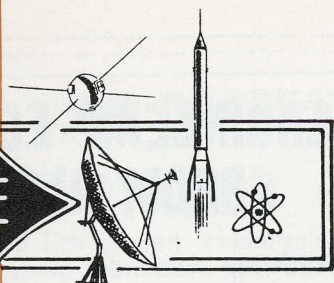


E
E

U. B. Jensen

DIGEST

CURRENT DEVELOPMENTS IN
ELECTRICAL ENGINEERING AND SCIENCE

Published by AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS for students

'Portable Defibrillator' Called a
Boon To Doctors in Life-Saving

Cambridge, Mass. . . . A method to reduce or eliminate thunderstorms or tornadoes has won patent rights. The method consists of controlling the electrical disturbances of the atmosphere by modifying the existing space charge. This modification, which could be either to decrease or increase the electrical storm activity, is brought about by introducing into the atmosphere a mass of particles all charged either negatively or positively.

Sydney, Australia . . . The world's second largest radio telescope, a 210-foot saucer located 200 miles west of Sydney, is believed to be earth's most far-seeing astronomical instrument. The Australian radio telescope's only rival is the British saucer near Manchester, England, which is 250 feet in diameter. However, the Australian instrument can outperform its larger rival, it is claimed, because it has higher surface accuracy and because its control system is extremely accurate.

Oak Ridge, Tenn. . . . Bone-marrow injections for radiation victims appear likely to have value. The conclusion is based on the survival of four Yugoslavian atomic scientists more than three years after exposure to high intensity radiation.

Washington . . . A 29-foot craft that can skim over the sea buoyed up by its own cushion of air, and land on the water for rescue operations has been designed for the U. S. Navy. Known as GEM (ground effect machine), the craft can carry a crew of six men and can glide over rough terrain and mount slopes with a 40 per cent incline, with a reported top speed of 80 miles an hour. The craft would weigh about 10,000 pounds.

Cherry Hill, N. Y. . . . In a program reported as unique in the computer industry, 31 British "students," the representatives of International Computers and Tabulators Limited (I.C.T.) are taking a concentrated course in American electronic data processing methods and equipment at the headquarters of the Radio Corporation of America's Electronic Data Processing activity.



Heart saver: Dr. William Kouwenhoven, electrical engineer, of Johns Hopkins University, (at right) demonstrates portable machine he devised which can restore normal beat to hearts that are "fibrillating" because of a severe electric shock or other cause. Dr. Kouwenhoven received AIEE's Edison Medal for developing the device. His assistant at left is Mr. Earl Becker, Mine Safety Appliance Co., Pittsburgh, manufacturers of the defibrillator. His patient is Miss Joanmarie McNamara, New York City.

AMAZING OPTICAL MASER

OPTICAL MASERS ARE PREDICTED THAT WILL MAP THE MOON, SERVE AS RADAR, COMMUNICATE THROUGH SPACE, ACT AS A SURGEON'S SCALPEL, AND EVEN "RAY-DOWN" THE ENEMY . . .

Concentrating light several million times more than a flashlight does, an extraordinary optical device — the heart of which can be gem rubies or gas mixtures — is expected to perform amazing tasks: map the moon, improve radar, communicate in space, act as a surgeon's scalpel, and as a death ray in warfare. It may also be used in the future to transfer power from the ground to a satellite. Dr. John W. Coltman, associate director of Westinghouse Research Labs., Pittsburgh, recently reported that ten million television channels could be carried by a single color, such as yellow, using the optical maser.

The optical maser (laser) is a mere baby among scientific laboratory devices. It was invented two years ago as an offspring of the radio maser, which performs with radio waves.

The optical maser, of which there are at least eight now being tested in laboratories around the country, is likely to revolutionize

many every-day activities in the future. The device amplifies and sharpens weak light waves to produce a very narrow, intense beam of a single, extremely pure color. As a result of this development, light waves can now be used in the same way as radio waves.

Boy on Swing Comparison

To understand how and why a maser works, Dr. F. T. Byrne of the U. S. Navy's Office of Naval Research compares its actions to a boy on a swing. If the boy sits perfectly still on a moving swing, the amplitude of the swing's motion gradually decreases owing to frictional losses. However, by moving his body in unison with the swing's motion, the boy can "pump up," or amplify the swinging motion. By opposite body motions — against the rhythm of the swing's motion — he can decrease the amplitude and stop the swing much more rapidly than by waiting for friction to cause the motion to cease.

(Continued on page 6, column 2)

Physicians throughout the country are being taught the new method of external heart massage that was devised by a Johns Hopkins University team in 1959.

Rescue squads, utility teams, and some police and fire departments have also received instruction in the technique, it was reported at the AIEE Winter General Meeting.

However, it is felt that efforts should not be made at this time to teach the method to the public. The problem is that the technique might become misused.

Portable Defibrillator

At the meeting the head of the Johns Hopkins team, Dr. William B. Kouwenhoven, an electrical engineer, received the Institute's Edison Medal. He and his associates also demonstrated a new defibrillator that is capable of shocking an injured heart back into its normal beating pattern in cases of ventricular fibrillation.

Associated with Dr. Kouwenhoven in the development of the technique of external cardiac massage — and also in the development of the new defibrillator — are Dr. J. Jude, a surgeon, and G. G. Knickerbocker, an electrical engineer. Dr. Kouwenhoven and his team have carried out

(Continued on page 6, column 1)

ENGINEERS' JOB
PROSPECT TOPS 1961

While non-engineers will find their job prospects about 19 per cent brighter than those of 1961, engineering graduates lead 215 industrial and business concerns' shopping lists by more than 26 per cent above 1961.

The increase in hirings is the greatest since 1957, which means that the business outlook is expected to be good.

The report was based on a survey made at Northwestern University, Evanston, Ill.

Various Industries Scanned

Industries represented in the survey, with light manufacturing, heavy equipment, and machinery predominating, included steel and other metals, automobile and aircraft.

(Continued on page 7, column 1)

JOIN YOUR AIEE STUDENT BRANCH

Rechargeable Silver-Cadmium Button Cells

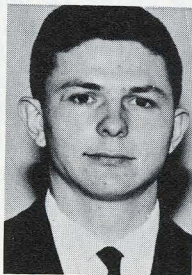
The present trend toward "cordless" devices was given a new push with the design of the rechargeable silver-cadmium button cells. The cells, reported to have 75 per cent more capacity than previous types of button cells and with a much greater useful life, have followed the development of Yardney Electric's standard-configuration sealed silver-cadmium cells. The standard cells were chosen for the Explorer XII satellite, and are still operating successfully.

The new Silcads, now in pilot production, have already completed tests of 300 to 500 complete recharging cycles, or 2,000 to 3,000 partial cycles, keeping a high percentage of their rated capacity until near the end of their useful life. Open circuit voltage is 1.4 volts, nominal voltage under load is 1.1 volts. The characteristically flat supply voltage assures dependable constant performance of the incorporating equipment. The low internal resistance of the cell permits high peak discharges when required.

At present, manufacturers are investigating the possibilities of the new cell in a variety of appliances. These range from low-drain devices such as electric shavers to portable machine tools, which are recharged after each period of use.

Other "cordless" applications are tape recorders and dictating machines, TV and radio receivers and movie cameras. The cells will be available in modules with 0.25-, 0.50-, 1-, 2-, 4-, and 6-ampere-hour capacities, and are maintenance-free.

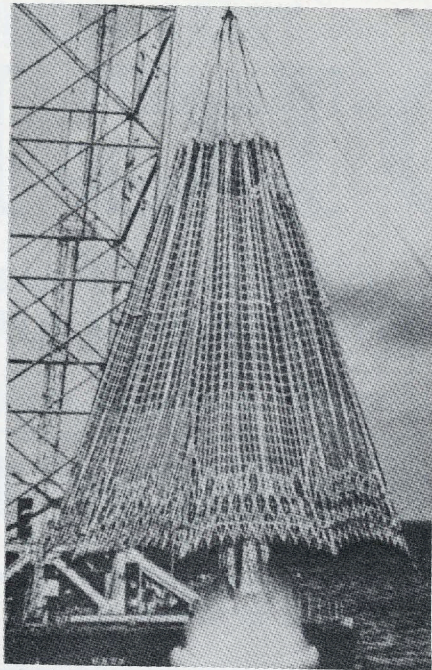
The standard size Silcads are undergoing continuous testing even yet, and have already completed more than 3800 cycles during tests in vacuum. These tests are conducted on 100-minute cycles, taking out up to 50 per cent of capacity during each cycle. The button cells are expected to equal the standard cells in quality of performance. One of the features of the Silcad button cells line is that the units do not require an overcharge to maintain the full capacity of the cell.



W. WILSON
E.E. STUDENT
1st PRIZE
PAPER
WINNER

AIEE National Student Prize Paper contests are held yearly. The winners are all outstanding student engineers. We plan to focus the spotlight on Bill Wilson, who is one of them. Bill won 1st prize in the 1961 contest, and earned his BSEE degree from the University of Washington with an average of 3.7 (92 per cent).

William Wilson, 22, single, was born in Spokane, Washington, where he attended Central Valley High School.



"OPERATION SNARE"—This device is used to test the advanced versions of the Navy's submarine-launched Polaris missile. It enables technicians and engineers at Lockheed Missiles and Space Company, Sunnyvale, Calif., to study the missile's underwater performance. The bag of nylon webbing is suspended with its bottom open and waiting directly above the launch tube on the ocean floor. The bag catches the missile as it breaks the surface of the sea.

Tiny Wireless Radios Called "Radio-Nurses"

Sugar lump sized wireless radios can monitor patients round the clock for heart, pulse rate, temperature and respiration, transmitting data to a central office.

The miniature units, placed against the fingertips, on the arm or elsewhere on the body, relay the physiological information to an antenna. No wire connections from the patient to recorder are needed. From the antenna the data are carried by wires to a central viewing tube or recorded in ink on paper.

Built into a small compact unit, the transmitters can be comfortably worn, providing a constant check on patients without any stress or disturbance to them. They supplement most of the devices described in the May 1961, EE DIGEST.

The small radios were developed by the Radio Corporation of America Laboratories, Princeton, N. J. Predictions are that the first application of the units probably will be in surgical recovery rooms where continuous patient monitoring is essential.

Bill is currently attending Massachusetts Institute of Technology, majoring in Information Theory. He expects his MS degree in August 1962. His thesis topic is "FM Feedback."

Wilson was presented with the award at the 1962 Winter General Meeting of AIEE. His prize winning paper was titled: "A Statistical Analysis of a Random Signal."

Future Plans

Bill hopes to continue graduate work toward a Ph.D. degree, possibly in computer application to Information Theory. Plans beyond this point are indefinite. Certainly to be considered is three years active duty with the Air Force. He is currently a 2nd Lt. in the AF Reserve, having been in the AF ROTC unit at the University of Washington.

ENGINEERS' EGO GETS BOOST FROM RUTGERS DEAN

Engineers' hearts will beat with pride when they read the following statement made by E. C. Easton, Dean of Engineering at Rutgers University. Dean Easton made his statement before John Glenn's flight.

Even The New York Times . . .

Recently the names of Gagarin, Shepard, Grissom, and Titov were featured prominently in the American press. All four had been passengers in vehicles designed, built, and operated by others. Despite their relatively passive roles in their respective adventures these men were hailed and feted as though each had performed the miracle of space-flight single-handedly. There was an editorial in The New York Times after Shepard's flight in which Shepard and even the astronauts who were trained, but did not make the flight, were given credit. Such reporting reveals an alarming ignorance of the area of responsibility for technological advances.

Let us have at least a faint cheer for the engineers who designed, built, launched, and controlled the vehicle in which these space passengers rode. Let's be sure that the public knows that the real heroes were engineers, not scientists or astronauts. The scientific principles which govern space flight are few and simple, while the engineering applications of those principles to accomplish a successful flight are incredibly complex.

An engineer told Shepard exactly what to expect at every instant of that flight. He told Shepard that he would experience so many G's within 15 seconds; that, at such a time, the periscope would come down; that, at a given time, the rotating rocket would fire and that, at another specified time, the retrograde rocket would fire.

The exciting thing is that someone on the ground, an engineer, was able to predict this before the rocket was fired. Furthermore, Shepard had in front of him a little globe on which the position of that capsule was located at every instant, and on which there was an arrow pointing to a landing place, if Shepard were to push the retrograde rocket button. How is it possible to design a thing that will tell a man in a tumbling space vehicle exactly where he is at any instant of time? This ability to design a complex vehicle and to predict its performance before it leaves the ground is the most sophisticated talent ever possessed by the human race and it is the mark of the engineer.

New Ignition System

- NO BREAKER POINTS
- NO MISFIRING
- LESS BATTERY DRAINAGE

An electronic ignition system for cars and trucks which eliminates the breaker points and condenser in the distributor has been developed with the advent of transistors. It is the first major development in ignition systems in the last forty years.

The new system replaces the old mechanical system with a small magnetic pick-up which is said to last the life-time of the car. The pulse generator is basically a wheel with spokes or teeth which rotate past a tiny magnet, without actual contact. Having no mechanical contact means no wear or adjustment. The Motorola Corp.'s Automotive Products Division reports that the slight additional original cost of the new system will be no more than the usual charge for one breaker point replacement.

The induced pulses are fed into a compact transistorized amplifier, then to the ignition coil. The new system has a number of additional claimed advantages. The pulse or dwell time is constant at all engine speeds. There is no misfiring due to point chatter at high speeds. There is a hotter spark at high speeds. And as an added bonus, battery drain is lower.

As it was reported, the new system is now undergoing tests by several major truck and car manufacturers.

"Wire-Wrap" For Complex Wiring

A novelty high-speed automatic device for wiring complex electronic panels on transistorized computers can attach 750 wires to a 20-by-30-inch panel in two and one-half hours. This is about ten times the speed attained by operators wrapping and wiring by hand.

Directed by punch cards, it cuts the spaghetti-thin wire from a spool, skins it, routes it and wraps the bared leads around a pair of bronze pins, all in a five-second operation. It also checks its own work by stopping for repairs if a wire is not connected properly. The machine is being produced by the Gardner-Denver Company, Grand Haven, Mich., and is trade named the Wire-Wrap.

EE DIGEST

Volume 3, March 1962, Number 4

PUBLISHED BY
AMERICAN INSTITUTE
of ELECTRICAL ENGINEERS
345 East 47th Street
New York 17, N. Y.

Warren H. Chase—President
N. S. Hibshman—Executive Secretary
C. J. Grimm—Consulting Editor
R. C. Mayer—Managing Editor
J. B. Torma—Production Manager

CONSULTANTS

Roy Krezdorn E. T. B. Gross
H. E. Corey L. F. Hickernell
R. T. Weil

Lawrence Leonard—Student
Co-ordinator

Printed in U.S.A.

BRITAIN BUILDS HIGH OUTPUT ATOMIC POWER STATION

Busy is the watchword on the five-year task of building the world's most modern atomic power station at Sizewell, Suffolk, England.

The \$1½ billion station's construction is well under way and it is reported to be the most powerful of its kind so far. Its electrical output on completion in 1966 will be 580,000 kw. It is also the most compact of those yet designed, occupying an area of 24 acres.

By last summer, excavation of the reactor foundation was well advanced and the majority of the temporary works required initially on site came into operation.

Excavation will amount to over half a million cubic yards.

Electrical and Nuclear Engineering Phase

The English Electric Co. will be responsible for the nuclear and electrical engineering, and in the latter will supply the main turbo-generators, transformers, switch-gear, circulation fans and auxiliary motors. The station will be exceptional in that it will only use two very large generators, each of 324 kw capacity, to produce power for the Supergrid and to drive the circulating fans.

The turbine house will be about 385 feet long by 155 feet wide, flanked by the electrical annexes at a higher level.

The turbo-generators, nuclear components, alternators, motors, transformers and switchgear are all made in England.

IRE-AIEE BOARDS APPROVE MERGER PRINCIPLES

On March 9th, the Boards of AIEE-IRE met simultaneously, at different locations in New York, and approved, with slight modifications, the Principles of Con-

solidation, Merger Agreement and the Constitution. These documents are now being presented to the joint memberships for approval.



Panel of joint IRE-AIEE eight man committee as they appeared at AIEE Winter General Meeting. Same panel met March 26 at IRE Convention to answer questions on merger.

MERCURY-ION SPACE ENGINE GETS READY FOR EARLY LAUNCH

Test-readiness of an electronic space engine for travel to planets, propelled by mercury, the fascinating "quick-silver" metal of our thermometer, is reported.

The mercury propelled electronic space engine will be on the launching pad during the early part of this year, and will be carried off 3,000 miles above the earth by a Scout rocket. There will be two electronic space engines to be tested together in space: one with mercury, one with cesium propellant.

Spokesman said the electronic engines will start once the capsule has been launched outside the earth's atmosphere. Also, engine performance in space will be checked against the earlier ground tests, which will be conducted before the launch. Telemetry gear and a space capsule will be in-

cluded with the flight prototype engine in the test package.

A space craft 15-to-20 feet long with instruments and using complete electronic propulsion system could possibly be sent into space by 1965, engineers feel. The power source for the engine is expected to be some type of nuclear generator.

The great importance of electronic space engines is their efficient use of so called "fuel" so that small amounts of propellants will take such a rocket a long way into space.

The mercury-ion engine was developed at Lewis Research Center, Cleveland, Ohio. It was suggested that the fuel of future manned space vehicles using electronic propulsion could serve as a radiation shield if the fuel tank was built as a sphere around the cabin.



Denver, Colo. . . . A red aurora occurring closer to the equator than the usually observed northern lights has been discovered. It is invisible to the eye but can be detected by instruments sensitive to colors for which the eye is "blind." The red radiation of 6,300 Angstrom units would have to be ten times as intense as the usual green aurora of 5,577 Angstroms to be seen.

Bloomfield, N. J. . . . An interesting approach to the nation's fluorescent lamp market has been developed. The program calls for a dual line of 40-watt fluorescent lamps. One line is specifically designed for long life, the other for maximum light output. The 40-watt lamps reportedly account for 55 per cent of all fluorescent lamps sold in this country. It was introduced by Westinghouse.

New York, N. Y. . . . A Columbia University dentist has adapted a U. S. Navy infrared "sniper-scope" to help doctors in the diagnosis and treatment of the blind. The devised instrument may help surgeons determine whether sight can be restored by a corneal transplant in patients afflicted with opaque corneas.

Groton, Conn. . . . Our time may see submarines used for vacationing ocean travelers. In fact, such commercial-type submarines "are technically quite feasible today," Mechanical Engineering magazine reported. The advantage of travel beneath the sea is that it is the most vibrationless, calm and stable means of transportation. It also would open to the adventure-seeking voyager a view of "inner space," the vast and picturesque world covered by the 300,000,000 cubic miles of ocean.

New York, N. Y. . . . A tube, known technically as a windowless multiplier phototube, for spacecraft and satellites, that operates without the familiar glass envelope of conventional "radio" tubes has been announced. Conventional electron tubes use envelopes or tubes of glass, metal, ceramic or other materials to keep out the air that would interfere with the tube's operation. The new "tubeless" tube is designed for use in outer space where there is no air. Hence there is no need for a glass envelope and its elimination permits a wider range of sensitivity.

Washington, D. C. . . . If and when an atomic bomb or earthquake shakes the earth, giant computers will whirl and tell America's alert defense organization what is going on. More than 40 sets of records on each earth tremor will pour into a new center being erected here to begin full operation by the middle of the year. The network is part of project VELA.

Greenbelt, Md. . . . Information radioed to earth from Explorer VII confirmed that the earth has a halo of helium, surrounding it in a shell nearly 1,000 miles thick, and starting some 600 miles above the surface.

Toronto, Canada . . . Traffic jams in Toronto are relieved by an electronic computer. Successful results of automatically controlling traffic signals in the Toronto metropolitan area by an electronic computer has given traffic design engineers a green light to consider general use of the system.

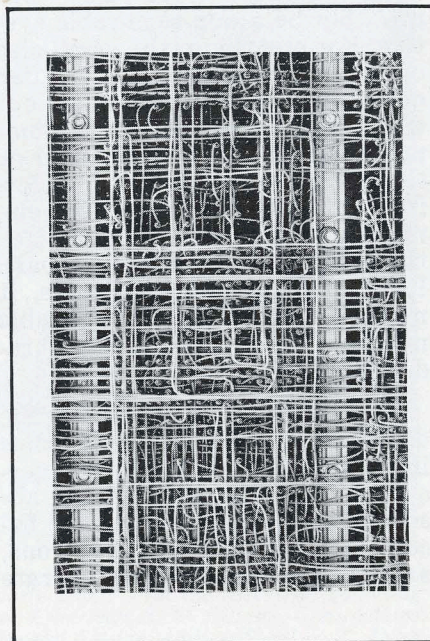
Rowe, Mass. . . . The Yankee Atomic Electric Company plant achieved a total output of one billion kilowatt-hours in January, and becomes the first in the nation to accomplish this mark on its original fuel loading. One billion k.w. hours of electricity would take care of 350,000 average New England homes for a year.

USSR, Ukraine . . . Soviet scientists may have found a promising method of treating paralysis with biological currents — body electricity.

An Ukrainian scientist has developed a "bioelectrostimulator" which transmits bio-currents from a healthy person to a paralyzed patient, causing his extremities to repeat the movements of the healthy "donor."

The "donor's" bio-currents are recorded as electrical impulses on magnetic tape, which is used for subsequent treatment.

WHAT IS IT?



MODERN BEDSPRINGS? NO—wiring of Burrough's B200 computer.

GIGA-CYCLES

In a few years, computers will be 1000 times faster than now. That was the prediction at a recent symposium of The American Institute of Electrical Engineers.

Four sessions were devoted to gigacycle computers at the Institute's Winter General Meeting. There appeared to be general agreement for the first time, that gigacycle computing systems can actually be built in the near future.

Gigacycle computing systems would operate at speeds a thousand times faster than the megacycle computers of today. Instead of a million cycles a second, the new systems would operate at a billion cycles a second. Hence the name gigacycle.

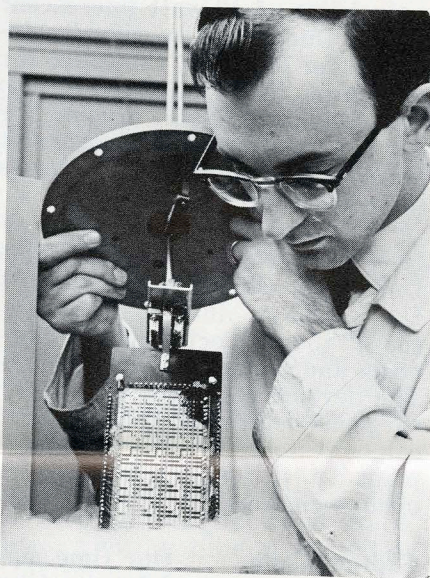
The nominal megacycle computing system of today — the IBM 7030 STRETCH is the largest computer built to date — is one in which the typical device switching time is about 0.3 microseconds, the bit transfer time is about two microseconds, and the memory cycle is some ten to twenty microseconds.

Proposed gigacycle systems will operate in nanoseconds or billionths of a second. That is, they would have switching time of 0.3 nanoseconds, bit transfer times of two nanoseconds and memory cycle times of ten to twenty nanoseconds, all a thousand times faster than today's fastest. All this, of course, is in the future and a great deal of work will have to be accomplished before a gigacycle computing system is plugged in. Nevertheless, some real advantages are foreseen.

Research into the possibilities of gigacycle systems started in 1957 with the Navy Bureau of Ships Project Lighting. Research contracts of Project Lighting have been awarded to a number of electronics companies, particularly those identified with the development of computers during the past decade.

The new generation of computers poses some very real problems. For example, the speed of transmission of an electrical signal through guides, wires, coaxial cables and other elements used to join part of the computing system together is less than the speed of light. In a nanosecond, for example, a signal might travel only six to ten inches. This suggests that gigacycle computers are going to have to be much smaller than present ones. One expert at the AIEE session suggested that the goal is a computer which can fit into a desk drawer, in place of a system (as at present) for which frequently a building must be constructed.

The objective, of course, is not necessarily to make computers small but to make them fast. But the two things fit together. Furthermore, there are important applications — in satellites or space vehicles, for example — where small size and light weight are definite advantages. Computer control of a vehicle, or data reduction for a scientific experiment in space, might be done very effectively at gigacycle speeds in a small and light weight device, carried into space.



New Memory Circuit — This model circuit shown above, (which contains 81 cryotrons, has a storage capacity of three 3-bit words,) is lowered into a Dewar flask. Measuring 3x6x.05 inches, the memory device is composed of five thin-film layers ranging in thickness from 3,000 to 10,000 angstroms. The new GE made cryogenic associative memory circuit is believed to be the first operating device of its kind. The circuit simultaneously compares all stored computer information, rapidly associating input data with any portion of related data contained in its memory. Estimates based on experimental data indicate that a comparison time of 50 microseconds would be required for searching a 300,000-bit memory to locate the first association.

The gigacycle computer will probably be a non-repairable system. For one thing, the small size of the box in which the computer operations must be carried out will make access difficult. Computer elements, such as Esaki or tunnel diodes, are made by plating or evaporating active elements. It is cheaper to replace them than to attempt to repair. If a system is non-repairable, it must be designed with replaceable modules, and self-checking redundant circuitry.

A promising approach in the design of gigacycle systems lies in operation at very low temperatures. At temperatures near absolute zero many materials become superconductors. Cryotrons, switching devices which operate

at cryogenic temperatures, may be improved to function at speeds of a fraction of a nanosecond if extremely thin films at very low temperatures can be achieved. The cryotron would be an ideal device to use in the cold of outer space since less cooling apparatus would be needed.

Memory access time appears to be one of the major problems that will face the designers of gigacycle computer systems. At the present time, it seems likely that memory systems will not be able to keep up with the logic circuits. Ingenious design of systems will be necessary to reconcile the memory and logic operations.

A number of types of problems that might be solved with gigacycle computing systems have been suggested. For one thing, the inherent speed of the systems might make it economically feasible to solve the problems that

ognition system might type out a message given it by voice. A pattern recognition machine might be used to read handwriting or to study photographs.

Large sets of partial differential equations might be solved with the new computers. Such solutions might have enormous application in fields from engineering to economics.

An early use of gigacycle computing systems might be in weather analysis. In this work, it is necessary to analyze a large amount of data in a short time if a forecast is to be produced before the predicted weather arrives.

It appears likely also that gigacycle computing systems would be of value to the military problems such as the analysis of an incoming ballistic missile "attack" and the planning of counter-moves. Although no such plans involving gigacycle systems have

THE TIME OF A GIGACYCLE IS TO ONE SECOND AS ONE SECOND IS TO 320 YEARS. THAT'S HOW FAST THE NEW SWITCHES ARE—1,000 TIMES SPEEDIER THAN FORMER SWITCHES

FEATURE

are beyond the reach of the fastest present computers. A computer speeded up a thousand times, even if it cost more to build, might handle a given problem with less machine time cost.

The speed of the proposed machines might make it possible to construct voice or spatial pattern recognition systems. A voice rec-

been made public, it is apparent that the Federal government has a big interest in the development of faster computing systems.

The AIEE conference, in brief, was evidence that new computer systems are in the offing. How far off? The earliest estimate was that a small gigacycle system might be in operation in late 1963. But others put the date a decade beyond that.

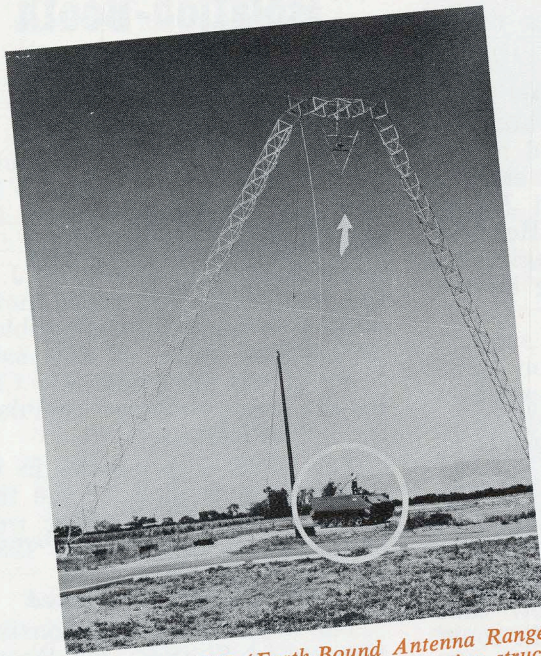
TERMINOLOGY FOR TOMORROW'S COMPUTERS

The following table of terminology was provided by one participant in the recent AIEE Meeting, to clarify terms used in today's advanced state of the computer art.

Prefix	Abbreviation	Factor
deci-	d	10 ⁻¹
centi-	c	10 ⁻²
milli-	m	10 ⁻³
decimilli-	dm	10 ⁻⁴
micro-	u	10 ⁻⁶
millimicro-(nano)	mu(n)	10 ⁻⁹
micromicro-(pico)	uu(p)	10 ⁻¹²
deka-		10
hecto-	h	10 ²
kilo-	k	10 ³
myria		10 ⁴
mega-	M	10 ⁶
kilomega-(giga)	km(g)	10 ⁹
megamega-(tera)	mm(t)	10 ¹²
GDHF	(?)	(?)

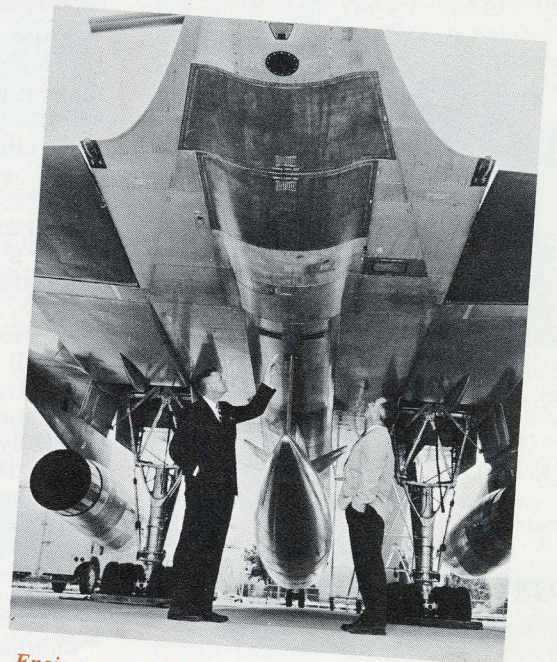
GDHF, he said, stands for gosh-darned high frequency.

THE NEWS IN VIEWS

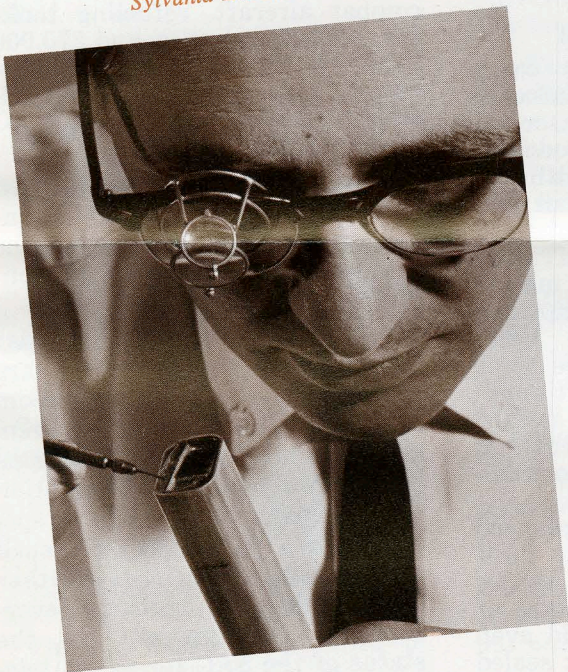


Named EBARF (Earth-Bound Antenna Range Facility), a new type of antenna testing structure is shown (above) testing a vehicle-mounted antenna (within the circle). Standing upright on its 120-foot "legs", the device has just completed a steady rise from ground level through a 90-degree arc, during which its log periodic antenna (arrow) has received continually the signals of the vehicle-mounted antenna, which electronic equipment then analyzes. The vehicle-mounted antenna was developed at Sylvania Electronic Products Inc.

Cranes lift a 70-foot wheel (below) into vertical position. The wheel weighs in at 40 tons and will be used to point a huge antenna for experiments in satellite communications, which will begin with the launching of a Telstar experimental satellite this spring. The construction project is for Bell Labs., and protected from the winter by an inflated shelter seen overhead.



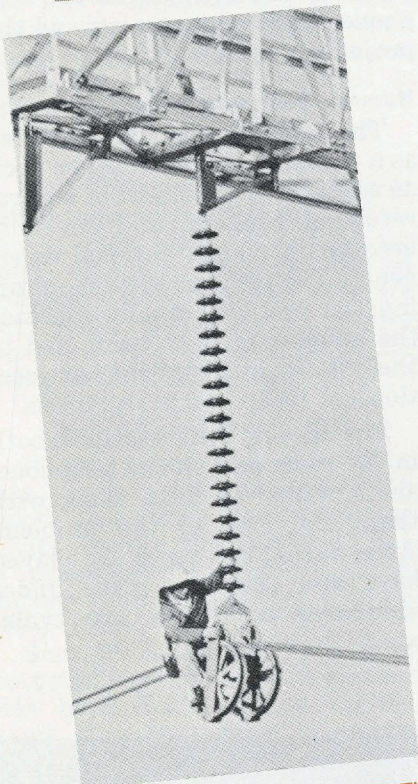
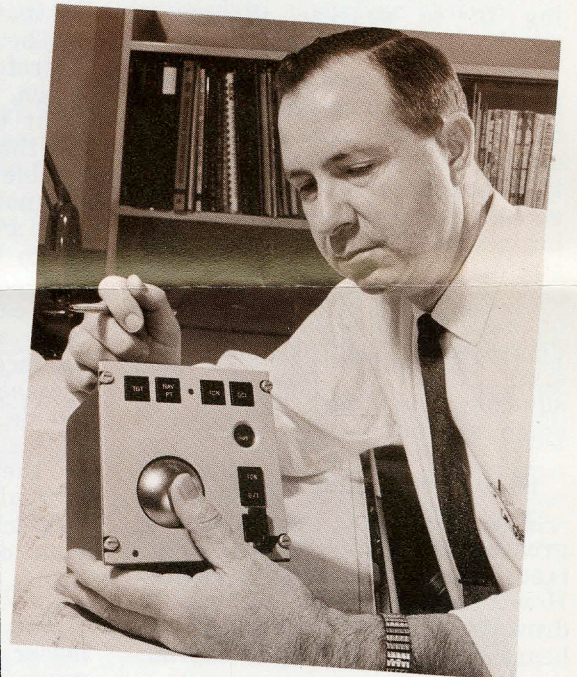
Engineers examine the non-magnetic covering on a belly radome of the U.S. Air Force's supersonic B-58 "Hustler" bomber. The radome covers part of the bomber's defensive electronic countermeasures system (DECM). The system, designed to withstand (DECM) strains (15 G) and temperature extremes, acts as an "electronic shield" to make the bomber almost "invisible" to enemy radar.



How much radiation man will meet in space will be measured by a new cigar-size detector (at left). In experiments by the U.S. Air Force school of aviation medicine, and Hughes Aircraft Co., the detectors will be carried in high-altitude balloons and Atlas missile space flights. The picture shows the detector's thin silicon tip which will "count" radiation penetrating simulated space-crew cabins.



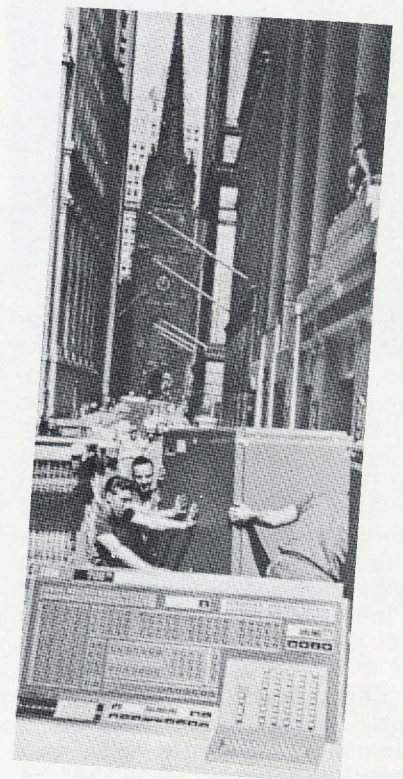
Bakelite light-touch control is a unique feature of a new "ball tracker" which is the U.S. Armed Forces' latest device for tracking aircraft or missile targets. The tracker instantly centers the tracking "pip" on a radar screen, saving valuable time in detecting targets.



Some high wire work at GE's EHV experimental operation at Pittsfield.



AIEE Winter General Meeting was visited by more than 5,000 electrical engineers. President W. H. Chase (center) was obviously happy with the successful gathering as he discussed problems with General Session Chairman, R. W. Gillette, Consolidated Edison Co., of New York Inc., (at left). General Session Address-Speaker, T. Keith Glennan, President, Case Institute of Technology, is at right.



The day the machines took over . . . some IBM computers being moved into Wall Street.



'Corona hunter' — Aiming an ultrasonic "gun" at a high-voltage transmission line, W. E. Pakala, Westinghouse power engineer, tests the line for electrical leakage. If present, the corona produces ultrasonic sound waves which are received by the device and made audible through electronic circuitry.

PORTABLE DEFIBRILLATOR

(Continued from page 1, column 4)

their work in the Department of Surgery of The Johns Hopkins University School of Medicine.

Without A Chest Operation

Formerly, physicians were able to massage the heart by making an incision in the chest and reaching in to squeeze the organ rhythmically.

About two years ago the Johns Hopkins group established that the chest did not need to be opened. They demonstrated that the heart could be squeezed enough to move the blood to the brain and other vital tissues by placing both hands on the breast bone while the patient was lying on his back. The breast bone is depressed an inch or more some sixty times a minute. This squeezes the heart against the spine, and pumps the blood.

Heart Attack Can Be Helped

The technique has had its greatest application in cardiac arrests in hospital operating rooms. However, it is also of use in drowning, electrical shock, or heart attack outside the hospital.

Dr. Jude said in an interview that it was impossible to say at this time how many lives might be saved if the technique were widely known. He pointed out that if it was incorrectly done the ribs could be fractured or the liver ruptured. Also there are cases in which the technique will be of no avail.

Only Forty-Five Pounds

The demonstrated defibrillator is a portable model made by the Mine Safety Appliances Company. It weighs forty-five pounds. Earlier defibrillators designed by the Johns Hopkins team have not been portable. Dr. Jude estimated that 30 per cent of the cases of sudden death are due to ventricular fibrillation. This is a condition in which the heart beats wildly and ineffectively so that the blood is not pumped. A defibrillator applies a strong electrical shock to the chest walls and stops the chaotic heart beat. The new equipment is designed with two external electrodes, one to be placed at the base of the neck and one below the heart. It delivers a short, sharp burst of current that stops fibrillation.

AMAZING OPTICAL MASER

OPTICAL MASERS ARE PREDICTED THAT WILL MAP THE MOON, SERVE AS RADAR, COMMUNICATE THROUGH SPACE . . .

(Continued from page 1, column 2)

These three different effects of the body's motion on the swing's motion correspond respectively to spontaneous emission, absorption and induced emission. And these three effects are why masers operate.

Radiation energy forces the maser's atoms into excited energy states, since they absorb the energy. Some of the atoms will then spontaneously emit radiation and fall back to the lower energy state. However, by hitting the active material with radiation of precisely the energy that would be emitted spontaneously, the atoms can be stimulated to emit their radiation in one great cascade. This induced radiation is the secret of the maser's operation.

'Charlie You Bum, Come Home'

If a strong beam of light from an optical maser were directed at the moon, it would not widen more than ten miles while traveling the 240,000 miles of intervening space. An ordinary searchlight of the same intensity would throw a beam 25,000 miles wide at that distance.

The optical maser beam could therefore be used to map the moon, by recording the time that light takes to travel from earth to the moon and back for all visible areas of the moon.

Another possibility of moon use, after man gets there, would be to put a series of masers on the moon and shine them toward the earth. A laser beam would send a message to a receiving surface as small as 100 feet in diameter. Provided there were no clouds, one could look at the surface and find letters saying, "Go to the Chardas to eat." At an adjoining town, the message might instead say, "Charlie you bum, come home."

Only Two Years Ago . . .

The first successful optical maser, or laser, made two short years ago, used a ruby crystal. In the same year four other substances, including uranium, were tested and lasers can now operate at a dozen wavelengths. The brightness of lasers, within each laser's narrow color band, is millions of times that of the sun. Its beam will intensely heat an object on which is focused, hence

the future possibility for death ray use.

Gas Atoms Make Laser

A different way to obtain excited atoms for an optical maser is using gas atoms in an electric glow discharge. Drs. Ali Javan, W. R. Bennett Jr. and D. Herriott of Bell Telephone Labs., engineers, built such a device using helium and neon gas.

Engineers tentatively suggest that another civilization on a distant planet developing slightly differently than the earth's civilization would have discovered laser action and decided this was the natural way to communicate. With ten kilowatts of power and using a 200-inch telescope beyond the earth's atmosphere for an antenna, calculations show that detectable amounts of light could be sent tens of light years (60 million million miles) into space.

If a maser could be made to generate substantial amounts of power, the resulting directed beam might be considered as a "wire" that conducts light rather than electricity. Power might in this way be transferred from the ground to a satellite.

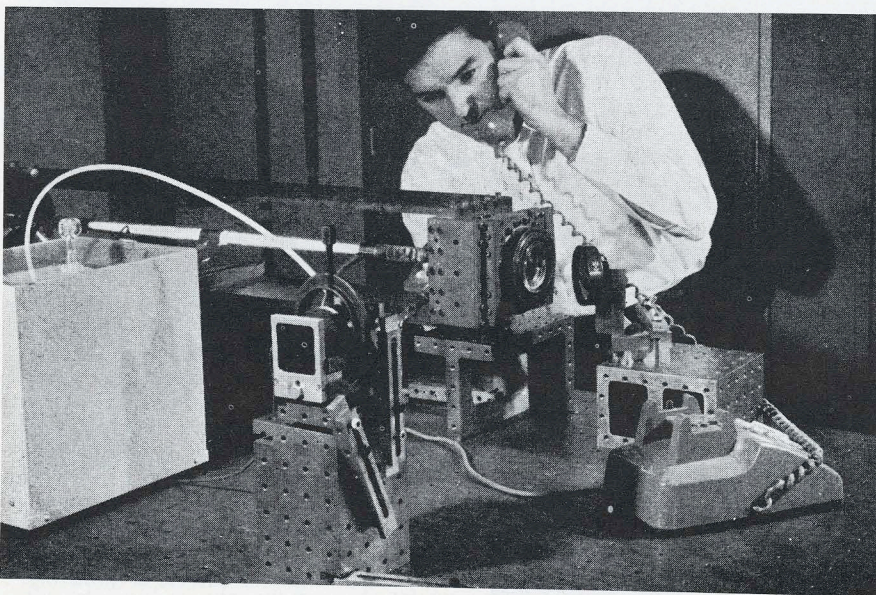
Use of Infrared Light

Light waves can also carry communications using infrared light from an optical maser. In one thousandth of the frequency, the optical light band width can carry as much traffic as all previously available communication means.

In medicine, optical masers promise a wide range of applications. By passing the beam through a lens, it could be made to penetrate most body tissues, coming to a focus where needed for such tasks as delicate cutting, sterilization, cauterization or radiation treatment.

The intense heat spot produced by focusing the coherent light from optical masers could also be used for fabricating all sorts of electronic devices. It would even be possible to weld a joint sealed in a glass envelope.

Other studies of coherent light may lead to a new and precise method of determining crystal structure. Another purely scientific development at this point is the generation of giant light pulses from a ruby laser.



CONVERSING BY LIGHT BEAM—One use of optical masers, carrying telephone conversations on a light beam, is demonstrated here by D. R. Herriot of Bell Telephone Labs.

Big Brother of "1984" In SAC's Isolation-Booth

- TWO WAY MIRRORS
- HIDDEN MICROPHONES
- TAPE RECORDERS
- WALL SIZE SCREENS

A huge "isolation booth" — 50 feet long and 35 feet wide — is being used in Paramus, N. J., to test equipment and man's mental powers in handling the problems of keeping track of the battle force of the Strategic Air Command under various simulated combat situations.

The booth incorporates in fascinating ways many of the trappings of the Big Brother world of George Orwell's book, "1984".

The Booth Is Automated

The auditorium sized construction called SimFac, for Simulation Facility, is to be used in connection with a proposed working model of a new SAC Command Control System developed by the International Electric Corporation. The Command Control System will be a fully automated, electronic computer network which will keep tabs on SAC's combat aircraft, refueling tankers, ballistic missiles, and 270,000 men. It will display up-to-the-minute force status on 16 wall-size projection screens at SAC headquarters.

The problems will be studied by IEC psychologists, human engineers and researchers in the closely-controlled laboratory conditions of SimFac.

A typical study works like this: Twenty Air Force officers are seated in the main control room of the laboratory. Before them are three huge projection screens on which a typical SAC situation is displayed. Each officer, a specialist in a particular field such as logistics, operations, weather or intelligence, receives ever-changing information on the status of the SAC forces via telephones, written messages and the projection screens.

Human Engineers Record Reactions

The problem may be presented as a routine training mission, such as controlling the flight of several refueling tankers, and suddenly become an all-out national emergency. The psychologists monitoring the problem rapidly increase the amount of data being fed to the officers, and record their reactions to tense battle situations.

The officers' conversations, both in the room and on the telephone, are recorded on tape, along with their reactions to the problem. Afterwards, the tapes are played back and decisions made under simulated conditions are evaluated.

Join Your AIEE
STUDENT BRANCH

Machine Age And Its Consequence

It is no news anymore that machines can learn in a way formerly regarded as exclusively human. But science did it again with the announcement of a shoebox size device which can do sums at the direction of a human voice.

The example reported was of an IBM engineer telling the machine "674 minus 674 — total" and the machine printed the answer: "0 0 0." Would it be a big deal in a human calculation? Most of us could, in all modesty, have figured it out, too, and even saved two "0s" in reporting the answer. But you have to admit that a machine that can subtract 674 from 674 can probably also subtract 675 from 675 and may even solve more complicated mathematical problems.

Soon, no doubt, the machines will begin talking not only to people but to each other; it may not be long before one telephone calls another, or one washing machine gives another a rinsing. And surely it is not insignificant that IBM's new voice-calculating machine has one failing — it has trouble understanding women. This makes the resemblance between men and machines so complete as to be downright frightening.

JOB PROSPECTS FOR 1962

(Continued from page 1, column 4)

Here are the compared figures in engineering requirements for 1962: Electrical: 73 firms seek 2,240, while 53 hired 1,783 last year; Mechanical: 91 firms want 1,763, compared with 89 that hired 1,425 last year; Chemical: 54 concerns eye 1,014, compared with the 671 hired by 46 firms last year; Civil: 18 firms will hire 173, while 18 took only 149 in 1961; Industrial: 44 firms to hire 323, where 41 took 237 in 1961.

The 215 firms participating in the study cover 27 States. As a group, they project their total needs at 17,230 college graduates, compared with 14,053 needed in 1961.

Salary Trend

Weighted averages of salaries, which take into account the number of men hired at each salary level within a category, are engineers, a \$560 average; accounting, \$493; sales, \$479; general business trainees about \$425, and other fields \$488 per month.

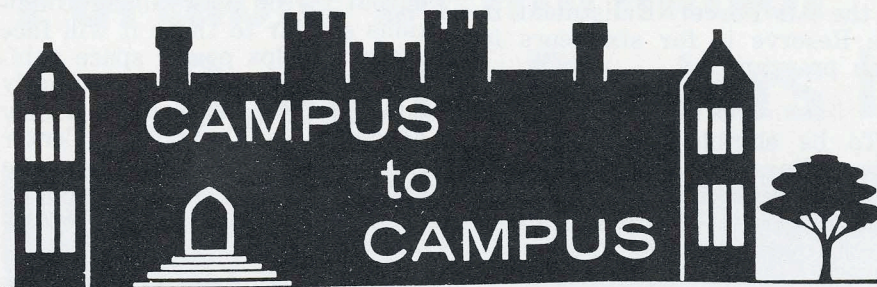
Is It a Good Barometer?

It was asked why the survey has proved such a consistently good prediction of business activity despite the fact that it is a graduate employment survey rather than a business expectations study.

Survey's leader Dr. F. S. Edin-cott said that although no attempt has been made to find correlations, it is reasonable to assume that the same psychological factors that lead management to make capital investments will also lead them to project higher or lower employment figures.



This exhaust nozzle for a solid-fuel ballistic missile was developed by lamp technology. It's made of tungsten (which goes into one of the component parts of a light bulb) by G.E., and will melt only when exposed to more than half the temperature of the surface of the sun. Thus it will withstand the terrific heat created during the firing of a rocket.



An underground accelerator vault and control room is being constructed in the University of Arizona's College of Engineering building for use of the Department of Nuclear Engineering. The new equipment is expected soon to be operational. The underground location provides additional shielding against high energy x-rays produced by the accelerator.

More powerful klystron tubes, improved power modulators, and "more sophisticated" instrumentation are being developed for the world's biggest electron accelerator soon to be built on the Stanford University campus under the sponsorship of the Atomic Energy Commission.

The University of Pennsylvania's Moore School of Electrical Engineering has begun a training program in biomedical engineering under a \$235,000 five-year grant from the National Institutes of Health.

Plans for the establishment of a Computing Center costing several millions of dollars at the University of Notre Dame have been announced. The installation will include a Remington Rand UNIVAC 1107 Thin-Film Memory computing system.

Oklahoma State University maintains an "Engineering Hall of Fame" on the ground floor in its Engineering Building. It was created to honor individuals and organizations who have made outstanding contributions to engineering. The Hall of Fame occupies a prominent area in the building, and a major section is devoted to the recognition of donors and winners of fellowships, scholarships, and prizes.

The Ford Foundation granted nearly \$50,000,000 for the betterment of education, science and engineering in 1961.

Two new films, on the subjects of vision and magnetism, have been added to the Bell Telephone Laboratories College Science Film Series. Titled "Short Term Visual Memory," and "Domains and Hysteresis in Ferromagnetic Materials," the films may be borrowed without charge from the company's offices.

George Washington University has received a DEM-301 electron micro-analyzer which is capable of identifying sub-microscopic particles as small as one-tenth of a micron in diameter. The unit will be used to determine the presence and quantity of metal ion deposits in diseased body tissues.

The battery of "atom-smashers" devoted to exploring atomic nuclei at the E. O. Lawrence Radiation Laboratory has been further diversified with the successful operation of the new 88-inch Cyclotron. The Laboratory is operated for the Atomic Energy Commission by the University of California.

A new program whereby Union College (Schenectady, N. Y.) engineering students can study for a year in Switzerland is meeting the need to provide engineers with international experience and understanding. The 5-year combined liberal arts-engineering program was reported in the Union College publication, the Concordiensis.

"Bio-physicists, now scattered among many departments at universities, should get together for an organized attack on the mysteries of the mind." This challenge was thrown by MIT's biophysicist, F. O. Schmitt, in a lecture at Northwestern University.

The Cooper Union's annual report recalled an unpleasant financial problem. It is harder to get money for endowment and routine operation than for impressive buildings. The trend began fifteen or twenty years ago. The report cited the continuing need for capital for endowment. A recent six-million dollar building campaign provided the school with a new engineering center and equipment.

Students at Georgia Institute of Technology got a chance to ask some searching questions about their engineering future during an "After Graduation — What Now?" panel discussion sponsored by the Georgia Section of AIEE, in Atlanta. The second annual program of this type, it was again well received by the students and faculty at Georgia Tech.

Balloon Invasion May Survey Earth's Weather

Some 2,000 balloons will soon circle the earth high in the atmosphere to survey the world's weather from its source. Information collected by the balloons will be relayed to earth by orbiting satellites.

The plan to launch the 2,000 balloons is now under intensive study by the Joint Meteorological Satellite Advisory Committee of National Academy of Science Study on weather.

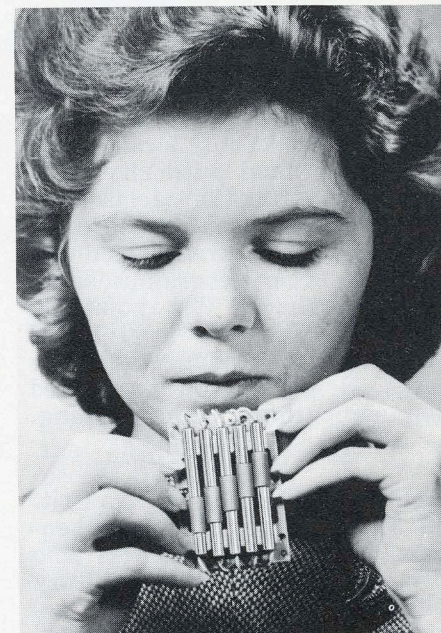
The balloons would be lightweight, high-pressure ones that would shatter harmlessly if hit by aircraft. They would fly at altitudes of from 20,000 to 100,000 feet and remain up for at least 60 days.

A report says the very thin plastic shell of the balloon would carry what is known as "two-dimensional electronics": electronic systems so thin they have, in effect, only length and breadth. The electronic system would note the temperature and relay this information to satellites upon request. The satellites would store the information received from balloons until passing over a check point when it would be telemetered to a surface station.

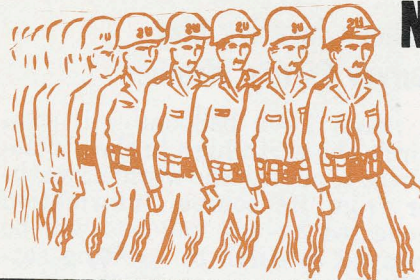
This system is nicknamed GHOST, for Global Horizontal Sounding Technique. It would eliminate the necessity of instrumenting satellites with complex devices to make indirect measurements of high atmospheric weather data.

A spokesman for the National Center for Atmospheric Research, Boulder, Colo., has calculated that eight satellites circling the globe in polar orbits every 90 minutes would give complete coverage of the world's weather every three hours. Four satellites would give six-hour coverage in the tropics and three-hour coverage at higher latitudes.

A SWAN SONG



Missile Whistle for errant missiles—These musical rods will vibrate to a particular quintet of tones transmitted from ground control by push-button radio should a missile go out of control. Responding like tuning forks to the "destructive chorus," the filters trigger the explosive charge that destroys the dangerous missile on command. The devices are made by Raytheon Company, Lexington, Mass., and demonstrated by Betty Lou Morell, Raytheon secretary.



NERVOUS ABOUT THE SERVICE?

by:
The Engineering Manpower
Commission of
Engineers Joint Council

Let's get down to "brass" tacks! The basic facts are simple enough:

Student Deferments

College students with the following class standings (among full time male students) are eligible for deferment: first year, upper half; second year, upper two thirds; third year, upper three fourths.

Further deferments for post graduate work are also possible if the student stands in the upper one-fourth of his graduating class.

At present most local boards are quite liberal in student deferments and are granting occupational deferment if degree requirements are maintained.

S.S. College Qualification Test

This test is given once every year (usually around April). A passing grade of 70 for undergraduate and 80 for graduate school automatically makes a student eligible for deferment regardless of his class standing. Taking the Selective Service College Qualification Test does not place a student under any obligation, nor does it change his draft status. It's a good deal no matter how you look at it, but remember, you get only one crack at it during your entire college career. So make it good. (If you flunk, at least you're no worse off than not having taken it at all.)

R. O. T. C.

Going through the R.O.T.C. program obligates the student to at least two years of active duty after college. It can often be postponed for valid reasons, such as graduate work, but never avoided (short of status change—prison, disability, death, etc.) Sometimes a six-month tour can be arranged, but do not count on it.

Your Dear "Board"

It's easier to change wives than a Local Selective Service Board. Once registered, it's for life—no divorce ever. Your local board always has final authority even though some functions (classification, physical examination, and induction) are transferred to boards in other geographic areas for convenience. The point is, keep your dear ole local board informed of any changes in your status. Someday you may need their sympathetic understanding.

Critical Skills Enlistment Program

All Armed Services have a Critical Skills Program for men engaged in essential activities who wish to discharge their military obligation with a minimum of active duty and reserve obligation. This program operates under an extremely low quota. Application is made by letter (no particular form) to the local Selective Service Board. After three months active duty for training, a man may be screened directly into the Standby Reserves (no weekly drill or summer camp).

Training Enlistment Program

The Army and Air Force have active duty for training enlistment programs for other than critical skills. The period of active duty for training is six months in the Army (nine-to-eleven weeks in the Air Force). Enlistment in the Reserve is for six years in each program.

Deferments After College

To be eligible for deferment after college, a man must possess a critical occupation (all types of engineers are included) AND must be employed in an essential activity. The current list of essential activities include: Production and Maintenance of Aircraft and Parts, Ship and Boat Engineering, Ordnance, Precision Laboratory Instruments, Apparatus and Scientific Laboratory Glassware, Production of Electronic and Communication Equipment, Production of Chemical and Allied Products, Water and Sewerage Systems, Health and Welfare Services, Educational Services, Research and Development Services.

Most local boards are liberal in interpreting the list of essential activities, provided a man has a critical occupation (but this may change). For a single man, up to age twenty-six, such occupational deferment is virtually the only alternative to active military service. After age twenty-six the possibility of being drafted is extremely remote, under present circumstances, even though liability may have been technically extended to age thirty-five by virtue of deferment. Of course, all bets are off if there should be an extreme national emergency.

Your Selective Service Classification

Most problems regarding military service arise from pure neglect. You should, for example, know your Selective Service classification and, if not deferred, appeal it immediately if you have a legitimate case. The action of local boards may be appealed to the state and sometimes to a national level, but do not wait until your dog-tags bite before appealing your classification. And above all, give your local board enough information to make the correct classification in the first place.



"Must've been used by those high-living people the H-bomb wiped out . . ."
(From: ELECTRIC LIGHT & POWER)

EXOTIC Threesome

While our attention was focused in the last issue on large nuclear electric power sources capable of generating hundreds of thousands of kilowatts (see Vol. 3, No. 3, pp. 5), there are other engineering successes in small power-generating sources rated in terms of a few watts, and even of milliwatts.

FUEL CELL: A hydrogen-oxygen fuel cell rated at 25 watts completed its first test phase on schedule. It delivered its rated output for 50 hours under conditions similar to those it will face when it helps power space vehicles. G.E. engineers promptly bundled their prize off to Valley Forge Space Technology Center for testing in a thermal vacuum (no radiant energy) by their Missile and Space Vehicle Department.

SOLAR POWER: At Phoenix, Arizona, engineering efforts to produce power from the sun are being rewarded.

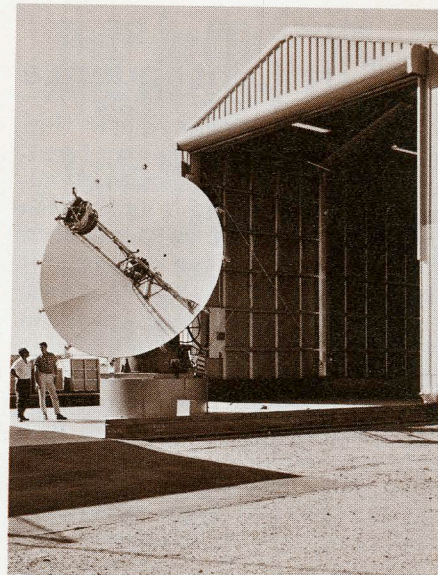
The research got "positive results" from the first tests of the big solar-thermionic electrical power system. The report said the results prove that such a system can be perfected for practical use on space projects.

Designed under an Air Force contract, the system produced 12.18 watts during its first test. Eventually, a spokesman said, a system can be designed that will produce a kilowatt of power for each 100 pounds of weight.

The focal point of the facility is a 195 sq. ft. solar collector that is rolled out of a 36-ft.-high hanger when the sun is shining.

THE NEWCOMER: Electrohydrodynamics is the latest entry in the field of exotic power sources. Engineers at Philadelphia have produced a net output of 1.4 milliwatts at 170 volts using the EHD system.

The system is similar to, but different in principle from, the MHD (magnetohydrodynamic) system on which engineers have been working for some time. An MHD generator produces an electrical current by passing ionized gas through a magnetic field. An ElectroHD produces an electrical current by passing ionized air through the electrostatic field of a corona discharge.



Indicating a sunny day the 195 sq. ft. solar collector is out of its hanger. The first tests were successful: a dozen watts.

RIDING HIGH

Space engineers-scientists may be able to capture an asteroid, one of the small planets in the solar system, by landing a rocket on it to first slow it down, then speed it up.

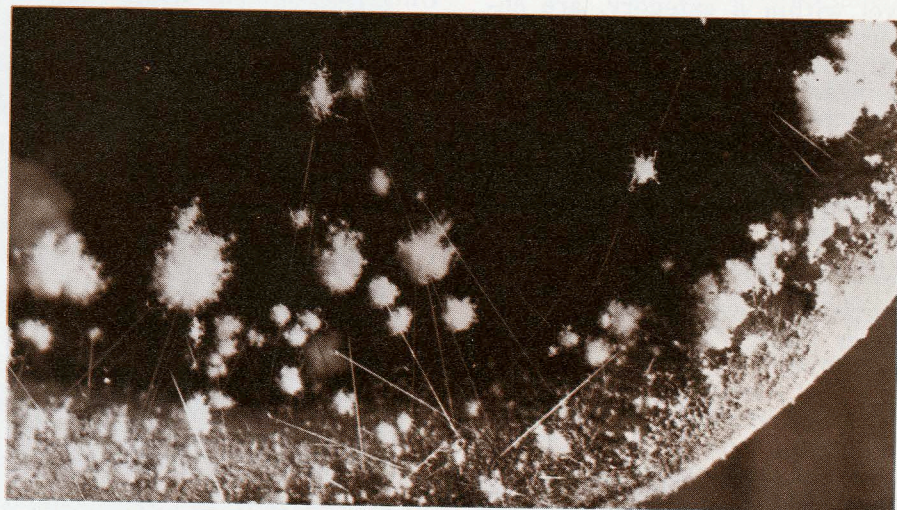
NASA reported that an asteroid would have to be slowed down in order to come close enough to earth to be captured into an earth orbit. After this is accomplished, the asteroid would have to be speeded up in order to go on traveling around the earth.

Such a "prisoner" asteroid would be important to engineers for studying the origin of the solar system, which is also one of the aims in exploring the moon. The capture could be accomplished by using a rocket with several stages and landing the last stage on the planetoid, NASA said.

The rocket would keep firing after landing to modify the speed of the asteroid. After a likely asteroid has been found, a computer can determine how much rocket action is necessary to change the velocity of the asteroid and make it an earth satellite.

The report said the asteroid would have to be brought nearer to the earth than to the moon.

Join Your AIEE
STUDENT BRANCH



Space whiskers — Sapphire "space whiskers" like these are being grown in search of methods of producing strong new space materials. Fine filament-like crystals shown here have been magnified 20 times. One pound contains over 14 million whiskers. The crystals are being grown at Rocketdyne, a division of North American Aviation, Inc.