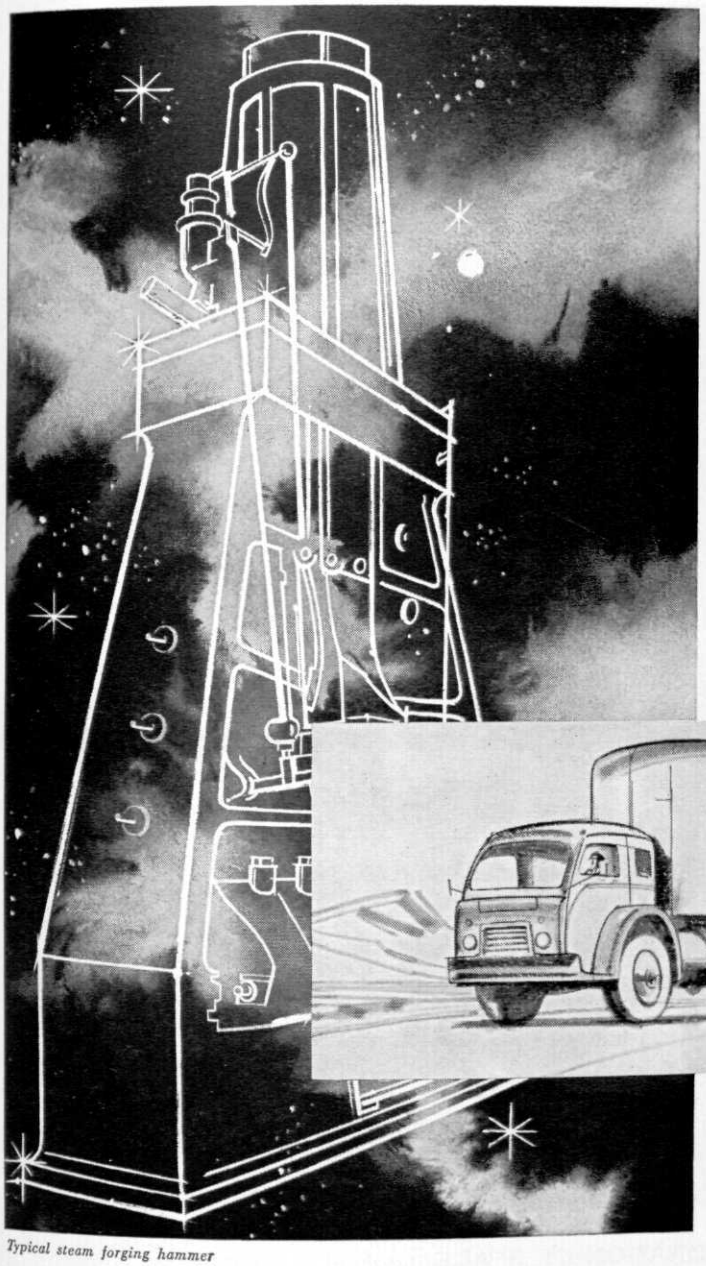
"This college turns out some great men."

"When did you graduate?"

"I didn't graduate. I was turned out."

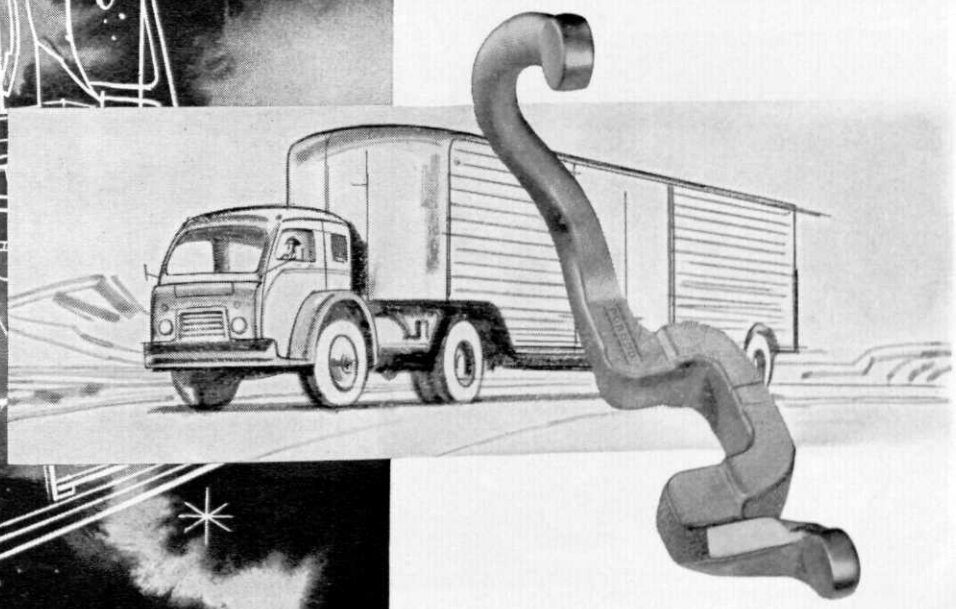
° ° °

—Now go back and read the rest of the magazine.



Typical steam forging hammer

REQUIRED SAFETY FACTORS in steering arm assured by designing it to be forged



By designing with forgings, a truck manufacturer can count on the required safety factors, with minimum "beefing-up" of parts to offset unknown internal structures or non-homogenious materials.

You, too, can achieve results like these by designing *with forgings* either at the start or on re-design. The benefits of forgings are equally impressive, whether you make home-workshop equipment or diesel engines.

Forgings start as *better* metal . . . are further *improved* by the hammer-blows or high pressure of the forging process.

Write for literature on the design, specification, and procurement of forgings.

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

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Since its inception nearly 23 years ago, the Jet Propulsion Laboratory has given the free world its first tactical guided missile system, its first earth satellite, and its first lunar probe.

In the future, under the direction of the National Aeronautics and Space Administration, pioneering on the space frontier will advance at an accelerated rate.

The preliminary instrument explorations that have already been made only seem to define how much there is yet to be learned. During the next few years, payloads will become larger, trajectories will become more precise, and distances covered will become greater. Inspections will be made of the moon and the planets and of the vast distances of interplanetary space; hard and soft landings will be made in preparation for the time when man at last sets foot on new worlds.

In this program, the task of JPL is to gather new information for a better understanding of the World and Universe.

"We do these things because of the unquenchable curiosity of Man. The scientist is continually asking himself questions and then setting out to find the answers. In the course of getting these answers, he has provided practical benefits to man that have sometimes surprised even the scientist.

"Who can tell what we will find when we get to the planets? Who, at this present time, can predict what potential benefits to man exist in this enterprise? No one can say with any accuracy what we will find as we fly farther away from the earth, first with instruments, then with man. It seems to me that we are obligated to do these things, as human beings."

DR. W. H. PICKERING, *Director, JPL*

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A Research Facility operated for the National Aeronautics and Space Administration

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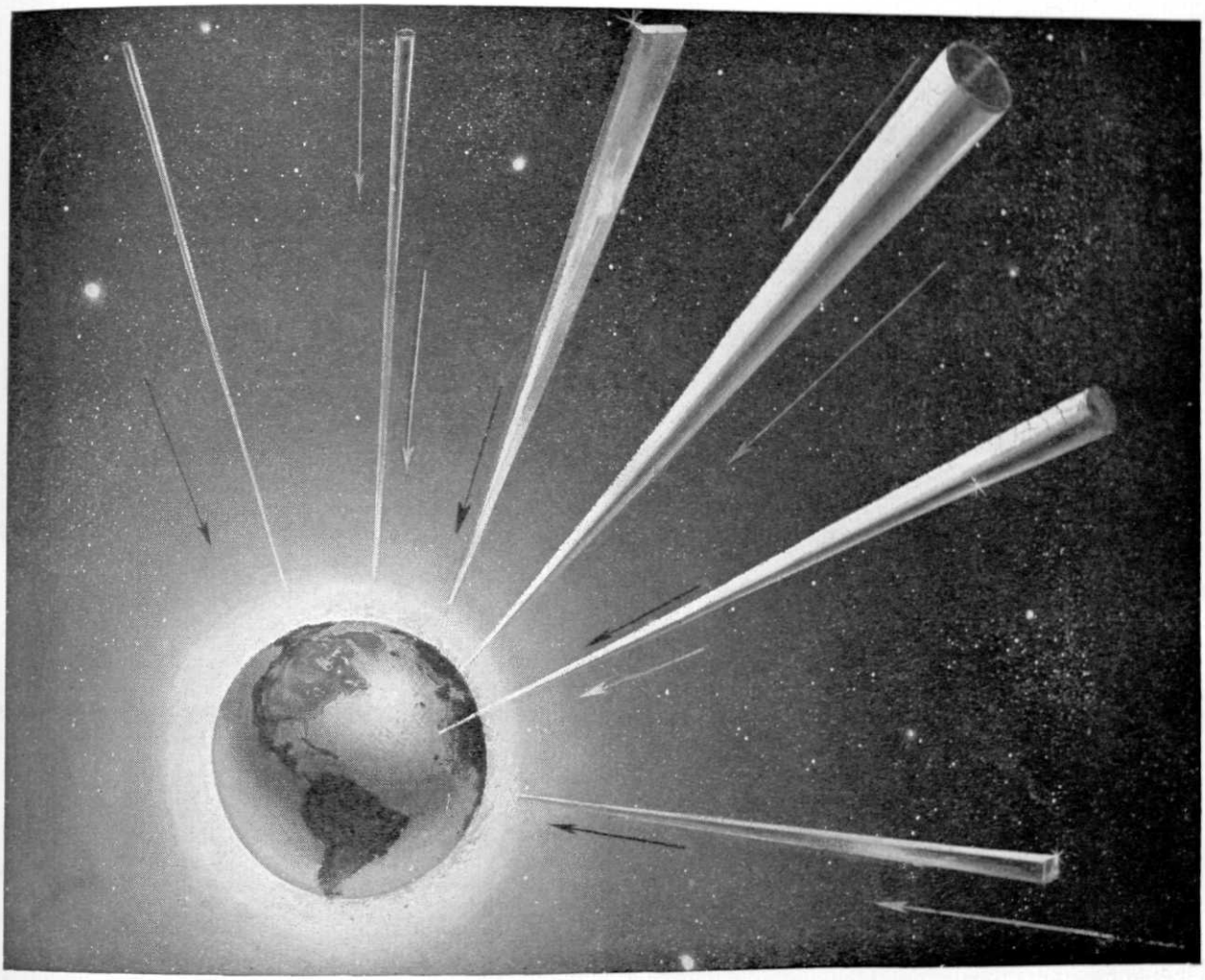
Send professional resumé for our immediate consideration. Interviews may be arranged on Campus or at the Laboratory.



METALS... the challenging heart of tomorrow's progress

Today the metals industry is poised at the threshold of its most exciting advances. New needs for metals yet undreamed of . . . revolutionary developments and production techniques . . . new modifications and applications of the basic metals . . . all spell opportunity for enterprising young metallurgists and engineers. Now is the ideal time to enter this challenging field, and lay the foundation for a richly rewarding career.

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To maintain its leadership in metals technology, Bridgeport is embarking on a major program of expansion and product diversification that will provide practically unlimited opportunities for professional achievement and rewards. To learn what this can mean to your future, ask your placement director for a copy of "Careers in Metals with Bridgeport Brass", or write direct to Mr. F. J. Finsinger, 30 Grand Street, Bridgeport 2, Conn.

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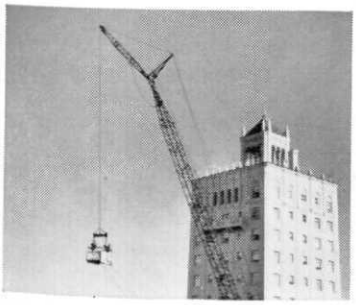
Freshmen, sophomores, and juniors are needed to fill vacancies in several editorial positions on the SPARTAN ENGINEER. Training in technical journalism is available to all interested engineering students who desire experience in the publication field. Come up and chat with us in Room 346, Student Services Bldg., any class day. Perhaps you, too, can reap the rewarding benefits of this extra-curricular activity.

ADVERTISERS' INDEX

Though the building is not yet built, this is a view from one of the apartments.

How to look out a window before the building is up



With 180 "view" apartments to sell, the developers of The Comstock turned to photography to get a jump on sales

A feature of The Comstock, San Francisco's new co-operative apartments on top of Nob Hill, will be the spectacular panoramic views of the Bay area from their picture windows.

How could these views be spread before prospective buyers—before the building was up? The developers, Albert-Lovett Co., found the answer in photography. From a gondola suspended from a crane, color photos were made from the positions of the future apartments. Now, the sales representative not only points out the location of a possible apartment on a scale model, but shows you the view from your window as well.

Photography rates high as a master salesman. It rates high in other business and industry tasks, too. The research laboratory, the production line, the quality control department and the office all get work done better and faster with photography on the job.

Whatever your field, you will find photography can save you time and cut costs, too.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

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Kodak
TRADE MARK

Interview with
General Electric's Earl G. Abbott,
Manager—Sales Training

Technical Training Programs at General Electric

Q. Why does your company have training programs, Mr. Abbott?

A. Tomorrow's many positions of major responsibility will necessarily be filled by young men who have developed their potentials early in their careers. General Electric training programs simply help speed up this development process.

In addition, training programs provide graduates with the blocks of broad experience on which later success in a specialization can be built.

Furthermore, career opportunities and interests are brought into sharp focus after intensive working exposures to several fields. General Electric then gains the valuable contributions of men who have made early, well-considered decisions on career goals and who are confidently working toward those objectives.

Q. What kinds of technical training programs does your company conduct?

A. General Electric conducts a number of training programs. The G-E programs which attract the great majority of engineering graduates are Engineering and Science, Manufacturing, and Technical Marketing.

Q. How long does the Engineering and Science Program last?

A. That depends on which of several avenues you decide to take. Many graduates complete the training program during their first year with General Electric. Each Program member has three or four responsible work assignments at one or more of 61 different plant locations.

Some graduates elect to take the Advanced Engineering Program, supplementing their work assignments with challenging Company-conducted study courses which cover the application of engineering, science, and mathematics to industrial problems. If the Program member has an analytical bent coupled with a deep interest in mathematics and physics, he may continue through a second and third year of the Advanced Engineering Program.

Then there is the two-year Creative Engineering Program for those graduates who have completed their first-year assignments and who are interested in learning creative techniques for solving engineering problems.

Another avenue of training for the qualified graduate is the Honors Program, which enables a man to earn his Master's degree within three or four semesters at selected colleges and universities. The Company pays for his tuition and books, and his work schedule allows him to earn 75 percent of full salary while he is going to school. This program is similar to a research assistantship at a college or university.

Q. Just how will the Manufacturing Training Program help prepare me for a career in manufacturing?

A. The three-year Manufacturing Program consists of three orientation assignments and three development assignments in the areas of manufacturing engineering, quality control, materials management, plant engineering, and manufacturing operations. These assignments provide you with broad, fundamental manufacturing knowledge and with specialized knowledge in your particular field of interest.

The practical, on-the-job experience offered by this rotational program is supplemented by participation in a manufacturing studies curriculum covering all phases of manufacturing.

Q. What kind of training would I get on your Technical Marketing Program?

A. The one-year Technical Marketing Program is conducted for those graduates who want to use their engineering knowledge in dealing with customers. After completing orientation assignments in engineering, manufacturing, and marketing, the Program member may specialize in one of the four marketing areas: application engineering, headquarters marketing, sales engineering, or installation and service engineering.

In addition to on-the-job assignments, related courses of study help the Program member prepare for early assumption of major responsibility.

Q. How can I decide which training program I would like best, Mr. Abbott?

A. Well, selecting a training program is a decision which you alone can make. You made a similar decision when you selected your college major, and now you are focusing your interests only a little more sharply. The beauty of training programs is that they enable you to keep your career selection relatively broad until you have examined at first hand a number of specializations.

Furthermore, transfers from one General Electric training program to another are possible for the Program member whose interests clearly develop in one of the other fields.

Personalized Career Planning is General Electric's term for the selection, placement, and professional development of engineers and scientists. If you would like a Personalized Career Planning folder which describes in more detail the Company's training programs for technical graduates, write to Mr. Abbott at Section 959-13, General Electric Company, Schenectady 5, N. Y.

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