Edited In Retrospect

A Loss for Tech

• Dr. Joseph M. DallaValle—regents professor of chemical engineering at Georgia Tech and a frequent contributor to this magazine during the past eight years—died June 1 after a short illness.

Born in New York City, 52 years ago, Dr. DallaValle received his B.S. degree from Harvard in 1927 and his M.S. and Sc.D. there in 1928 and 1930.

After over 28 years experience with government and industry, Dr. DallaValle came to Tech as an associate professor of chemical engineering in 1948. The following year he was named a full professor and in 1955 he was honored by being named a regents professor, highest academic rank on the campus.

In 1953, he received a Fulbright grant and served for that academic year as a lecturer in chemical engineering at the University of Milan in Italy. Our regular readers will remember his impressions of an Italian University published in the April 1955 issue of this magazine.

Dr. DallaValle was an extremely prolific researcher and writer and had a long list of technical publications to his credit. But we suspect that the greatest impression that Joe DallaValle made was on the many graduate students who received the benefit of his encouragement and advice. He was a great judge of scientific talent and spent much of his spare time working with the graduate program at Georgia Tech.

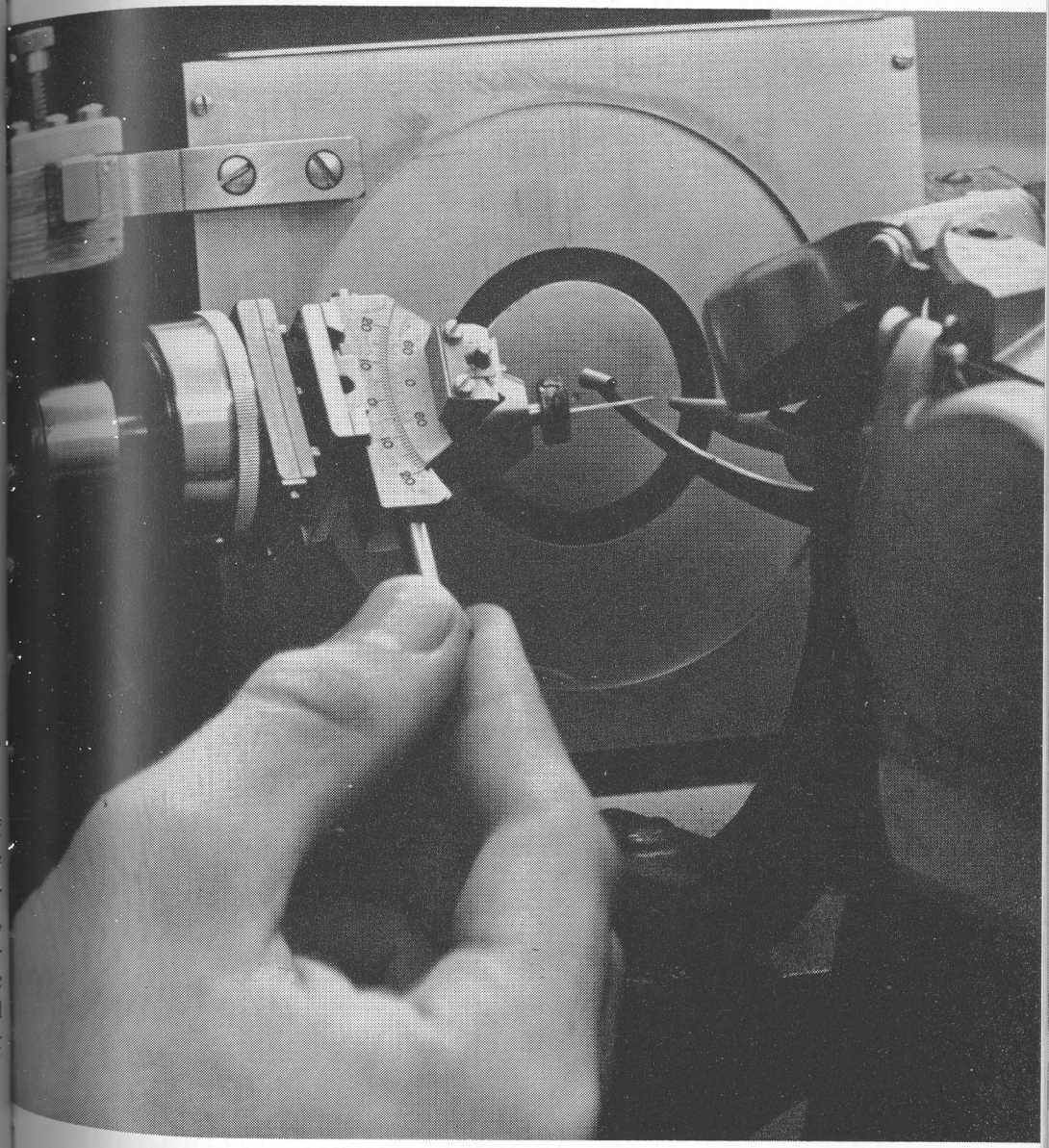
A New Schedule

• This may well be the last July issue in the history of THE RESEARCH ENGINEER. Beginning with the next issue we are inaugurating a new publishing schedule on a five-times-a-year basis. A copy should reach you in January, March, May, September and November. This new schedule is being adopted in order that we may publish the annual report of research at Georgia Tech as a special issue. We hope that you will be looking for the September issue which will be devoted to this annual report.

OCTOBER, 1958

The Research Engineer

Published by the Georgia Tech Engineering Experiment Station



A SPECIAL RESEARCH REPORT

The Research Engineer

VOLUME 13, NO. 4 OCTOBER, 1958

Published quarterly by the Engineering Experiment Station
Georgia Institute of Technology, Atlanta, Georgia

contents

the cover

The precession camera used in X-ray diffraction work at Georgia Tech is just one of the many precision instruments necessary to a modern research organization. Widely used in the determination of the structure of crystals through diffraction patterns, this instrument is also used at Georgia Tech to study imperfections in a single crystal. Along with the other instruments shown on the following pages, the precession camera is as much a part of research as those who man it.

The cover and all photographs in this issue by Bill Diehl, Jr.

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GEORGIA TECH RESEARCH AND INDUSTRY IN THE SOUTH

THE CLOSE CORRELATION of teaching, graduate study and research is essential to the effective operation of any institution of higher learning.

Beyond its conscientious efforts toward continuing this concept at Georgia Tech, the Engineering Experiment Station makes a direct and significant contribution to industry in our state and region.

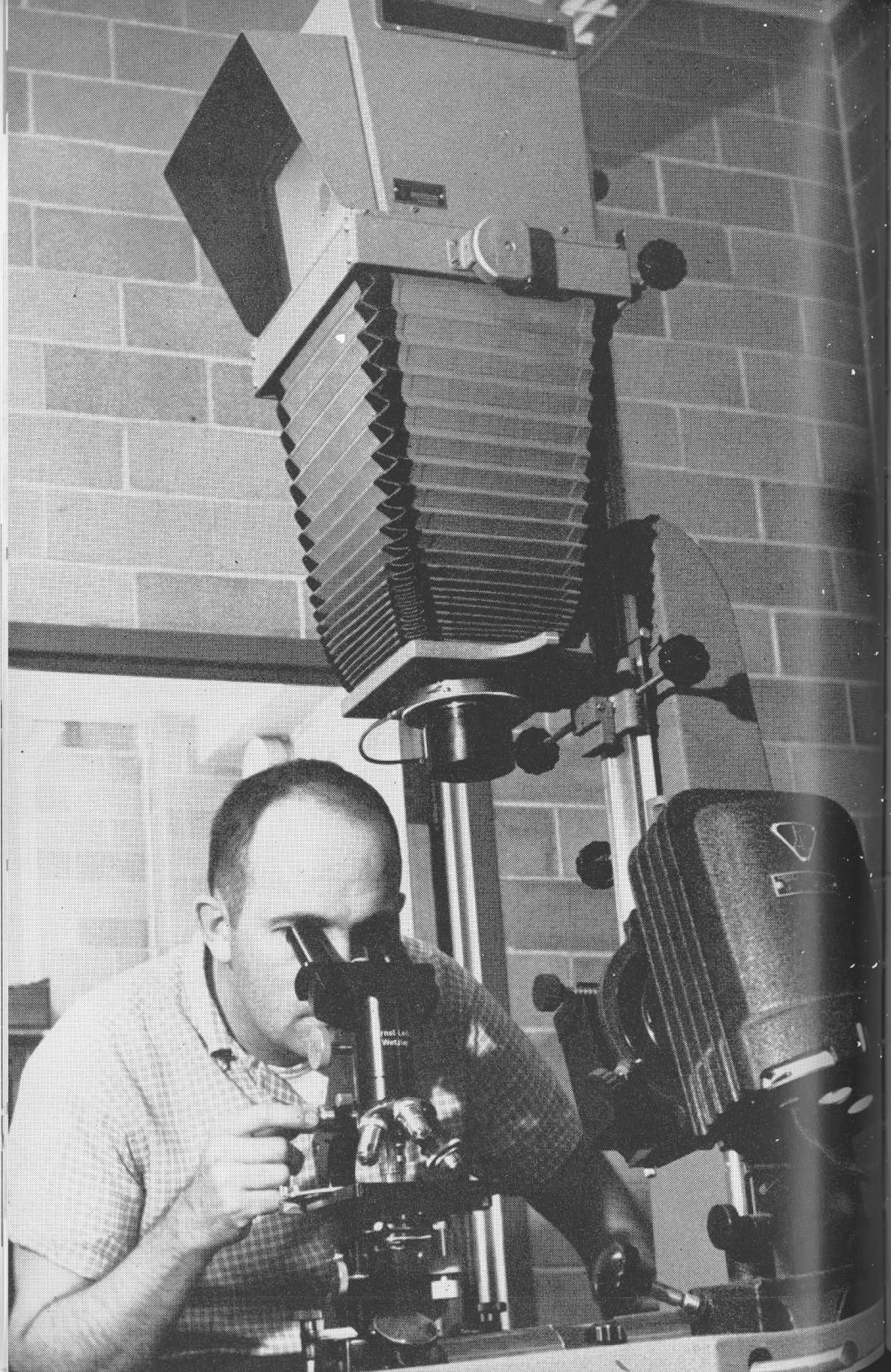
Since the Station undertook its first industrial project back in the thirties, one of its primary objectives has been the continued development of a program in which Georgia Tech could better serve industry.

During the past year, Georgia Tech's research activities have been stepped up in several highly specialized areas in which research service and assistance have not previously been available to industry in this region. As a result of this increased activity, Georgia Tech now offers a more extensive program of industrial research than at any time in its history.

With the addition of new computation equipment this fall, the completion of the Radioisotopes and Bioengineering Laboratory in the winter, and further expansions in other research areas during the year, Georgia Tech's ability to provide research service to all types of industry will continue to improve.

Through the research efforts of the highly qualified engineers and scientists that make up its staff, Georgia Tech is not only keeping pace with the South's industrial growth, it is actively contributing to it.

E. D. Harrison
President



1957-58, A Year of Contrast

BY JAMES E. BOYD, DIRECTOR
GEORGIA TECH ENGINEERING EXPERIMENT STATION

THE YEAR 1957-58 in the Georgia Tech Engineering Experiment Station was one of extreme contrasts. It began under the pressure of a Defense Department cutback in basic and applied research, spanned a nation-wide recession, and yet ended as the most successful year in the history of research at Georgia Tech.

Dollar volume and number of projects —the usual though not the ultimate indications of research effectiveness—both showed large increases over the record 1956-57 year. Research dollar volume, $2,383,000, was 20 per cent above the $1,960,000, volume of last year. The list of projects numbered 270, an increase of 42 over last year's total.

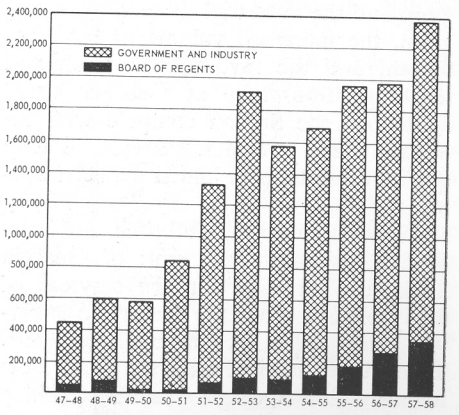
Far more important than these increases, however, was the improvement in the quality of Georgia Tech's research as well as the expansion of its services to higher education, industry, and government. Especially encouraging was the increase in basic research projects sponsored by government agencies and through the use of State funds. Through these increases, the Station was able to offer more assistance on graduate theses problems and faculty research than ever before.

The year was also one of significant advances toward another objective of Georgia Tech research—the continuing development of a program of assistance to the industries of Georgia and the Southeast. The successful year in the face of adverse conditions nationally was due partly to greater activity in this program. The number of projects sponsored by industrial interests increased by 21 during the year, reflecting particularly the expanding work of the Rich Electronic Computer Center, the Industrial Development Branch and the 9-foot wind tunnel.

The increasing support from the Board of Regents also reached a record level of $345,000, or 14.5 per cent of the Station's total income. This represents almost a threefold increase in three years —proof that the Governor, General Assembly and the Board of Regents appreciate the value of Georgia Tech and its research efforts to the development of Georgia's scientific leadership, industrial capabilities and natural resources.

The largest portion of the research effort during the year was again devoted to Government-sponsored research. It is felt strongly that the Station must continue to contribute to the security of the nation through work on military prob-

The Engineering Experiment Station's income by source during the past ten years of operation.



lems as well as through the basic research that increases our knowledge and understanding of natural phenomena.

The growth of all of the Station's programs, the industrial services in particular, during the past year utilized the full capacity of the Station's facilities. Some expansions were made through reorganization and the purchase of new equipment, but further growth was held in check by the lack of working space.

Part of the expansion and reorganization resulted in a new operating division, the Materials Sciences Division. This outgrowth of the Chemical Sciences Division was necessitated partly because of the spectacular advances of the Ceramics Branch, and partly in order to provide headquarters for the Station's new Mineral Development Program.

In close cooperation with the new division and especially its minerals work is the now two-year-old Industrial Development Branch. The research of this group of engineers and economists is laying a solid foundation for a balanced program of industrialization for the State of Georgia. The Branch's rapid growth and early achievements during the year offer great future promise for this aspect of Georgia Tech research.

Although the national demand for qualified research personnel continued to be strong, the Station made some progress during the year toward both reducing turnover and attracting high-level talent. The growth of the nuclear program and the industrial development program, the increased volume of basic research, and the favorable research and teaching atmosphere at Georgia Tech, all helped the Station compete with industrial salary scales. Several highly qualified researchers joined the staff during the year.

In addition to its full-time staff the Station, as an integral unit of Georgia Tech, can arrange for the services of many experts from the faculty to supervise and carry out research projects. Trained in many diversified fields, the members of Georgia Tech's teaching faculty are ideally suited to carry out both basic and applied research. The Station employs on a part-time basis 75 teaching faculty members to aid in the planning and execution of many of its research programs. Through this program, the faculty members develop in scientific stature by increasing their knowledge of their specific fields and by acquiring better appreciation of problems that their students will soon be facing. The Station and its government and industrial sponsors also benefit greatly from the availability of this wealth of knowledge and experience.

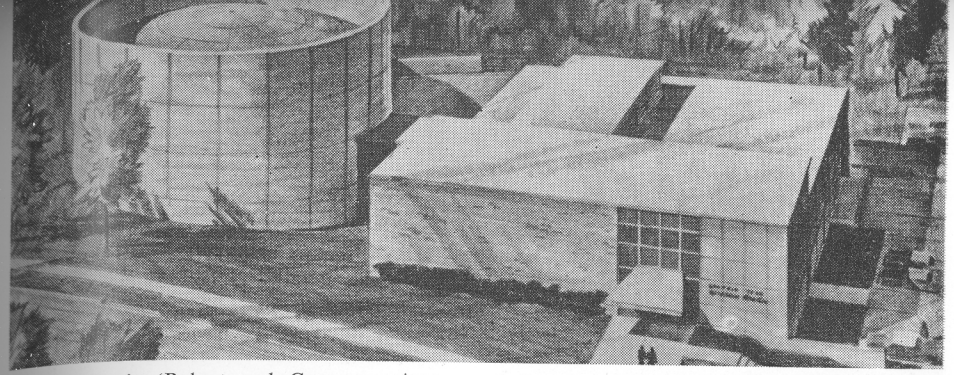
Georgia Tech Research Institute

In addition to handling contracts and patent matters for the Station and establishing contracts with possible industrial and government sponsors, the Georgia Tech Research Institute continued to aid research activities at Georgia Tech by making available over $92,000 in funds. The greater part of this sum was in machine time and a Rich Foundation grant that the Research Institute administered for the maintenance of the Rich Electronic Computer Center.

During the year the Research Institute received one U. S. patent and one foreign patent, and Station staff members originated work that led to 93 records of invention and 12 additional patent applications. By the close of this fiscal year, a total of nine patents had been issued on the inventions of staff members since 1946; 35 patent applications were pending before the U. S. Patent Office; 12 applications had been filed with foreign countries; and three patents had been licensed to industrial firms for commercial development.

A cooperative effort

The work of the Institute's Nuclear Science Committee once again provided an excellent example of effective cooperation between several divisions of Georgia Tech. The committee represents the science and engineering schools as well as



The architect's (Robert and Company, Associates) sketch of Georgia Tech's multimillion dollar research reactor which will go under construction near the campus within a year.

the divisions of the Station that have an interest in the development of an integrated nuclear science program.

During the past year the committee saw many of its plans essentially completed. Construction began on the Radioisotopes and Bioengineering Building, valued at over $500,000. This building was made possible by special allocations of $300,000 from Governor Marvin Griffin, a grant of $125,000 from the National Institutes of Health, and a special grant from the Board of Regents. It will be partially equipped by grants valued at over $250,000 from the Atomic Energy Commission. This building will provide 16,000 square feet of badly needed space and will house many research and instructional activities associated with the nuclear science and engineering programs.

The reactor program also showed some major advances during the year. Governor Griffin made an allocation of $2,500,000 for the construction of the reactor facility. The conceptual design was completed by the nuclear engineers, and preliminary designs of the buildings were submitted by the architects. The committee also made progress on loan approvals and other financial aids needed for the complete nuclear program.

Service to Georgia Tech

As an integral part of Georgia Tech, the Station follows the policy of serving the students, and faculty and of assistance with educational programs of the Institute in every way possible. During the year, the Station employed over 70 graduate students and over 100 undergraduate students. Through this employment the students gained valuable experience as well as needed financial aid.

Sixteen employees of the Station received graduate degrees at the 1958 commencement. Graduate theses of some students were made possible through work on research projects sponsored by the Government or supported by State funds. More than 30 graduate thesis problems were handled by the Computer Center.

Aside from the faculty members employed for part-time research, a number of the Station's regular staff participated in graduate colloquia and seminars in various academic schools. A still larger number served as thesis advisors for graduate students, and others have taught special and advanced courses on a part-time basis.

In many cases the Station has made research equipment and facilities available to students and faculty. Last year several ceramic engineering students made use of the X-ray Laboratory in preparing their bachelor's theses. Specialized equipment was procured by the Station for graduate student and independent faculty research. And the machines in the Computer Center were used for laboratory purposes by 15 courses in the Schools of Mathematics,

Electrical Engineering, Industrial Engineering, Chemical Engineering, and Mechanical Engineering.

Service to the nation

In an age when engineering and science are playing a significant role in the safety and welfare of our nation, Georgia Tech carried out the largest part of its research for various agencies of the Federal Government. While of immediate importance to the Armed Services, much of this government-sponsored research is fundamental enough to contribute directly to the advancement of science. And history has indicated that some of it eventually will lead to developments of distinct benefit to the people and industry of America.

Service to industry

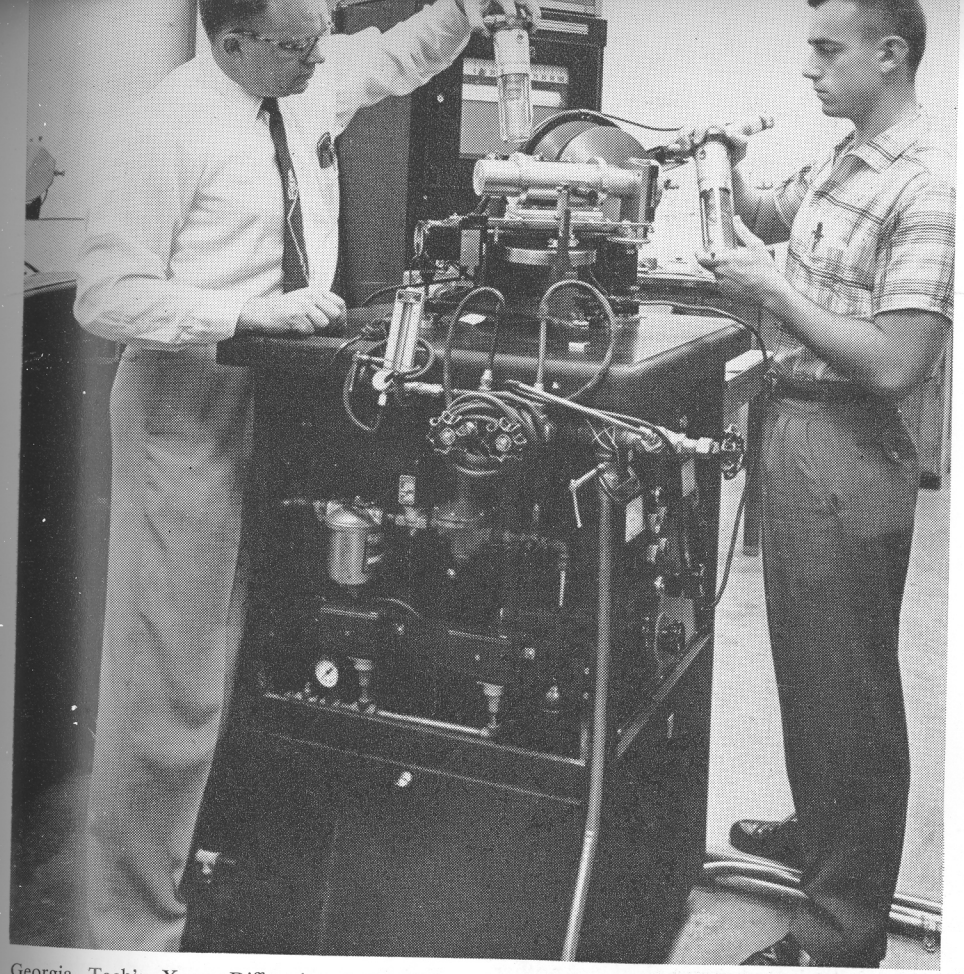
Georgia Tech research continued to provide strong support to Georgia's industries as well as to other non-manufacturing businesses and to the community, State and region at large. The number and size of the Station's industrial projects, most of which were carried out for Georgia firms, again reached a record level. These projects, along with the valuable research of the industrial development program, were the most tangible types of service rendered by the Station to industrial Georgia and the South. But far more frequent were the contracts in which the Station served as a clinic to which industry brought its problems for the scientific cure.

Because of the know-how possessed by the staff, industrial organizations increasingly called on the Station for advice, consultation, and information. It is estimated that the Station had over 500 such contracts during the year. The Industrial Development Branch, Computer Center, Industrial Products Branch, Mechanical Design Section, and the X-ray and Microscopy Laboratories handled the bulk of these inquiries. Although Georgia Tech is seldom compensated in terms of revenue for these services, its awareness of its obligations to the people and to industry of the State provided reason enough for this policy.

In still another important way, Georgia Tech is contributing to the industrial and scientific strength of the South: well over half of the previous employees and graduate students who worked part-time at the Station have remained with firms in Georgia and other Southern states. Many of these alumni have advanced degrees, along with extensive practical experience in research and engineering. They represent a manpower resource that is extremely valuable to the South, especially in these times of great national demand for skilled technologists.

The development of new facilities, the Nuclear Science Program in particular, will extend the capabilities of the Institute to assist local industry. Furthermore, the Radioisotopes Building, the Computer Center's new machinery and other expansions expected during the coming year will materially enhance the industrial environment of the State of Georgia.

Georgia Tech's electron microscope has been an important research tool for twelve years.



Georgia Tech's X-ray Diffraction Laboratory offers a number of important research services.

A SPECIAL REPORT

Technical Operations

EACH MEMBER of the Engineering Experiment Station's staff is assigned to one of its technical divisions or branches or to one of the service groups which provide the auxiliary functions necessary to a modern research organization. Projects are assigned to the division or branch in which the major portion of the work will be conducted, while the other units render assistance as required. Under this system, now in its eighth year at Georgia Tech, administration and supervision of each project are centralized, and the facilities and full capabilities of the Station are available for use in the prosecution of all projects.

THE MECHANICAL SCIENCES DIVISION

Although the number of projects in the Mechanical Sciences Division increased only 10 per cent, their total value increased to about $290,000, 60 per cent above the previous year.

The previous year's modernization of Georgia Tech's 24-year-old, nine-foot wind tunnel permitted 12 sponsored projects to be conducted in the tunnel during the year. These projects varied from studies on helicopter fuselages to flutter studies of the C-130 turboprop aircraft.

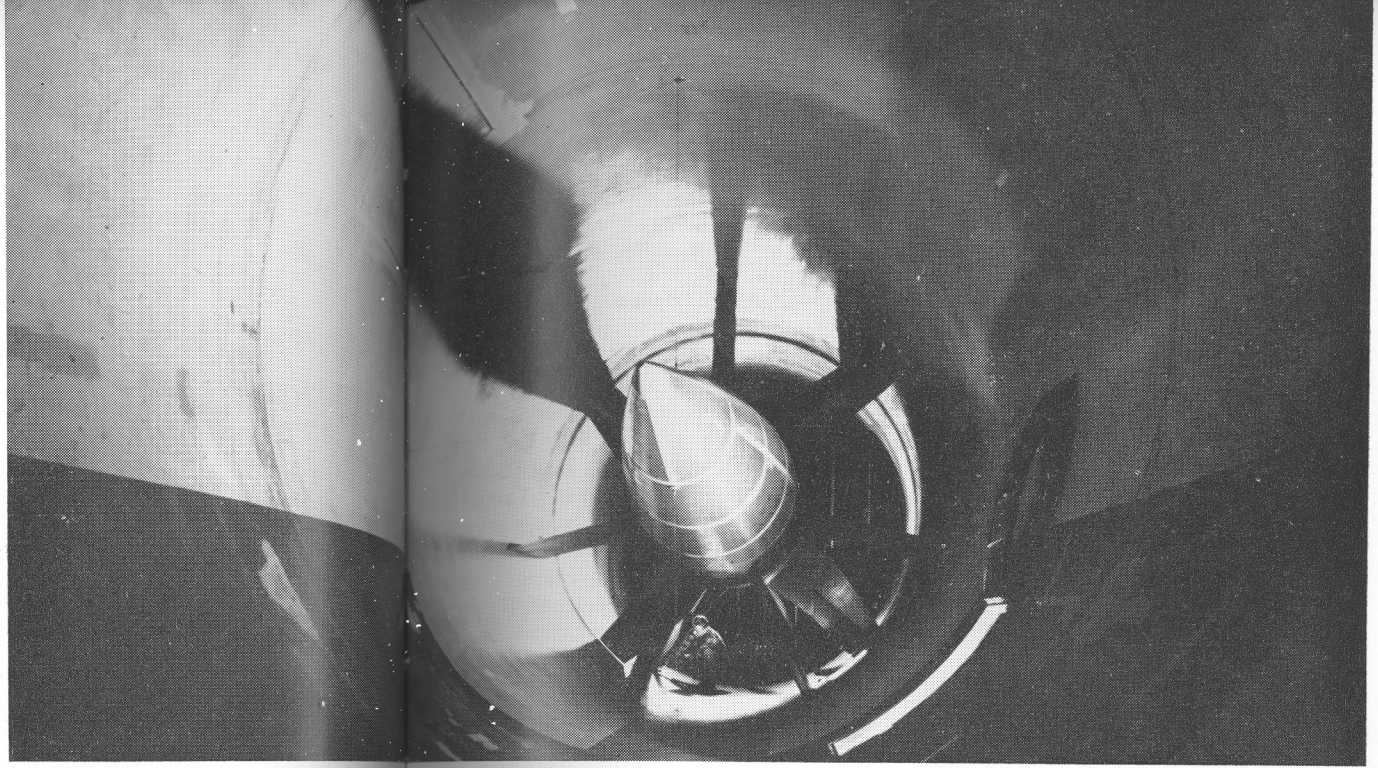
In addition to wind tunnel studies, theoretical and experimental work on flow through helicopter rotors was also conducted using the facilities in the School of Aeronautical Engineering.

One continuing study sponsored by the NACA concerns ground effects on helicopter rotors. This work involves an experimental apparatus in which smoke trailing from the tips of a small rotor blade will be photographed. Another study on the influence of one blade upon another in a helicopter rotor is being sponsored by the Office of Naval Research. Still another project is under way for the Army's Ballistic Missile Agency, Huntsville, Alabama, and concerns pressure responses in the plumbing of missiles.

Since 1951, the Geological Survey of the U. S. Department of Interior has sponsored at Georgia Tech an extensive research program in the field of open channel hydraulics. Research manpower on this project is made up largely of regular employees of the Geological Survey, but Georgia Tech undergraduates and faculty members also work on it.

Research on discharging characteristics of highway embankments, the flow of water over weirs and spillways, the influence of boundary roughness on abrupt enlargements, tranquil flow through openings and other types of hydraulic investigations are being carried out. The laboratory has a large 3½ ft. wide by 90 ft. long, variable-slope flume which is very useful in this work. Also many other pieces of hydraulic equipment are available.

In addition to work in hydraulics, the Civil Engineering School, in conjunction with the Engineering Experiment Station, has three projects with the State Highway Department of Georgia. The purpose of one project is to investigate the stresses produced in layered systems of flexible pavements which are loaded by pneumatic tires operating under various loads. In order to make this study, a large concrete pit has been constructed in which various pavements will be built up. Embedded in pavements will be load cells that can measure the stresses produced by pneumatic tires.



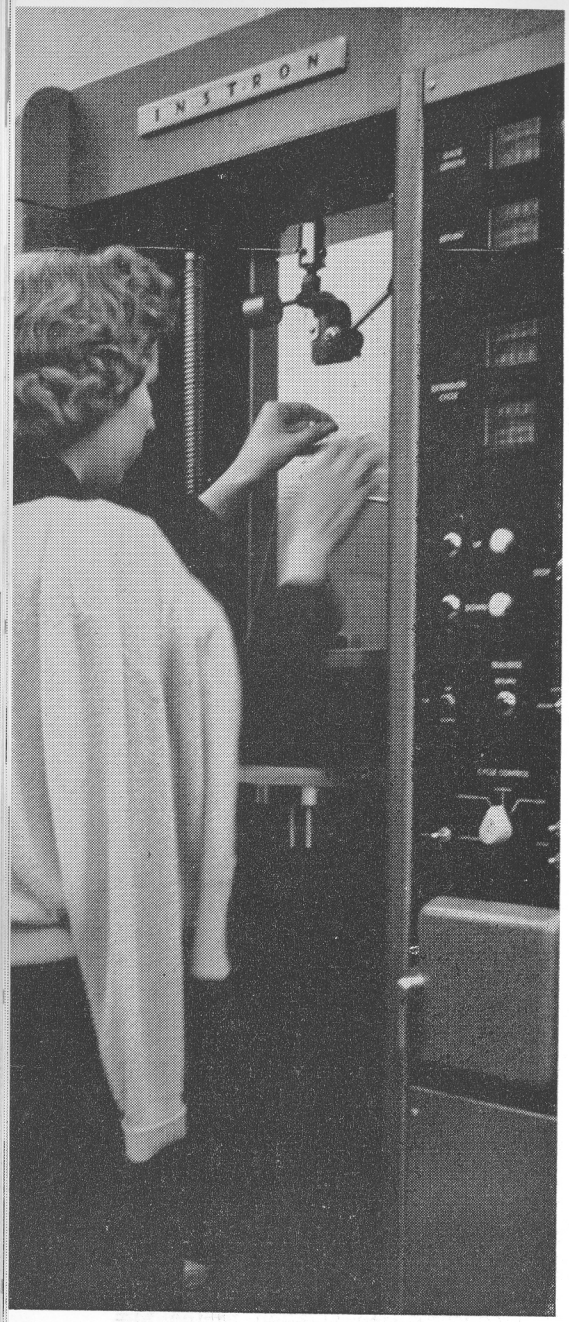
GEORGIA TECH'S RECENTLY MODERNIZED NINE-FOOT WIND TUNNEL.

Another project is an investigation to determine the economy and practicality of using various soils treated with Portland cement or other admixtures for highway construction. This cooperative, basic research program on highway construction should lead to improvement of the highways all through the State of Georgia.

Research in the Mechanical Engineering School has been concerned with the determination of the viscosity of high-pressure and high-temperature steam, the thermal diffusivity of gases, the thermal diffusivity of rocket propellants, and wetting effects on boiling heat transfer. One project entitled "The Viscosity of Steam" was sponsored by the American Society of Mechanical Engineers and resulted in the first Ph.D. thesis earned in the School of Mechanical Engineering at Georgia Tech.

Research toward better fuel systems for automotive engines is continuing. State-supported research at Georgia Tech has resulted in a fuel injection system that is under development for production by Thompson Products of Cleveland, Ohio. It is anticipated that in a few years automobiles may be using this novel and workable fuel injection system.

The centralized research of the Mechanical Sciences Division is carried out largely in the Engineering Experiment Station. The Mechanical Design Section is actively serving as a consulting agency for private individuals as well as industrial concerns. In addition to the Mechanical Design Section's research on small industrial projects, the Division has a large defense project of a classified nature for the Navy Department.



Georgia Tech's Instron testing device used extensively in the textile research program. It measures the strength of yarns of fibers and then automatically plots all the data.

THE CHEMICAL SCIENCES DIVISION

Although this Division transferred over one-third of its staff and about the same proportion of its projects to the newly created Material Sciences Division, the number of projects for the year decreased only slightly to a total of 63, compared with 77 for the previous year. The total amount expended on the projects was about $280,000. Of the 63 active projects, 14 were supported by Station funds made available by the Board of Regents and 49 projects were sponsored by industry, the Federal Government, the State and various counties and cities.

Many fields of research were represented, including adhesives, bacteriology, bioengineering, catalysis, chemistry of photoengraving, clay minerals, concrete products, corrosion, fine particles, industrial wastes, meteorology, naval stores chemistry, organic chemistry, paints, radiation chemistry, surfactants, textile chemistry, textile fibers, and water quality.

A large number of the Chemical Sciences Division's projects were of a basic nature, particularly where the projects could serve the dual purpose of promoting fundamental research by faculty members and training of graduate students. Many of these basic studies were supported by the Federal Government.

Several of the industrial projects were important to the State of Georgia. These were primarily in the areas of: (1) industrial wastes, (2) analysis of polluted streams, (3) naval stores chemistry, and (4) water quality control. Many other studies were supported by industry, helping to make it possible for Georgia Tech to serve as a research center for local and area industry.

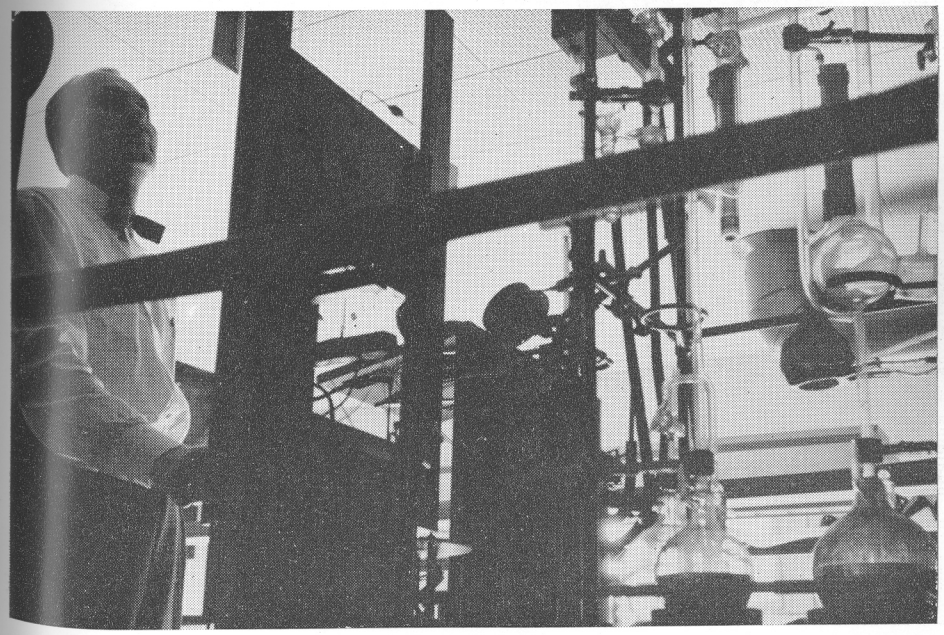
The Division's Industrial Products Branch is staffed and equipped to handle a wide variety of industrial chemical problems, ranging from laboratory-scale investigation to full-scale pilot operation. The Georgia Tech powderless etching method for copper photoengraving plates, developed by this branch, has attracted world-wide attention. This method reduces a half-day's work to one-half hour, a speedup long needed in a time-precious business.

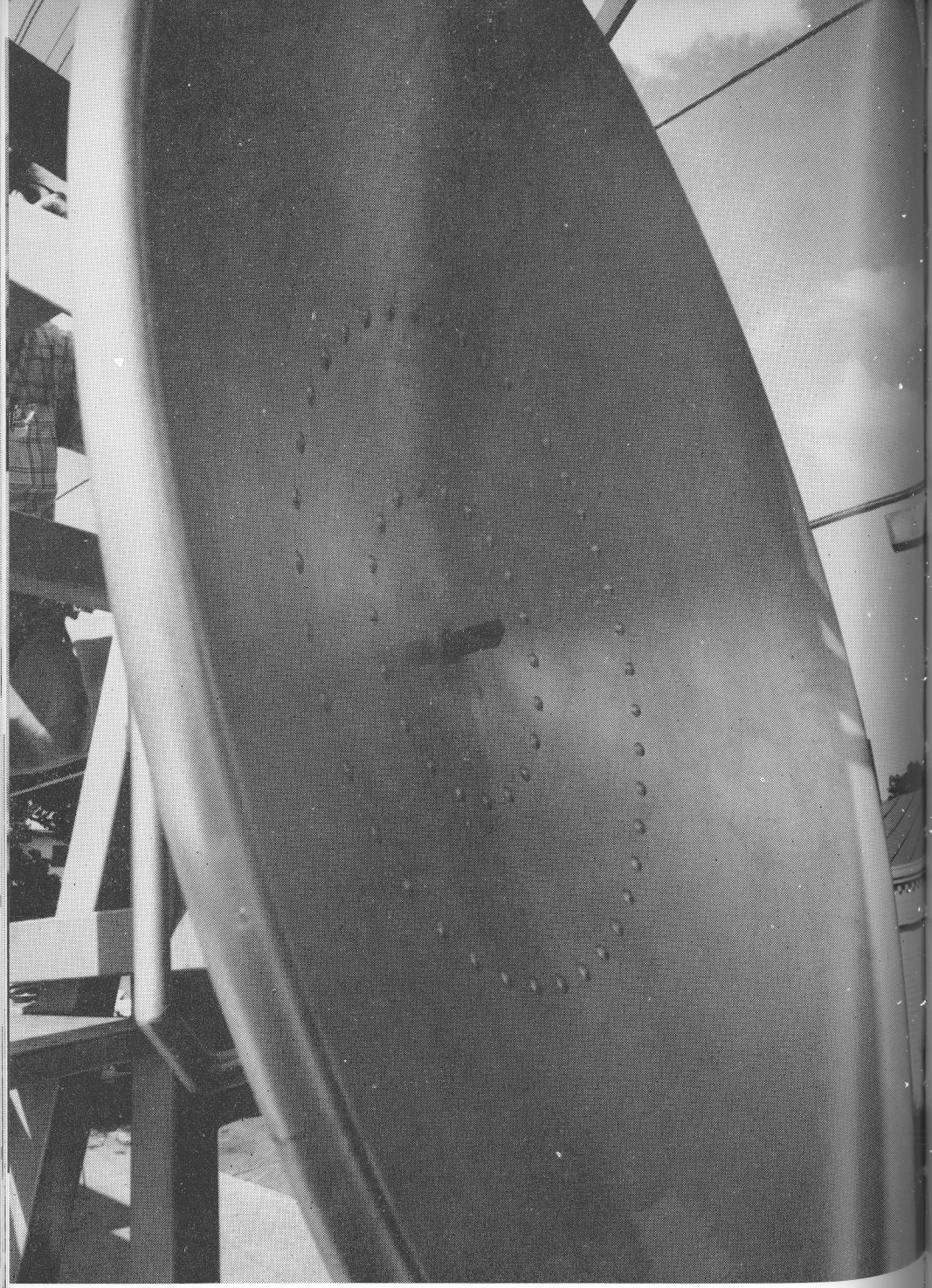
In the field of bioengineering, investigations were carried out under a number of different projects, dealing with factors involved in the survival of airborne bacteria, aerial disinfectants, the effect of radiomimetic chemicals on living cells, the effects of chlorine on bacteria, water quality, and waste disposal. The results of all these investigations are of value to the public health. They contribute to fundamental knowledge of air hygiene, causes and cure of cancer, and water purification and sanitation. These projects received most of their support from the National Institutes of Health.

Major projects accomplished in the Micromeritics Laboratory during the year were in the fields of physical meteorology and physical chemistry. The former involves the solubility of synthetic atmospheric ions, and the latter encompasses investigations of: (1) surface energy, (2) the surface area and pore volume of powders, and (3) the adhesion of powders. Most of the work was basic research, and as such, contributed to the general welfare. Significant contributions were made toward the understanding of weather processes and air pollution control, as well as to the value of Georgia resources, notably clay and farm products.

The radiation chemistry program is a part of the nuclear science program being developed at Georgia Tech. The major activities of the radiation chemistry group were studies of the effects of various types of ionizing radiation (X-rays, gamma rays, etc.) on different kinds of chemical systems, and the use of radiation as a tool in organic synthesis.

THE LOW TEMPERATURE LABORATORY IS A CHEMICAL RESEARCH TOOL.





Georgia Tech's Radar Branch is the largest research group connected with the Station.

THE PHYSICAL SCIENCES DIVISION

The Physical Sciences Division continued its healthy growth in 1957-58. Although a reduction in Government activity affected the Division in the first part of the year, recovery was rapid and new contracts brought the total work to record levels. During the year, the Division performed research on 68 projects with a value of more than $1,100,000.

Another milestone in Georgia Tech's history was reached this year when the AC Network Analyzer completed 10 years of effective operation and service to the power industry. During 1957-58, the Network Analyzer was utilized for 153 days in studies for power companies from the states of Georgia, Alabama, Mississippi, Virginia, North Carolina, Florida, and Louisiana, as well as the territory of Hawaii.

In the problem of personnel turnover, this Division met with some success during 1957-58. The gains more than offset the losses. However, increasingly higher industrial salaries and crowding of the Station's facilities will require even greater efforts next year to maintain a high level of research.

Analysis Branch

The interest of the Analysis Branch has been concentrated in the field of stochastic processes or, more generally, mathematical statistics. On the applied side, the Branch studied stochastic processes identified with communication systems, radar, and liquid pressure fluctuations.

The Branch has developed a specialty in the interference problem, both in radio communications and in radar. Work in this area has been largely theoretical, although some experiments planned by this group and performed by the Navy resulted in some new and significant information on the statistics of the mutual gain of microwave antennas in the near zone.

Communications Branch

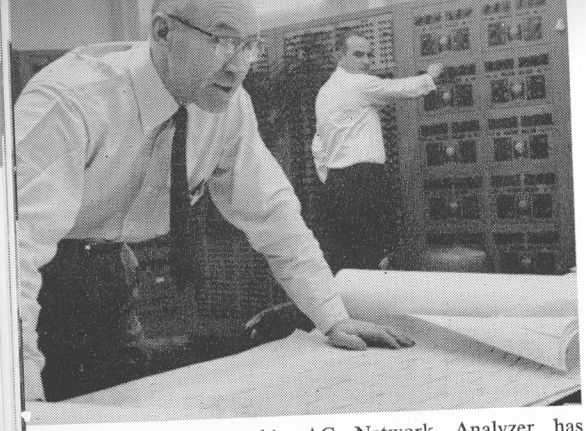
The Communications Branch continued research and development progress in the areas of communications systems, equipment, components, antennas and propagation phenomena. Particular emphasis this year was placed on expanding mutual interference studies of military communications equipment. With the cooperation of the Computer Center, data are being collected and analyzed to determine minimal interference methods for establishing communications systems in field army environments. Accomplishments in this program are already far beyond original expectations.

In the frequency control area, methods were developed for utilizing quartz crystals for direct (overtone) oscillator control at frequencies up to 500 megacycles.

The meteor-scatter communication programs have developed digital computer prediction methods for meteor rate and radiants which are supported by field data, and which contribute significantly to engineering efforts directed toward the utilization of meteor trails for communication systems.

Defense Branch

Research activities of the Defense Branch have been primarily in the field of military countermeasures, with emphasis on evaluation of systems and techniques. During the past year these activities were reduced due to the nation-wide curtailment of defense spending but are now returning to their previous level.



Georgia Tech's AC Network Analyzer has completed ten years of operation and service to power industry of the South and the nation.

The Defense Branch also has responsibility for operation of the Station's Analog Computer Laboratory, which until this year was almost completely concerned with the solution of problems encountered in the countermeasures projects. As a result of the defense cutbacks, the Laboratory was able to devote a substantial amount of time to other research work at the Station. More important, with the establishment of a special budget by the Station, the Laboratory initiated a program of research assistance to faculty and students that has (1) increased the usage of the facility for instructional purposes, (2) provided major assistance in connection with Master's and Doctor's thesis studies, and (3) uncovered a number of significant new areas of application for analog computing equipment. Plans are currently underway to expand the facility and to exploit more fully its potentialities as an analytical tool in both basic and applied research. The Analog Computer Laboratory is now becoming an important and far-reaching facility for research at Georgia Tech.

Physics Branch

All work presently in the Physics Branch can be included under the general heading of "The Structure and Behavior of Solids and Gases." The studies of gases include gaseous electronics and microwave spectroscopy. And the studies of solids include the properties and behavior of thin films of metals and nonmetals; corrosion of solids; magnetic properties including nuclear magnetic resonance; x-ray crystallography, particularly the imperfections, bonding, and thermal motion in crystals.

Though the Branch's accomplishments have not seemed spectacular, some of their consequences may be. Thin metallic film resistors have been made to successfully dissipate high power at elevated temperatures up to 600°C. And films with very low temperature coefficients of resistance over extended temperature ranges have been fabricated. Progress has been made toward solutions of industrial problems, including problems associated with corrosion at elevated temperatures, and improved tones in door chimes. Steady progress has been made in increasing knowledge in gaseous electronics, in the structure of certain organic molecules by way of microwave spectroscopy, and in mechanisms of metallic corrosion.

Radar Branch

Research in radar included studies of microwave propagation and scattering, microwave optics, millimeter wave components and techniques, radar system evaluation and development, and generation and detection of microwaves.

The dollar volume for project expenditures within the Branch exceeded $500,000, with research being performed on seven government projects, one with Emory University and two Station-supported projects. The majority of the research effort was devoted to two Signal Corps projects.

The Radar Branch enjoys a fine reputation among the military services and universities doing research in this field. It is hoped that the Branch will be able to purchase new equipment (much of the present equipment is on loan from the Federal Government) and obtain adequate permanent housing in order to expand Georgia Tech's capability in this field.

THE MATERIAL SCIENCES DIVISION

The newest of the Station's operating divisions was established in January, 1958, to accommodate research and development in material sciences (chemical engineering, ceramics, metallurgy, propellants, mineral resources including water, forest products, and industrial utilization of agricultural products). Accordingly, the activities within the Ceramics Branch, the propellants group, and microscopy of ceramics and minerals were transferred to this division from the Chemical Sciences Division.

Research activities were conducted under twenty projects representing an expenditure of about $265,000. Of the twenty projects, seven were supported by industry, eight by the Government, and five by State funds.

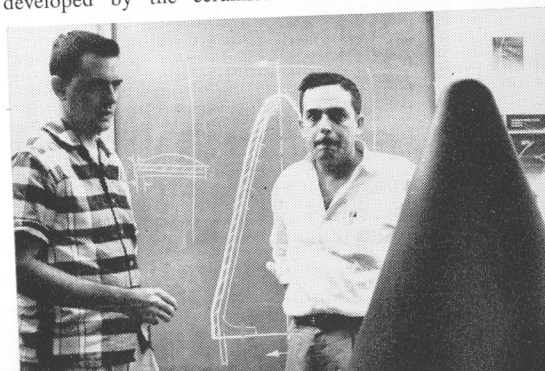
During the past year the work of the Ceramics Branch attracted nation-wide attention. This interest was a result of the Branch's development of a fused silica material with almost zero expansion at temperatures up to about 1800°C. This material appears to have great promise for applications where high resistance to thermal shock is paramount, such as rocket nose cones, rocket nozzles, rocket-sled shoes, radomes, aircraft brakes, molds for metal castings, investment castings, etc. Diesel engine furnace rings made of this material have been under operational tests for over six months and have shown little if any deterioration. This compares to a usual three-month life for the refractory materials now used for these rings.

Industry-sponsored work in the Ceramics Branch included the development of permanent molds for the metal casting industry, the above-mentioned fabrication of articles from fused silica, evaluation of high temperature materials, and basic studies of Georgia kaolins. Government projects—sponsored by the Army, Navy, and Air Force—were concerned with high temperature materials, high temperature wire insulation, ceramic brake friction materials for aircraft, glass coating for steel plate and missile nose cones.

To accommodate the expanding ceramics work, the Station was able to more than double the space allotted to ceramics laboratories. However, the total facilities are already inadequate and additional space, either on or off campus, will be sought for the continued development of ceramics as well as other Division programs.

Activities in the Mineral Development Program were concerned largely with the planning of an active program to start July 1, 1958. Plans in coordination with the Industrial Development Branch were made for field exploration work this summer and for setting up a temporary laboratory in the Geology Department for examination of materials. Three full-time researchers joined the Station starting July 1, 1958, as the nucleus for the Mineral Development Program. The program will expand further as more working and laboratory space is acquired.

Rocket nose cones are among the items which can be manufactured using a new material developed by the ceramics branch at Tech.



THE RICH ELECTRONIC COMPUTER CENTER

By all measures, the past year was by far the most successful one in the short history of the Computer Center. Use of the computers by faculty and students of Georgia Tech as well as for sponsored research increased at a fast pace during 1957-58. For instance, the machine charges for sponsored research were over $7,000 for the month of May, 1958, as compared to less than $3,000 for the same month of 1957. The total number of new sponsored projects during the year was 25, almost double the number of such projects accumulated in the Computer Center since its opening in December of 1955.

The new projects came from a variety of sources. Several engineering and business firms in the area sponsored many of them, as did State and Federal agencies. Georgia Tech's undergraduate and graduate divisions also doubled their use of the Center for laboratory sessions, demonstrations, graduate thesis problems and faculty research. The Computer Center's machines were consistently working overtime by the close of the year.

These projects naturally covered a wide range of scientific and engineering work. Examples of projects carried out for industrial and other commercial firms are: solutions of equations for engineers designing an expressway bridge; computations for an actuarial consulting firm; data-processing studies for Rich's, Inc.; and several problems for the Georgia Power Company.

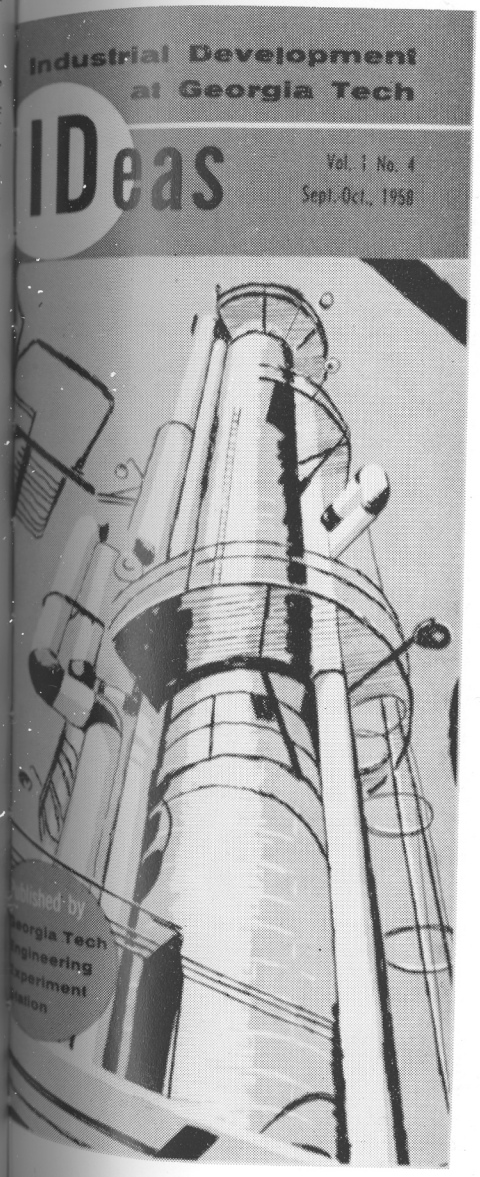
State and Federal agencies sponsored such projects as "Design of Skewed Bridges on Horizontal Circular Curves" for the State Highway Department of Georgia; and stream pollution computations for the Tennessee Valley Authority. Projects sponsored by Station funds involved research problems such as "Meteor Shower Studies and Star Finding," "A Study of Generators of Random Numbers," and "Numerical Solution of a Reactor System."

During the year plans for the addition of important new machinery were essentially completed. In November, 1958, the UNIVAC SCIENTIFIC is scheduled to receive a 4,096-word magnetic core memory, made possible by an appropriation of $39,400 by the Board of Regents. The new memory will greatly extend the machine's capacity for handling complex problems.

The Center will soon expand its capability to solve even larger problems with the installation of a Datatron 220 in late 1958. This machine, made by the Burroughs Corporation, has a 5,000-word core memory. And four additional magnetic tapes, each with a 1,400,000-word capacity, are to be added to the equipment soon after installation.

The addition of the Datatron with its needs for attendant equipment, air-conditioning, personnel and office space will bring many new growth problems for the Center. Only three years old this fall, the Computer Center has already overgrown its present facilities. But the program of modernization and expansion must continue if the Center is to be of maximum service to Georgia Tech and the Southeast.

THE INDUSTRIAL DEVELOPMENT BRANCH



Rapid growth has dominated the Industrial Development Branch's second year. Expenditures on 20 projects during the year totaled $110,000, and the eleven new contracts initiated during that period totaled over $200,000. To handle the growing volume of research, a diversified staff of 20, including chemical and industrial engineers, management and manpower specialists as well as economists and statisticians, had been assembled by the year's end. Six additional research personnel, including two geologists joined the Branch during July and August.

Major projects initiated during the year include an analysis of the industrial potentials of the Valdosta, Brunswick and Columbus areas, a broad-scale evaluation of manufacturing opportunities in Georgia being carried out for the Georgia Department of Commerce with funds allocated by the General Assembly at the request of a Joint House-Senate Industry Committee, an analysis of intercounty commuting of workers in Georgia, preliminary work on the feasibility of locating an "H-Iron" plant and related steel industry facilities in the State, and preliminary work on determination of per capita income by counties.

An analysis of the feasibility of locating a petroleum refinery in the Brunswick area typifies the work completed to date as well as work planned. Technical assistance was provided by industry experts in refining, shipping and petroleum equipment manufacturing, as well as by research associates on the Georgia Tech campus and a private testing firm. Financing was made possible through the joint efforts of the Engineering Experiment Station, City of Brunswick, Glynn County Commissioners and Brunswick Port Authority. A research team composed of economists,

IDeas, a new publication of the Industrial Development Branch, keeps key business and government leaders up-to-date on research activities at Georgia Tech in this important field.

statisticians, and chemical and civil engineers participated in the collection and analysis of data.

Most important of all, focus on such basic or "breeder" industries can make possible the addition of not merely a refinery but many related industries in the petrochemical, chemical and plastics fields. Although a long-range possibility, the vast results to be expected if a refinery is secured would amply justify the time and costs involved.

Workshops like those carried out under a contract with the Georgia Power Company in 13 South Georgia communities are expected to become an increasingly important part of the Branch's program. They combine preliminary evaluation of each city's resources with the laying out of specific steps required to establish a new development program or to strengthen an established one. A working draft of a "Georgia Tech Industrial Manual," published this year, will be expanded for use with other communities interested in participating in future workshops.

There is a great deal of work that needs to be done in the fundamental studies of Georgia's resources. Without additional data and information it will be difficult or impossible to determine the industries and plants best suited for location in Georgia. Urgent needs for the State include a minerals program of broad scope; a forest products research program; studies of the State's potentials for expanding steel and for building other basic industries; evaluation of Georgia's transportation network, including not only highways as they relate to industrial development potential but also to the State's waterways and future port development; manpower research to determine not merely skills presently available but potential skills and the cost of upgrading workers to higher skill levels; a State-wide workshop program; and a greatly expanded program of service to both public and private development groups. This last would include providing market, natural resource, transportation, manpower and other data that Georgia communities and industrial development groups need in their dealings with industrial prospects.

The Industrial Development Branch also is overcrowding its original office area and already has a pressing need for four times as much space. Plans are being made to rent off-campus quarters until campus space becomes available.

THE TECHNICAL INFORMATION SECTION

During the year this section handled 32 separate studies—varying from cursory literature surveys, requiring only a few man-hours of effort, to the final work on the *Bibliography on the Technology of Peanuts,* which required more than a man-year of work. In addition to work on seven different projects assigned specifically to this section, literature surveys were performed for five projects assigned to other divisions.

The Monthly Literature Review, an internal publication, completed its fifth year as a service to the research staff.

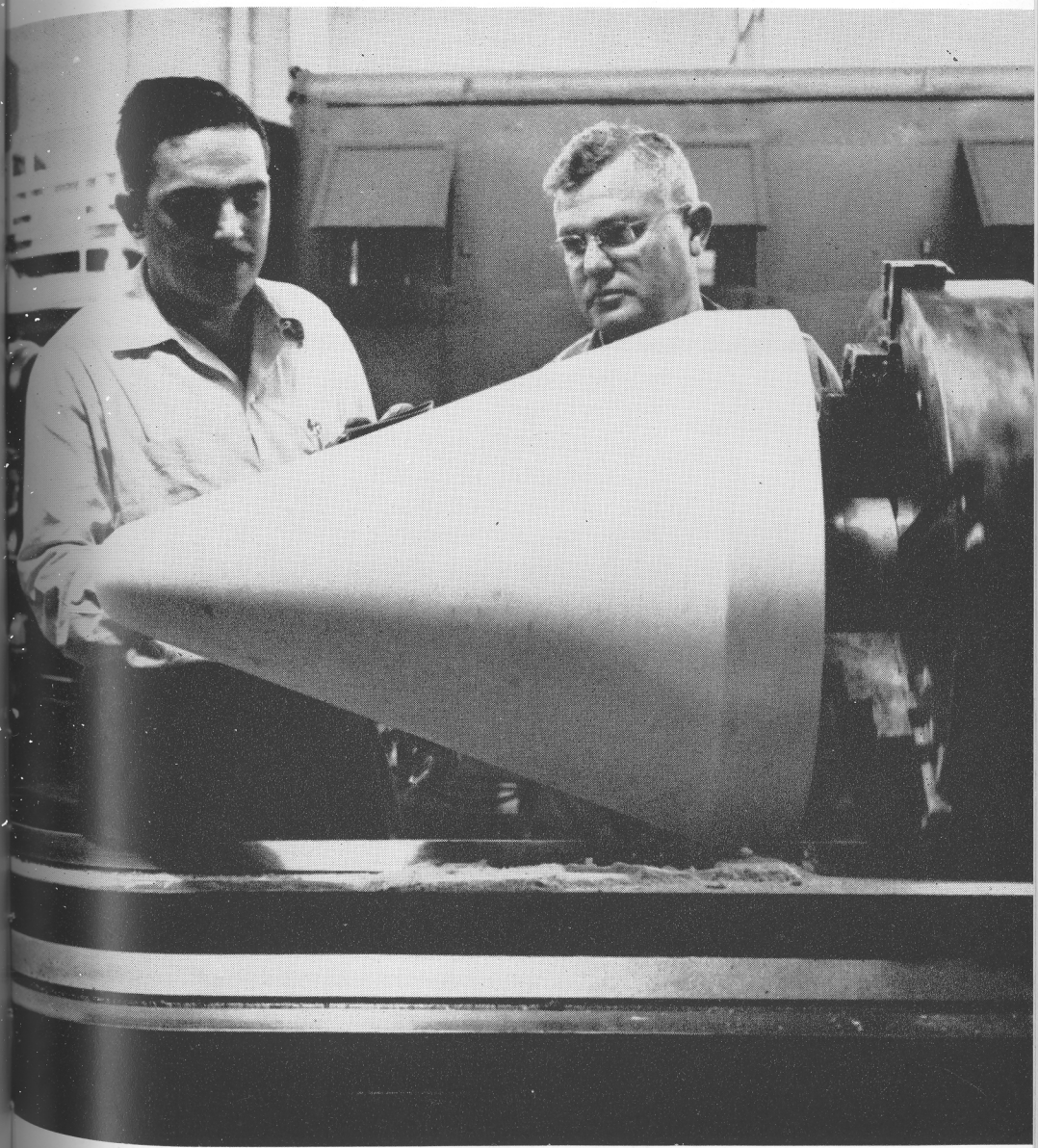
The Special Monthly Literature Review, Analog Computers, initiated by the Technical Information Section, is apparently the most extensive analog computer bibliography being prepared anywhere in this country at the present time. Although it was initiated originally for the purpose of keeping the section's bibliography on analog computers up to date, it now serves many off-campus people as well. Every major manufacturer of analog computers in this country has requested this review, and many foreign organizations have asked to receive it regularly.

The translation pool maintained by this section has become of increasing value to the Tech community. The pool consists of a listing of qualified translators, most of whom are foreign students attending Georgia Tech.

DECEMBER, 1958

The Research Engineer

Published by the Georgia Tech Engineering Experiment Station



Follow-up Ceramics Report