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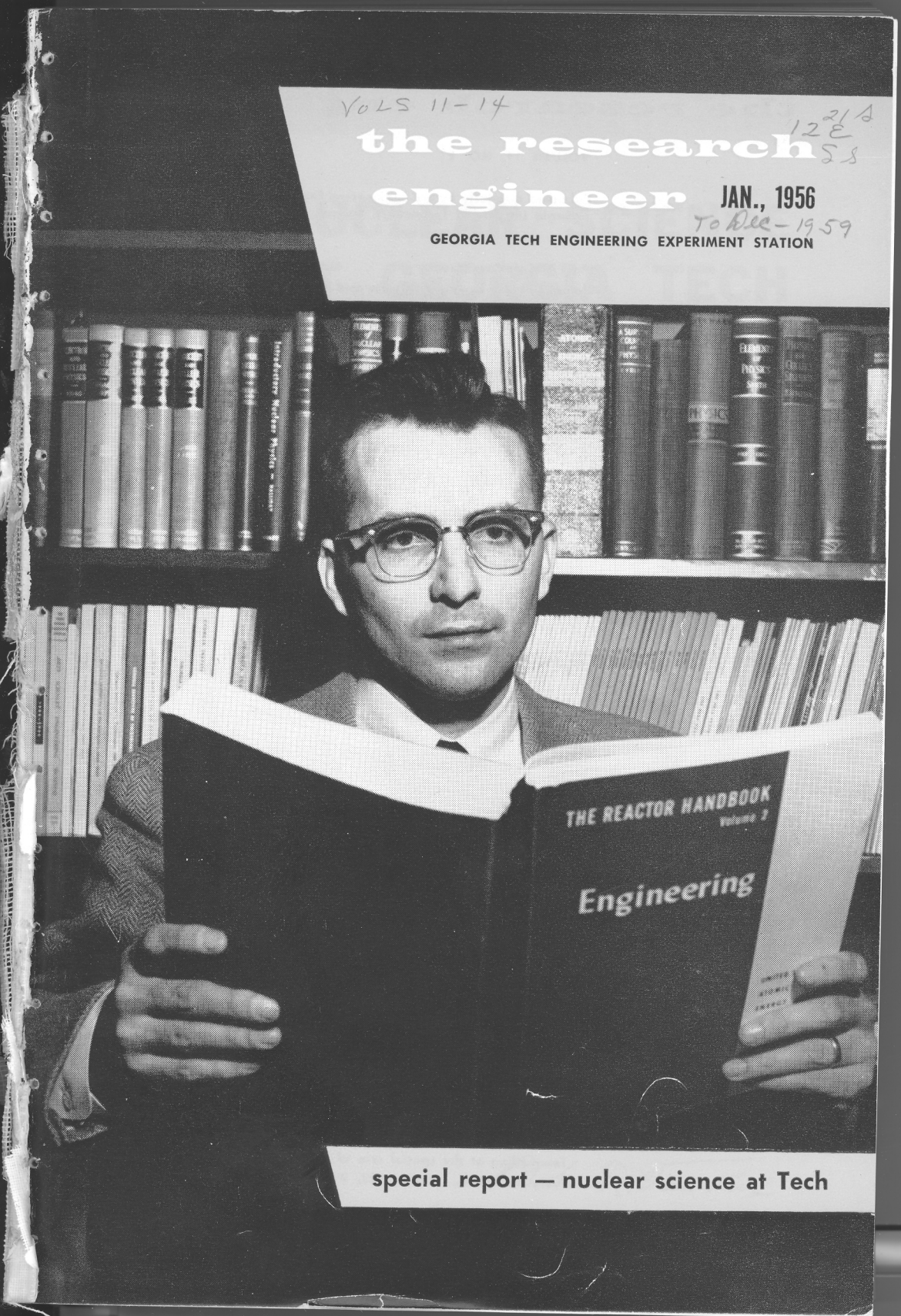
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the research engineer

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GEORGIA TECH ENGINEERING EXPERIMENT STATION



special report — nuclear science at Tech

the research engineer

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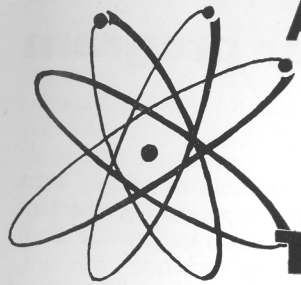
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the cover

Dr. William B. Harrison, III, an associate professor in Tech's School of Mechanical Engineering, is typical of the young scientists who have been working on Tech's nuclear science program featured in this issue. As head of the Reactor Subcommittee, Dr. Harrison carries one of the major responsibilities for the development of Tech's nuclear program of the future. For more about the program and the men behind it, turn to page 4 of this issue.

THE RESEARCH ENGINEER is published quarterly, in January, April, July and October by the Engineering Experiment Station, Georgia Institute of Technology. Entered as second-class matter September 1948 at the post office at Atlanta, Georgia under the act of August 24, 1912. Acceptance for mailing at the special rate of postage provided for in the act of February 28, 1925. Section 528, P.L.&R., authorized on October 18, 1948.

NUCLEAR SCIENCE AT GEORGIA TECH



THE PEACETIME USES of atomic energy are increasing so very rapidly that it is impossible to estimate the effects of these developments on our society even ten years from the present. This technological expansion carries with it a demand for many more scientists and engineers with special training, as well as a demand for a broad program of fundamental research and engineering development. To a great extent, these demands must be satisfied by technological centers which carry on both teaching and research. Thus, the future progress of Georgia Tech might be measured against its contributions in both teaching and research as they relate particularly to the peacetime uses of atomic energy.

It should be emphasized that these new developments do not make obsolete any of the established fields of basic science or engineering. Rather, the effect is to expand the old areas while adding new areas of study to these fields.

It is customary to apply the name nuclear science to these new areas of study which involve the investigation and application of properties of the atomic nucleus and of nuclear radiation. Thus, *nuclear science* may be said to include what is more loosely termed, *the peacetime uses of atomic energy*. It is my hope that the report on the following pages will give you a better insight into what nuclear science includes, as well as what Georgia Tech is doing to promote the development of this new, yet rapidly-changing, branch of science and engineering.

Blake R. Van Leer

A MINIMUM OF MONEY PRODUCES
A WIDE VARIETY OF EXPERIENCE

Tech's current nuclear program

RESEARCH IS NOW in progress at Georgia Tech on a number of problems in nuclear science and atomic energy. This research ranges from studies of the nucleus and nuclear-decay processes to engineering problems arising in the production of nuclear power.

In nuclear physics, Profs. C. H. Braden and L. D. Wyly are studying the decay processes in radioactive elements under a grant from the National Science Foundation. In many cases, these radioactive nuclei are known to throw out more than one particle as they decay. A special feature of this research involves the measurement of the angles between the paths of these particles as they are emitted from the nucleus. This kind of information will provide a clue to the complicated mysteries of nuclear structure.

The experiments of Profs. T. L. Weatherly and J. Q. Williams yield a different kind of information about the nucleus. By studying the way in which molecules of a gas absorb high frequency radio waves, it is possible to learn, among other things, whether any of the nuclei within the molecule are slightly flattened or elongated from a perfectly spherical shape. This research is sponsored by the Office of Ordnance Research of the Department of the Army.

Prof. F. K. Hurd is studying the absorption of high frequency radio waves by certain crystals in the presence of a magnetic field. A by-product of this research will be information concerning the magnetic properties of nuclei. Prof. Hurd's project is supported by the University Center in Georgia and the Engineering Experiment Station.

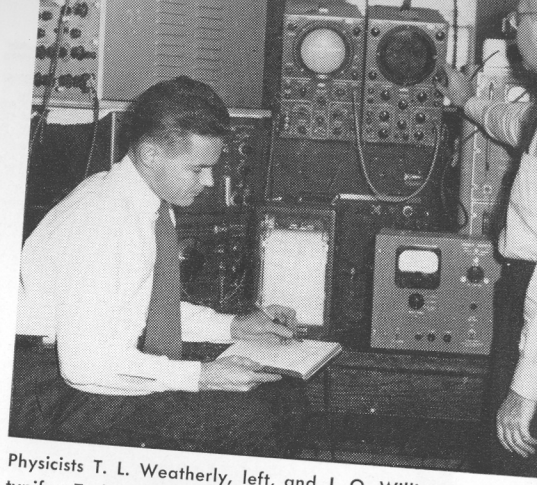
The radioactivity of nuclei, even though not completely understood, can be used in many interesting ways. One important use follows from the fact that the presence of a small number of these nuclei can be detected by measuring their characteristic radiation. As the number of radioactive nuclei in a sample decreases they become increasingly hard to detect. This problem of detecting very small amounts of radioactivity is the special interest of Prof. E. W. McDaniel. At the request of the Bureau of Surgery and Medicine, Department of the Navy, Prof. McDaniel is developing apparatus for detecting the extremely low-level, natural alpha radiation in biological materials. The Engineering Experiment Station has given support to two additional projects in which these low-level measurements will be used: (1) the dating of archeological specimens and (2) the study of Georgia's mineral resources for atomic uses. (The latter project is under the direction of Prof. H. W. Straley.) These two projects are in the initial planning phase and will require external support if they are to develop fully. A small but versatile Nuclear Measurements Laboratory has been developed at the Engineering Experiment Station for performing less difficult radioactive measurements. Much of this laboratory has been assembled by Mr. J. H. Tolan, who has also worked on instrumentation for civil defense (sponsored by both the state and federal Civil Defense Administration) and on radioactive therapy equipment for Emory University Hospital.

The increasing use of radioisotopes in hospitals has created a whole set of new problems in Sanitary Engineering. Radioactive wastes, even in small amounts, cannot simply be poured down the drain and be forgotten. This problem of the treatment and disposal of radioactive sludges is being studied by Prof. W. N. Grune under a grant from the National Science Foundation. One of the aims of this investigation is to establish limits on the amounts of radioactive materials which hospitals may safely dispose of through existing sewers.

Problems associated with the development of atomic power provide the basis for another group of research studies at Tech. An important example of this type is the problem of removing heat from a nuclear reactor and transferring it, for example, to the boiler of a steam turbine. This is the problem of heat transfer on which Prof. W. B. Harrison is actively working. Two other heat transfer projects are now under way, one concerned with the heat transfer to a flowing column of liquid sodium (sponsored by the Office of Ordance Research) and the other concerned with the effects of vibration on the heat transfer to air (sponsored by the National Advisory Committee on Aeronautics).

The Oak Ridge National Laboratory has given financial support to the work of two other faculty members: Prof. J. A. Nohel is making a mathematical investigation of the stability of circulating fuel reactors, and Prof. H. C. Saxe has recently completed a study of the physical properties of high density concrete used in shielding against intense sources of radioactivity.

The effect of very energetic cosmic rays at high altitudes on biological materials is being studied by Mr. F. Dixon, working in cooperation with Dr. H. J. Schaefer of the School of Aviation Medicine, Pensacola, Florida.

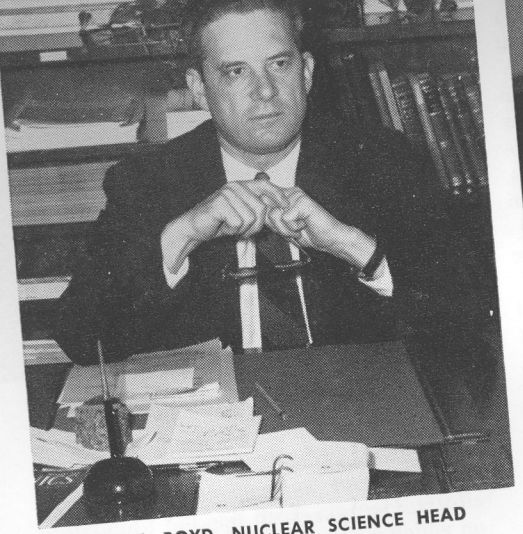


Physicists T. L. Weatherly, left, and J. Q. Williams typify Tech's experienced nuclear researchers.

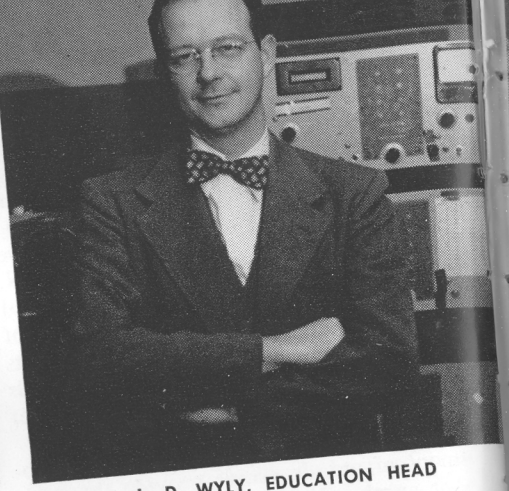
In addition to these current research efforts, Georgia Tech has the foundation on which a much larger research program can be built. The Price Gilbert Library is one of four officially designated Atomic Energy Commission Industrial Information Depository Libraries. Thus the Library is already able to support an extensive program in nuclear science. The Rich Electronic Computer Center provides facilities for complex mathematical calculations that are equalled at few other universities in the country.

At present the Computer Center is carrying out computations to assist Profs. Braden and Wyly in their research in nuclear physics. Computations are also being programmed for the U. S. Naval School of Aviation Medicine to determine the effect of cosmic rays on idealized biological targets.

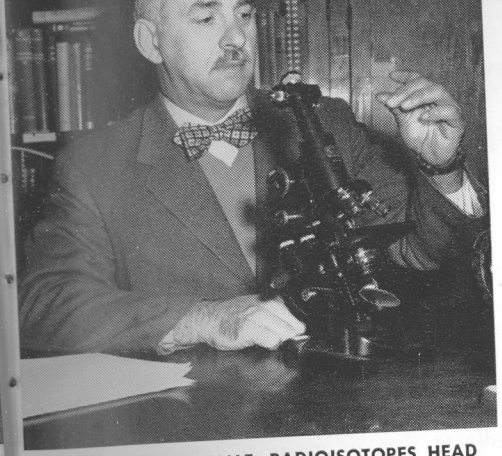
Georgia Tech is also a member of the Oak Ridge Institute of Nuclear Studies which opens a number of avenues for cooperation with the Oak Ridge National Laboratory (ORNL). Faculty members pursue their own research as Research Participants at Oak Ridge, and members of ORNL are invited to the campus for lectures. The extent to which Georgia Tech has taken advantage of the Research Participation Program at ORNL is indicated in the "faculty-experience" section of this report.



JAMES E. BOYD, NUCLEAR SCIENCE HEAD



L. D. WYLY, EDUCATION HEAD



J. M. DALLAVALLE, RADIOISOTOPES HEAD

a progress report

THE NUCLEAR SCIENCE COMMITTEE

EVEN THOUGH GEORGIA TECH is now making significant progress in nuclear science, it is obvious that this endeavor must be greatly increased in the future if we are to maintain our standing in education and research. To this end, President Van Leer has appointed an advisory committee of faculty members to examine ways in which our contributions in this field might be increased. This committee, known as the Nuclear Science Committee, is headed by Dr. James E. Boyd, associate director of the Engineering Experiment Station. The committee consists of seventeen members and includes representatives from all the divisions of the institution that are directly concerned with developments in nuclear science at Georgia Inst. of Technology.

The aims of the Nuclear Science Committee are twofold: (1) to determine what role nuclear science should play in teaching and research at Georgia Tech and (2) to determine what steps Georgia Tech should take to develop research and teaching in nuclear science.

Shortly after the organization of the Nuclear Science Committee, a steering subcommittee, headed also by Dr. Boyd, was appointed. This subcommittee handles administrative matters and plans the work of the Nuclear Science Committee. Upon recommendation of this steering subcommittee, three additional subcommittees have been formed. Each one of them is concerned with a principal facet of the overall work of the Nuclear Science Committee.

The Education Subcommittee, headed by Dr. L. D. Wyly of the School of Physics, is following the stated aims of the committee with specific regard to educational problems. The Radioisotopes Laboratory Subcommittee, headed by Dr. J. M. DallaValle of the School of Chemical Engineering, is busy developing plans for a radioisotopes laboratory at Tech. And the Reactor Subcommittee, headed by Dr. W. B. Harrison of the School of Mechanical Engineering, is investigating Georgia Tech's needs for a nuclear reactor facility, as well as studying various types of reactors and their research potential. Upon completion of their studies, these subcommittees will submit detailed reports of their findings.

It is impossible to estimate at this time, the extent to which nuclear science will change the technology of today. This means that Georgia Tech, as a center for education and research, must continually make plans for the future. And the present planning represents the first step toward the already foreseeable segment of the future.

The Atomic Energy Commission has recently completed a survey of training and manpower requirements for the Atomic Energy Industry. At the present time they estimate that there are less than 5,000 engineers and scientists in the country trained to work effectively in this new industry. Present training programs are geared to turn out less than 400 engineers and scientists per year. If the Atomic Energy Industry expands as estimated, however, more than 1200 new trained people per year will be required for the next three years. The requirements for new engineers and scientists will probably be several times greater ten years hence.

In order to help meet the needs for well-educated modern engineers, Georgia Tech must offer courses of study in nuclear science and technology. There will be an increasing demand for engineers in the present engineering disciplines who are better grounded in the fundamentals of their field and who also have a basic knowledge of nuclear science and of how their field of specialization may be applied to nuclear engineering problems. A recent survey of the curriculums at Georgia Tech revealed that many existing courses are directly applicable to the field of nuclear engineering. Proposals for additional courses and laboratories which are desirable to strengthen our educational program in nuclear science will soon be presented to the Graduate Council. The majority of the new courses will be introduced at the graduate level in order to permit the student to apply this work to his field of specialization A program of study leading to the Master's Degree in Nuclear Science (Engineering) is under consideration. Their primary efforts have been directed toward this graduate program.

Radioisotopes Laboratory

If Georgia Tech is to increase its contributions in nuclear science, it is most important that the present radioisotope laboratory facilities be greatly expanded. From the point of view of education, it is necessary that special laboratory facilities be developed for courses in neutron physics and in radiochemistry. Until such facilities are available it will not be possible to initiate the Master's Degree Program in Nuclear Science and Engineering. Thus the next logical step in the work of the Education Subcommittee cannot be taken until these laboratory facilities have been obtained. From the point of view of faculty and student research, a radioisotope laboratory with research facilties is also an immediate need. Present day research in all branches of engineering, as well as in chemistry and physics requires the use of radioisotopes. The availability of laboratory facilities for the storage, handling, and measurement of these materials would permit a considerable extension of many of the research projects now in progress here.

As a result of the joint need for a radioisotope laboratory in education and in research, it has been decided that the most economical procedure would be to incorporate both functions in a single laboratory building. This building should include space for a student laboratory and space for research laboratories of two kinds: (1) a low-level counting laboratory for special research problems and (2) a general purpose laboratory which would include facilities for the processing and measurement of radioisotopes. Additional storage and office space would also be required. Initial estimates indicate that a one-story building with about 5000 square feet of floor area would be required. This centralized radioisotope laboratory should be under the direction of a scientist who is competent to advise faculty members on the use of radioisotopes and on the safety measures that are required in their use. It is also expected that such a man would conduct his own research program and take some part in the educational program.

A centralized laboratory, as it is now planned, would by no means be the only place where radioisotopes could be used on the campus. Such a laboratory would, however, provide equipment and handling facilities when they are required, and insure the safe and effective uses of these materials.

The Radioisotopes Subcommittee also foresees a less immediate future need for a high-level laboratory facility which could conduct experiments in the radiation damage and food sterilization (for example) using very intense sources of radiation such as those found in the "waste products" of nuclear reactors. The detailed requirements for this laboratory are not under study at present, but it is clear that such a high-level laboratory would necessarily be separate from the one now contemplated.

by John H. Tolan and Thomas A. Elliott

COBALT 60 TELETHERAPY*

Design and construction of a 200 curie Cobalt teletherapy unit for Emory Univ.

The X-ray discovered by William Conrad Roentgen in 1895 found use in the treatment of disease almost immediately after its discovery. The medical science of radiation therapy thus begun soon found that the magic ray did not provide a universal cure, but that for some disease types the response to treatment by X-ray was very promising. As information on the effect of this radiation on human tissue grew in volume, it became apparent that great care must be exercised in its use and that special techniques should be developed to yield uniform response to treatment. It was found, for example, that for treatment of malignant tumors lying well below the surface, the penetrating power of the radiation should be increased as much as possible. This meant that the high voltage applied to the X-ray tube should be increased to the maximum, and that filters should be employed that would selectively reduce the quantity of radiation not reaching the tumor.

For this reason X-ray generators have been manufactured which operate up to peak voltages of one or more million volts and provide radiation of sufficient penetrating power to treat deep tumors. Unfortunately, these high voltage X-ray generators are expensive both in initial investment and in subsequent operation and maintenance. Thus, only the larger of the tumor clinics can finance such

** Teletherapy is a term used to denote therapy from a distance as opposed to therapy on the surface or within the surface. Distances normally used range from 15 to 100 cm.*

*** The term "curie" indicates the activity or rate of disintegration of the source, and does not indicate directly the intensity of radiation emitted by the source. If one knows the energy released per disintegration, as well as the number of curies, the intensity of radiation can be calculated.*

an installation. Therefore, patients needing this specialized treatment sometimes must travel great distances at considerable personal expense. This is not intended to imply that less costly X-ray generators do not provide satisfactory treatment for the majority of cases, but that, occasionally, treatment by the higher voltage apparatus is preferred.

The successful development during World War II of the nuclear reactor by the Manhattan District Project of the U. S. Army and the refinements of these reactors by the atomic energy programs of the United States and Canada after 1946, have presented an entirely different avenue of approach to the problem of producing highly penetrating radiation. Soon after the activities of the Manhattan Project were made public and the Atomic Energy Commission was established, interest was stimulated in the prospect of producing radioactive materials having similar radiation characteristics to those produced by high voltage X-ray generators. This is accomplished by exposing prepared samples of inactive or stable materials to the neutrons within a reactor. The exposed atoms absorb neutrons and become radioactive. The stable material selected must have the property of high absorption of neutrons and the radioactive material produced must have the proper type of radiation and a sufficient life to permit use over a relatively long period of time. Also, for teletherapy applications, the source must be concentrated in a small volume and the irradiation time must be reasonably short; consequently, the reactor must be capable of producing a high flux of neutrons.

One material having the necessary characteristics is cobalt 59, a relatively abundant and easily worked metal. The radioactive isotope produced is cobalt 60 which has a half-life* of over 5 years and emits highly penetrating gamma radiation equivalent to X-rays produced by a 3-million volt generator. The nuclear reactor having the capability of producing enough neutrons to obtain a concentrated source of high intensity was the one operated at Chalk River, Canada, by the Canadian atomic energy program. This was at the time the only reactor in existence having this capability; although there were many other reactors.

The first large-scale attempt to produce a therapy machine utilizing cobalt 60 as the source material was sponsored by the late L. G. Grimmett, Physicist, of the M. D. Anderson Hospital, Houston, Texas. The program was developed through the Medical Division, Oak Ridge Institute of Nuclear Studies. Contracts were let to the General Electric Company for the engineering design and construction of the source housing and support mechanism and to the Eldorado Mining and Refining Company, Ltd. of Canada for the source. The unit was subsequently fabricated and temporarily installed in a special room at the Medical Division Hospital in Oak Ridge, Tennessee. The unit remained there while physical measurements were made by J. E. Richardson of the M. D. Anderson Hospital physics staff. Following the successful completion of these measurements, the unit was shipped to Houston, Texas. It is now routinely used in the clinical program of the M. D. Anderson Hospital. Concurrently, units utilizing cobalt 60 as a radiation source were being developed by Johns and Watson of the University of Saskatchewan and by the Eldorado Mining and Refining Company, Ltd.

The Teletherapy Evaluation Program

During the latter part of 1952, the Medical Division, Oak Ridge Institute of Nuclear Studies, invited representatives of medical schools to discuss a proposed program for the evaluation of radioisotope teletherapy. The result of this meeting was the formation of the Teletherapy Evaluation Program representing more than twenty medical schools throughout the United States.

In order to facilitate the investigation of various aspects of this program, a number of subcommittees were formed. One of these was concerned with the investigation of a small-source (100-1000 curies) teletherapy unit.

** The half-life is that period of time in which one-half of the original number of radioactive atoms have disintegrated.*

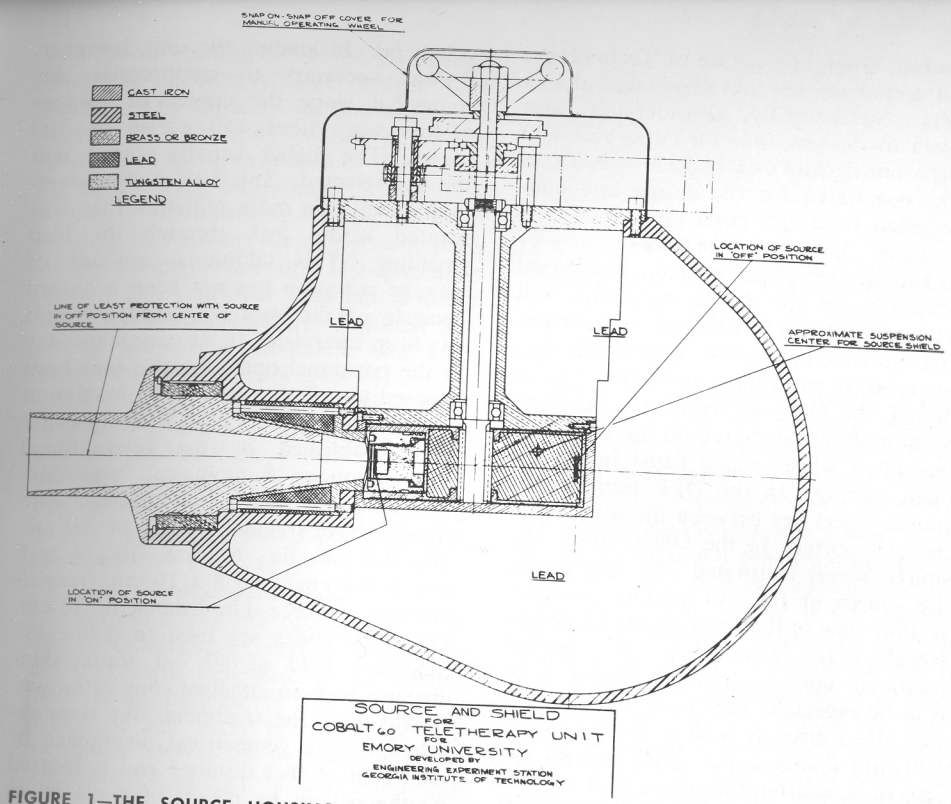


FIGURE 1—THE SOURCE HOUSING WEIGHS 1200 LBS. THE DESIGN CAPACITY IS 200 CURIES.

During the discussion phase of this program, a commercial firm (W. F. and John Barnes Co. of Rockford, Illinois) specializing in machine tool manufacture became interested in the small-source teletherapy unit and began a prototype design based on the subcommittee recommendations. The unit which resulted is now being distributed by the Keleket X-ray Co. of Boston, Massachusetts. However, the commercial unit was stretched considerably beyond the original concept of the subcommittee in order to provide a more flexible device with additional commercial appeal. The major expansion took place in the source capacity of the housing. This factor was increased from a nominal output intensity of 300 roentgens* per hour at a distance of one meter to a nominal output intensity of 600 roentgens per hour at one meter. (Actually this design has been loaded up to 1200 roentgens per hour at one meter which corresponds to a source activity of 1000 curies or in the kilocurie range.)

** Unit of radiation quantity named after discoveror of X-ray.*

The Emory Program

The interests of the group at Emory University deviated somewhat from the resultant subcommittee recommendations. Stimulated by the favorable results obtained in England and the Scandinavian countries with the use of small radium teletherapy units, the Emory group considered the development of a small cobalt 60 unit containing 50 curies. It was the intention at that time to use the unit for treatment of tumors lying in the head and neck region of the body where shorter treatment distances and, hence, higher intensities were possible. A proposal for the design and construction of this unit was prepared and submitted by the Engineering Experiment

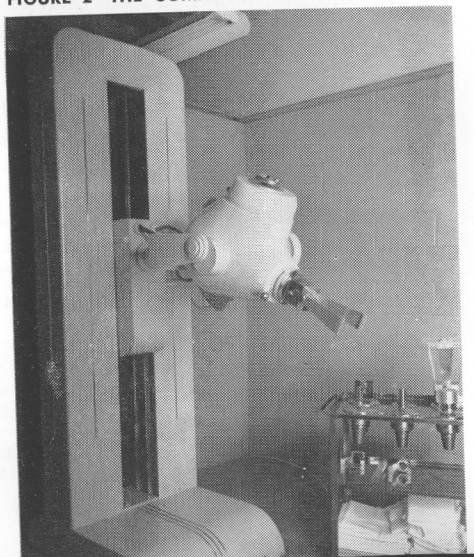
Station, Georgia Institute of Technology, but a contract was not negotiated at this time. Subsequently, consideration was given to designs for 100 curie and 200 curie units. And late in 1953 a contract was negotiated for the design and construction of a 200 curie unit.

The Georgia Tech Design

The design which evolved was based primarily on the L. G. Grimmet unit with refinements introduced by commercial practice and with special features required by the Emory program. In this design, the ON-OFF control is achieved by mounting the source on the edge of a lead-filled wheel which turns inside the main casting. In the OFF position the source wheel lies between the source and the exit portal. In the ON position, the source wheel is rotated 180° presenting the source at the exit portal. A cross-section view of the source housing, source wheel, drive mechanism, and typical treatment cone is shown in Figure 1. It is to be especially noticed in this drawing that the source is a thin circular wafer (20 mm dia. x 2 mm thick) about the size of a quarter contained in a capsule of standardized dimensions made of tungsten alloy. The standardized dimensions of the capsule permits standardized loading procedures, as well as replacement or interchange of sources with other units.

The source housing shown in Figure 1 weighs approximately 1200 lbs. and has a design capacity of 200 curies of cobalt 60. In loading the unit, however, it was necessary to compromise this somewhat since the choice of sources offered was either 150 curies or 300 curies. The higher activity source was the one selected. This 50% source overload meant that more radiation than was wanted would leak through the lead shielding. This additional amount of leakage radiation has not been a hazard because of the way in which the unit has been operated. In no case have any of the personnel operating this unit been exposed to radiation above the maximum permissable exposure of 0.3 roentgen per week established by the International Commission on Radiological Protection.

FIGURE 2—THE COMPLETED UNIT



The six treatment cones furnished with the unit have treatment areas of 2.0 cm. dia., 3.5 cm dia., 6.5 cm. dia., 4 x 6 cm., 6 x 8 cm., and 8 x 10 cm., respectively at a source-skin-distance of 30 cm. The same cones are used to define the treatment field at 50 cm source-skin-distance with an attached cone extension. In this case, the treatment area is established by the geometrical divergence of the beam at that distance and is located on the patient by means of a plexiglass end plate on the cone extension. Each cone was separately cast in brass, machined, and plated. The cones each weigh about 17 lbs. and are somewhat cumbersome to handle. The alternative to a number of heavy fixed area cones is to provide a variable area diaphragm. The design of such a device, however, is not a simple task, and the construction would be relatively costly. Such a diaphragm is being considered, nevertheless, and will probably be added to the unit in the near future.

The completed source housing was mounted on a modified, old-model Keleket tube stand. A new yoke support for the housing, a new rotational motion, and the addition of 500 lbs. of lead counterweights were the principal revisions of the old mechanism. This tube stand was generously provided by Enoch Callaway, M.D., of LaGrange, Georgia, who was interested in the development of this unit.

The source was loaded in the main housing by remote handling equipment in a special loading cell at the Oak Ridge National Laboratory, Oak Ridge, Tennessee. The housing in this case also served as a shipping container for the source and was transported to Oak Ridge by Engineering Experiment Station personnel. After returning the loaded source housing to Atlanta, the component parts of the complete unit were transported to Emory University for installation in the new Woodruff Memorial Medical Research Building. Installation was completed during the latter part of October 1954. After the necessary physical measurements to establish radiation levels in and around the therapy room and beam intensity measurements were made, the clinical program began on November 2, 1954. Figure 2 shows a photograph of the completed unit.

Modifications Indicated

After more than one full year of heavy use, modifications of certain features of the unit seem indicated. Chief among these is an increase of the source capacity of the main housing. As was mentioned above, the unit was designed for a source activity of 200 curies but was actually loaded with a source activity of 300 curies. If the source wheel were reconstructed of a combination of tungsten alloy* and lead and if some of the lead behind the source in the OFF position were replaced with tungsten alloy, the source capacity could be increased to 500 curies or more. The advantage of this is not simply that the unit would now safely house a higher activity source. If another cobalt 60 teletherapy unit were used in conjunction with it—for example, one having a 1000 curie capacity—then a source starting in one unit at 1000 curies and decaying after one half-life to 500 curies could be transferred to the other unit. Since Emory University is seriously considering the purchase of a commercial unit which would have a 1000 curie capacity for their new clinic installation, it would seem reasonable to so modify the existing unit.

** Tungsten alloy has a relative absorption power of 1.4 that of lead for the gamma radiation from cobalt 60.*

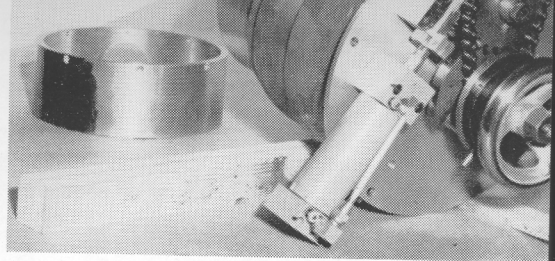


FIGURE 3—DESIGN SANS COIL SPRING

Another modification which is indicated and which will probably be done at the time the source capacity is increased is to change the method of driving the source wheel ON and OFF. The present design incorporates a short stroke air piston driving a gear train against the restoring force of a coil spring as shown in Figure 3 (coil spring is not shown). While this driving mechanism has performed adequately and while it can be operated from compressed gas tanks rather than the compressed air now being used, the general feeling after operating the unit for some time is that an electric motor drive should be substituted for the air piston.

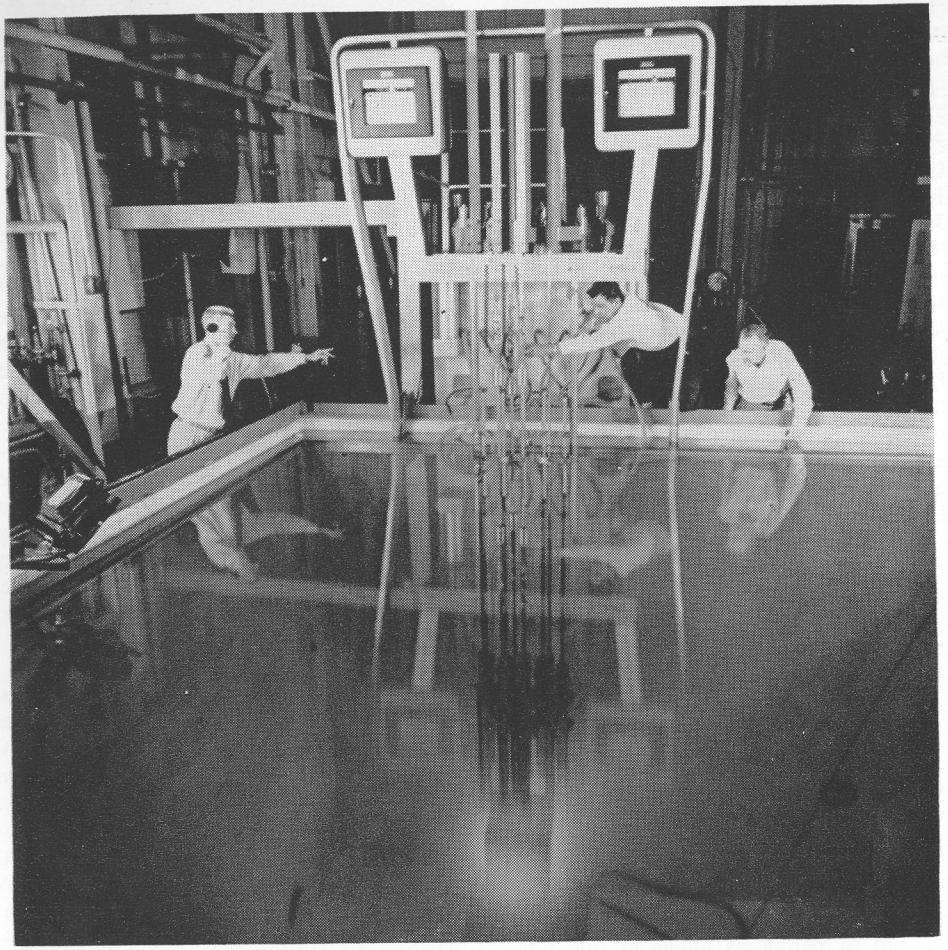
Conclusion

The objective of this development was to provide a teletherapy unit having the flexibility of the commercial units then becoming available but a maximum source capacity well below that of any commercial unit, and to take advantage of this fact in producing the unit at a cost substantially below that of the larger commercial units. Certain compromises in the appearance and operating convenience were possible which further reduced the cost. The success of the unit in the clinical program has been gratifying to all of the personnel associated with the project and has demonstrated the soundness of the basic design.

This is another example of the growing number of applications of radioactive materials. The experience gained by Engineering Experiment Station personnel in producing this unit will assist them in meeting the challenge of new problems in the atomic age.

a progress report

Photograph courtesy of the Union Carbide and Carbon Corporation



The "swimming pool" reactor at Oak Ridge, one of the many types now on the American market.

Tech's needs for a Nuclear Reactor

IT IS AN ABSOLUTE MUST IF TECH IS TO CARRY OUT AN UP-TO-DATE PROGRAM IN NUCLEAR EDUCATION

If Georgia Tech is to become a major center for nuclear science, a nuclear reactor must be available on the campus as an integral part of a research and educational program. To be effective, such a reactor should provide a high neutron flux at relatively low power.

A research reactor would provide for research possibilities which are presently of great interest but impossible at Georgia Tech. For example, a reactor would make available isotopes of short half-life. This would open up fields of research which are impossible except in the vicinity of a reactor. In a recent survey of the staff at Georgia Tech, particular interests were expressed in reactor facilities for neutron diffraction, nuclear spectroscopy, activation analysis, radioisotope production, studies of effects of radiation on properties of materials, and other subjects. Further, the Engineering Experiment Station has recently had the opportunity to consider two requests for research proposals from outside agencies which would involve the use of a nuclear reactor. This is considered to be an additional indication of the existing need for a research reactor facility.

The presence of a research reactor facility at Georgia Tech would motivate interests of the staff in new directions. At present, there can be no stimulus for certain lines of thought, because facilities do not exist for reducing the ideas to practice. It is believed that the presence of a reactor would generate many new approaches to engineering problems, bringing technical advances, new staff contributions, and associated credit to the institution and to Georgia.

A research reactor would strengthen the educational program in nuclear science. The strength would come from the fact that the reactor embodies many principles which can be demonstrated to students in nuclear science. It would also serve as a center of graduate research activity in the field of nuclear science.

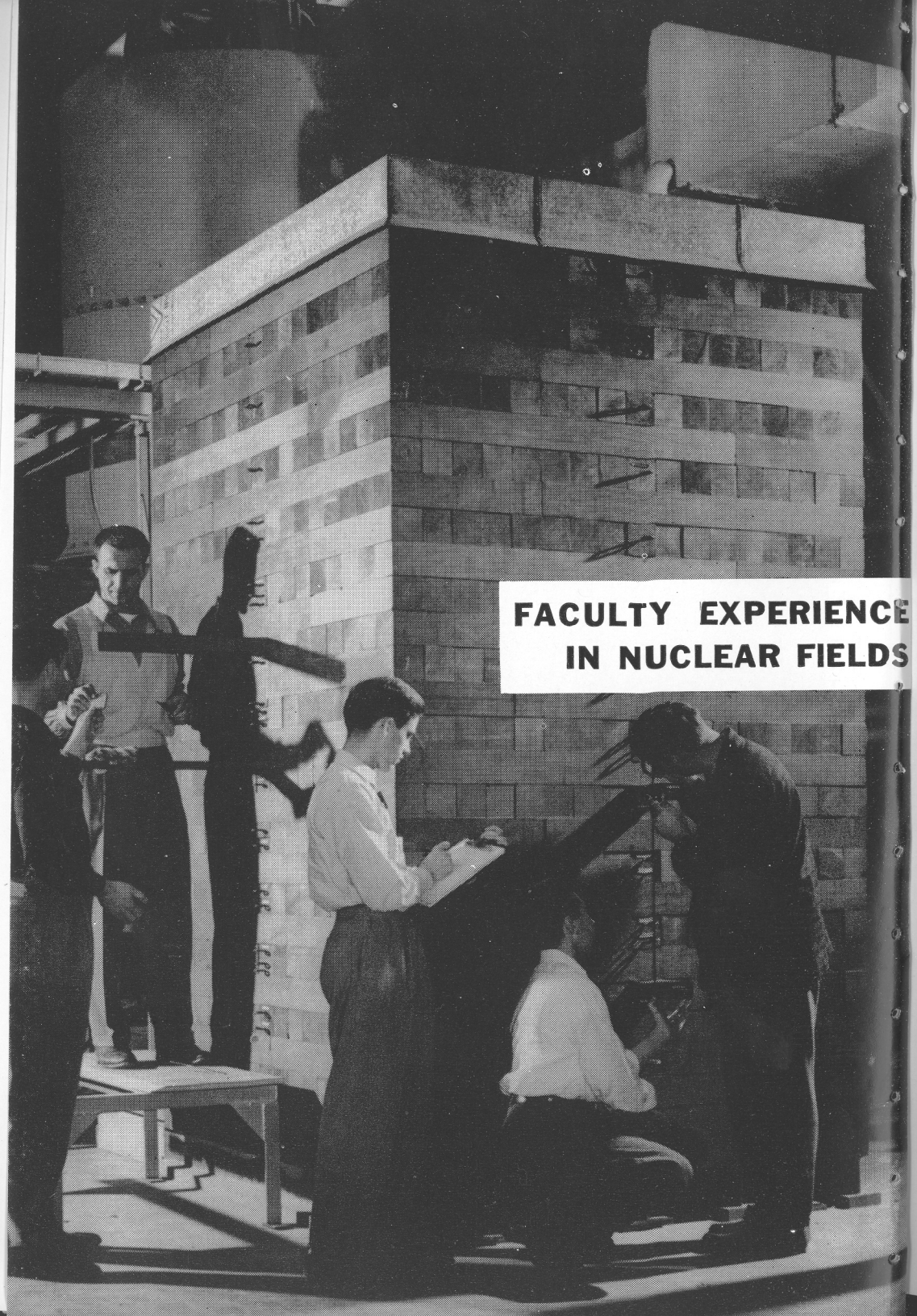
A research reactor would serve as an added inducement for competent scientists and graduate students to come to Georgia Tech, thereby helping to insure continued advancement in science and technology.

A research reactor, as any other major facility on the campus (for example, the Computer Center), would increase the scope of operations which can be employed in research and educational problems, thereby increasing the potential of the institution for gaining additional supported research programs.

The existence of a reactor in Atlanta should be a strong inducement for certain industrial concerns to locate in Georgia, bringing increased revenue to the area. A reactor would benefit hospitals, universities and other activities in the vicinity of Atlanta. For example, there is a need for short-lived isotopes in medical research and in some applications of radioisotopes to industrial problems.

A research reactor facility is becoming established as standard equipment in academic institutions of the size and character of Georgia Tech. A strong motivation for acquisition of a research reactor is the desire to meet academic competition. In the August 1955 issue of Nucleonics, it was stated that 30 U.S. universities are considering research reactors, including the reactor in operation at North Carolina State College, and those under construction at Illinois Institute of Technology, University of Michigan, and Pennsylvania State University. (The one at Pennsylvania State has been completed and is now in operation.) Of particular interest in the Southeast are plans by Vanderbilt University, Alabama Polytechnic Institute, and the University of Florida. Other examples of interest are the University of California at Los Angeles, Massachusetts Institute of Technology, and Purdue University.

To the entire country, the reactor symbolizes a new era of nuclear energy and related research, and the lack of a reactor facility can be construed as a deficiency with respect to the advances of science and technology. If Georgia Tech is to maintain a reputation of leadership in research and education, acquisition of a research reactor is a must.



FACULTY EXPERIENCE IN NUCLEAR FIELDS

Thirty-nine of Tech's faculty members have had a wide variety of practical experience in the nuclear fields

Department	Name	Degree	Experience
Aeronautical Engineering	A. L. Ducoffe	Ph.D. (Univ. of Michigan)	Relevant classified research at Sandia Corp., Summers, 1954 and 1955.
Ceramic Engineering	Lane Mitchell	Ph.D. (Pennsylvania State College)	Research at ORNL, Summer, 1954, on the development of a Ceramic Sorber for atomic waste liquors.
Chemistry	W. H. Eberhardt	Ph.D. (California Inst. Tech.)	Gaseous diffusion research at ORNL, Summers, 1949-55.
Chemistry	L. D. Frashier	Ph.D. (Univ. of California)	Separation of fission products, use of tracers in diffusion studies; research at ORNL two summers.
Chemistry	J. K. Gladden	Ph.D. (Northwestern Univ.)	Mass spectrometer studies of U^{235} consumption in a reactor, research at ORNL during two summers.
Chemistry	E. Grovenstein	Ph.D. (Massachusetts Inst. of Tech.)	Radiocarbon tracer studies of the mechanism of organic reactions, research at ORNL.
Chemistry	Jack Hine	Ph.D. (Univ. of Illinois)	Radiocarbon tracer studies in organic reactions.
Chemistry	R. F. Sessions	Ph.D. (Stanford Univ.)	Study of the mechanism of oxidation of sodium and classified work, research at ORNL during three summers.
Chemistry	W. M. Spicer	Ph.D. (Univ. of Va.)	Consulting work on phase diagrams at ORNL.
Chemistry	A. C. Topp	Ph.D. (McGill Univ.)	Separation of rare earth elements and purification of separated isotopes, research at ORNL.
Chemical Engineering	J. M. DallaValle	D.Sc. (Harvard Univ.)	Consultant on the flow properties of thick suspensions for homogeneous slurry reactors at ORNL, research at ORNL during two summers.
Chemical Engineering	Clyde Orr	Ph.D. (Georgia Inst. of Tech.)	Heat transfer problems related to reactor design.
Chemical Engineering	W. T. Ziegler	Ph.D. (Johns Hopkins Univ.)	Wartime employee on Manhattan District Project as physical chemist; extensive research in properties of matter at low temperatures.
Civil Engineering	W. N. Grune	Dr. Eng. Sc. (N. Y. Univ.)	Sanitary engineering research on the treatment and disposal of radioactive sludges.

Department	Name	Degree	Experience
Civil Engineering	H. C. Saxe	D. Sc. (Massachusetts Inst. of Tech.)	Consultant to ORNL on physical properties of high density barities-colemanite concrete for shielding purposes. Work on blast effects of nuclear weapons at M.I.T. and the Nevada Test site.
Electrical Engineering	F. K. Hurd	Ph.D. (Univ. of California)	Research in paramagnetic resonance.
Engineering Experiment Station	R. B. Belser	M. S. (Emory Univ.)	Experimental studies of the properties of thin metal films.
Engineering Experiment Station	J. E. Boyd	Ph.D. (Yale Univ.)	Research on x-ray scattering and radioactivity, activation studies with Ra-Be neutron source.
Engineering Experiment Station	F. Dixon	M. S. (Georgia Inst. of Tech.)	Calculation of the specific ionization of cosmic rays in idealized biological targets in cooperation with Dr. H. J. Schaefer of the School of Aviation Medicine, U.S. Naval Air Station, Pensacola, Fla.
Engineering Experiment Station	R. H. Fetner	Ph.D. (Emory Univ.)	Research on the effects of x-radiation in various atmospheres on chromosome breakage in microspores.
Engineering Experiment Station (and Public Health)	R. S. Ingols	Ph.D. (Rutgers Univ.)	Biochemistry, study of the effects of high level radiation from Ga^{72} on liver respiration at ORNL during a period of six months.
Engineering Experiment Station	T. W. Jackson	Ph.D. (Purdue Univ.)	Thirty months in the Aircraft Nuclear Propulsion Program of the Air Force, heat transfer calculations on reactors, design of fuel plates; technical representative at the General Electric Aircraft Nuclear Propulsion Plant at Evendale, Ohio.
Engineering Experiment Station (and Physics)	E. W. McDaniel	Ph.D. (Univ. of Michigan)	Experimental nuclear physics, radiocarbon dating and low-level activity measurements.
Engineering Experiment Station (and Physics)	M. L. Meeks	Ph.D. (Duke Univ.)	Theoretical nuclear physics, theory of beta decay.
Engineering Experiment Station (& Ind. Eng.)	J. J. Moder	Ph.D. (Northwestern Univ.)	Consulting work for ORNL on fine particle separation in the liquid cyclone.

Department	Name	Degree	Experience
Engineering Experiment Station (Not full time staff member)	J. H. Tolan	B.S. (Georgia Inst. of Tech.)	Consultant (from Emory University School of Medicine) to Medical Division, Oak Ridge Institute of Nuclear Studies; consultant to Federal Civil Defense Administration, work on instrumentation and applications for radioisotopes.
Engineering Experiment Station	W. C. Whitley	Ph.D. (Univ. of Wisconsin)	Research on the high temperature chemistry of uranium at ORNL during four summers.
Engineering Experiment Station	W. E. Woolf	M. A. (Emory Univ.)	Neutron resonance measurements, Argonne National Laboratory, 1948-50; Research Assistant, Van de Graaff Accelerator Group, Duke University; x-ray diffraction studies.
Mathematics	J. A. Nohel	Ph.D. (Massachusetts Inst. of Tech.)	Investigation of the stability of solutions to differential equations describing circulating-fuel reactors.
Mechanical Engineering	M. J. Goglia	Ph.D. (Purdue Univ.)	Consultant to ORNL on problems related to gaseous diffusion.
Mechanical Engineering	W. B. Harrison	Ph.D. (Univ. of Tennessee)	Heat transfer research with the Reactor Experimental Engineering Division at ORNL for four years.
Mechanical Engineering	F. A. Thomas	M. S. (Georgia Inst. of Tech.)	Work on industrial hygiene in AEC plants for two years.
Mechanical Engineering	J. P. Vidosic	Ph.D. (Purdue Univ.)	Work on the mechanical testing of radioactive materials.
Physics	C. H. Braden	Ph.D. (Washington Univ.)	Experimental nuclear physics, research on scattering of charged particles by nuclei and on nuclear spectroscopy.
Physics	H. A. Gersch	Ph.D. (Johns Hopkins Univ.)	Research in statistical mechanics, neutron diffraction research at ORNL during summer, 1955.
Physics	J. R. Stevenson	Ph.D. (Univ. of Missouri, to be awarded in June, 1956)	Research on solid state physics, low temperature research at ORNL during Summer, 1955 in connection with nuclear alignment of U-235.
Physics	T. L. Weatherly	Ph.D. (Ohio State Univ.)	Research in microwave spectroscopy, quadrupole spectra studies.
Physics	J. Q. Williams	Ph.D. (Duke Univ.)	Research in microwave spectroscopy, quadrupole spectra studies.
Physics	L. D. Wyly	Ph.D. (Yale Univ.)	Research with the Yale cyclotron (2 years); work on ORNL cyclotrons (4 summers), experimental study of nuclear decay schemes.





Tech's retired vice-president Cherry L. Emerson, presses the key on the flexowriter that types the automatic message officially opening the new $1,000,000 Rich Electronic Computer Center.

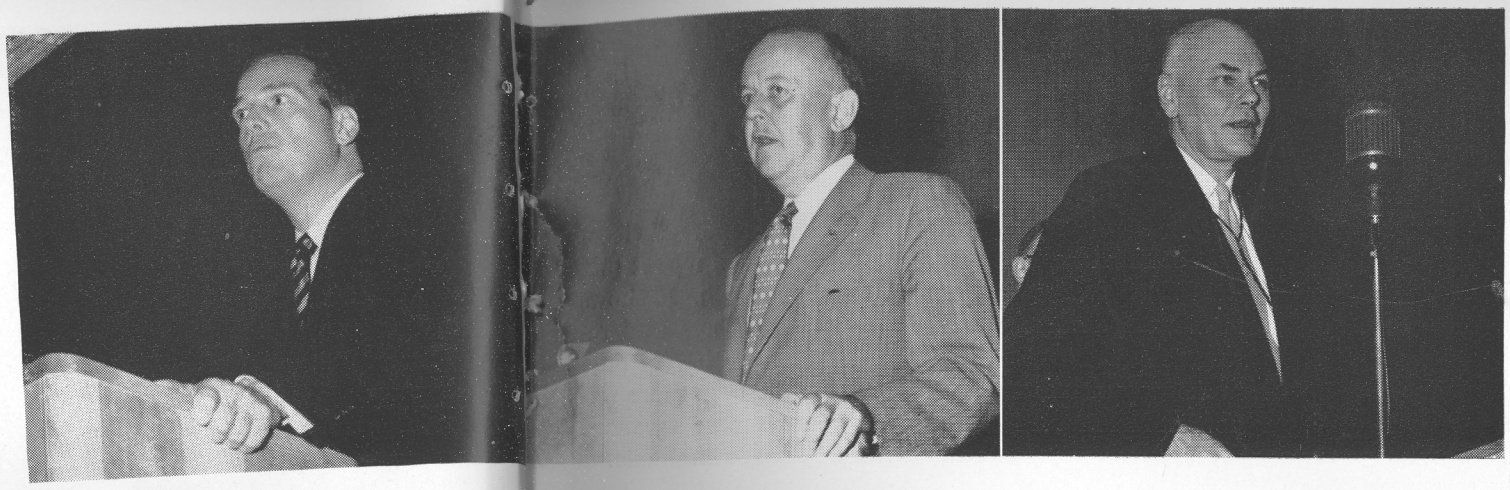
D-DAY FOR THE COMPUTER CENTER

A GREAT NEW FACILITY for education, service to industry and research was unveiled at Georgia Tech on December 2 when the Rich Electronic Computer Center was dedicated. Acting as Master of Ceremonies, Tech President Blake R. Van Leer traced the history of the new addition to the Engineering Experiment Station and introduced a group of distinguished guests to the capacity crowd in Tech's Architecture Auditorium. Georgia Tech Research Institute Chairman, William E. Mitchell introduced speakers C. L. Keenoy and Dr. H. T. Engstrom. After the speaking, the group moved over to the new computer wing for open house. On these and the following pages, the Research Engineer brings you this story in photos.

Photographed for the Research Engineer by L. W. Prouse

DEDICATION
continued

Feature speakers of the December 2 ceremonies included, left to right, C. L. Keenoy, vice president National Cash Register Co.; Dr. Howard T. Engstrom, vice president, Remington Rand's Univac Division; and Dr. Howard H. Aiken, head of the Havard Computation Laboratory. The talks covered the proper use of the Tech computer center, a history of computers and the future use of computers.





Research Engineer

Despite the bad weather, most of the crowd stayed for the demonstrations of the capabilities of the NCR 102D, shown left, and the ERA 1101, below. The rest of the day the center held open house.



edited in retrospect

in this issue

• This issue is mainly devoted to the initial report of Georgia Tech's Nuclear Science Committee. It is a report that should be read by every friend of Georgia Tech. It shows in black and white just how much the teachers and researchers at our school have accomplished with very little in the way of funds. And it points up the even more important fact that if Tech is to carry on the more-advanced nuclear research, more funds must be made available.

Since this report was completed, two happenings have given the Nuclear Science Committee hope that these funds will soon be available: the Governor of the State, Marvin Griffin, indicated that he was interested in nuclear research in Georgia in a speech before a large gathering of Tech alumni on November 25 in Atlanta, and the Lockheed Aircraft Corp. announced plans for a large amount of nuclear work in their Marietta, Georgia plant. We hope that this report will indicate to these two interested representatives of government and industry that Georgia Tech stands ready to carry out what nuclear research and teaching is needed in this state. We have the men with the background to carry out the work. All we need now is the proper financing.

the changing scene

• The change in the appearance of the magazine is due to a change in editors. Odom Fanning, who brought the magazine out of the woods, has left the Engineering Experiment Station to take a position as manager of information services with Midwest Research Institute in Kansas City, Mo. With the new editor comes the new look, it's always that way in the publishing field.

coming in April

• The next issue will feature an article on Trade Marks, a photo story on a Tech research project and Part II of Cobalt 60 Teletherapy by researchers Tolan and Elliott.

the research engineer
APR. 1956
Georgia Tech Engineering Experiment Station



from fishing rods to antennas — page 11