EES

1973 Annual Report

Engineering Experiment Station

Georgia Institute of Technology
Atlanta, Georgia 30332

Front cover: Transmission electron micrograph of a replica of New Zealand Halloysite.

1973 Annual Report
The Engineering Experiment Station

Observations of the Director

A Year of Renewed Growth

The Engineering Experiment Station (EES) is a client-oriented research center, supported primarily by Federal and industrial contracts. The balance of funding comes from a State appropriation to encourage the development of Georgia. EES operates under a legislative charter that includes research and service for the benefit of Georgia's people, its industry and its economic development, and assistance to national programs of science, technology and preparedness.

The Station serves the Nation, the State and the Georgia Institute of Technology through advanced technological research and development programs. It serves the State by bringing in dollars to Georgia directly through contracts, through attracting industry, through developing new industries, and through creating new jobs in existing industries.

In March 1972, organizational changes were made as a step toward making EES one of the nation's leading client-oriented research centers. This year sponsored personal services increased 10 percent over the previous year, a reflection of the beginning of what is intended to be a sustained growth pattern. To further the process, contract development teams were established during January 1973 in the major research units of EES. The first task of these teams is to broaden the potential base of support from agencies that are not current sponsors, but have supported our work in the past, or from agencies that are totally new contacts. The goal is to develop and maintain a growth rate of 15 percent (in sponsored personal services) per year on challenging research and development programs. Comprehensive facility planning is underway to support our program for renewed growth.

The thrust for a stronger contract research program is coupled with a push toward improved payoff to Georgia in the use of State funds. There are good reasons to be proud of the impact of EES on the economic development of Georgia through technology. The Director will continue, with strong support from the Office of Program Development, to press toward greater contributions to the public, industrial, and business needs of Georgia.

One of the nation's leading client-oriented research centers

Dr. W. M. Long
Director
Engineering Experiment Station

Research Volume and Station Staff

Total expenditures included in the EES budget amounted to $6,955,067. The funds are obtained from contracts handled by the Georgia Tech Research Institute, from the State appropriation received through the Board of Regents, and from several smaller sources. The income exclusive of that from the Board of Regents equaled $5,164,891. The allocation from the Board of Regents was $1,823,000; the comparable figure for the previous year was $1,616,194. Sponsored personal services amounted to $2,665,428, up from $2,432,294 for the previous year.

On May 31, 1973, the total number of employees was 505, including 300 full-time and 205 part-time. Of the full-time employees, 178 were on the professional staff and 122 were non-professionals. There were 54 members of the professional staff and 36 graduate research assistants as part-time employees, as well as 83 undergraduate assistants and 32 members of the non-professional staff.

Contributions to Georgia and the Nation

The Engineering Experiment Station is the principal technological resource which is readily accessible to Georgia's business, industry, government, and public and private organizations. It has a significant record of accomplishments. Each year thousands of jobs are created or preserved in Georgia by the research and service activities of EES. By using standard economic measures for the fiscal year ending in June 1972, analyses indicate that the total impact of EES and its spin-offs amounted to $93.2 million. State tax revenues generated by this economic activity were approximately $3.8 million, or more than twice the amount of the State allocation for EES in FY 1972. The economic activity clearly is not a complete measure of the benefits to Georgia. As an example, the benefits of providing jobs to persons who would otherwise be unemployed — and large numbers of jobs are being filled by persons previously considered as unemployables — are immeasurable in terms of savings to the State.

During the year EES continued to pursue a wide range of research projects and service activities which are needed by Georgia. An area that continues to be of particular interest is the generation of employment in rural areas. These programs have tremendous payoff in terms of jobs and cost effectiveness. An example that occurred during the year was a manpower availability project that registered potential employees in the Bainbridge market area. As a direct result of this registration, a manufacturer of woven polypropylene carpet backings and yarns purchased a 67-acre tract in Bainbridge and broke ground for a 500,000-square-foot plant to employ over 500 persons by 1974 and more than 1000 ultimately. At full operation, the plant will increase the manufacturing payroll by approximately $5 million annually — more than 1000 times the cost of the study that was instrumental in establishing the plant's location in Bainbridge.

Research in waste utilization continues to be a promising area. In addition to the activities on carbonaceous chars produced by a waste converter concept, fuel products have been investigated in preparation for applications work. One program in

its infancy is considering the use of wood waste as a fuel for power plants in selected areas of Georgia. Another potential uncovered is that of processing the organic fractions of dredge spoil that is of interest to the U.S. Corps of Engineers.

An investigation is being made on the State's problem of peach tree decline with the U.S. Department of Agriculture's Fruit and Tree Nut Research Station at Byron, Georgia. Color infrared aerial photographs of peach orchards have been produced by NASA and are being studied using a method of image-processing and analysis for early detection of the decline of peach trees.

General knowledge of our success in Georgia on the development of small businesses in rural areas is widespread. EES uses pragmatic approaches developed by the Industrial Development Division in combination with the technological support of the total EES complex. The outlook is improved for support on international programs from the Agency for International Development, Organization of American States, and the Inter-American Development Bank. Such programs, supported from funds coming from outside Georgia, provide greater perspective and opportunities for developing the economy of Georgia.

Personnel of EES, the State Air and Water Quality Control Branch, the State Radiological Health Unit, and the State Scientific Computer Center are developing a remote surveillance system that is to report on air quality over the State.

A program involving the Technology Applications Group, Industrial Development Division, and the Georgia Department of Community Development to convert Georgia kaolin to alumina continues to appear promising.

The Federal Government is our main source of contract support for advanced technological research. This outside funding itself supports a payroll for performing attractive work and improves the image of the State, thereby helping Georgia to attract industries to the State and assisting with the creation of new industries.

The program on solar energy initiated by the High Temperature Materials Division last year has expanded through support from the U.S. Army. The areas of concentration include high temperature evaluation of materials and utilization of solar energy for industrial and home use. The activity has made possible an agreement between EES and the French National Center for Scientific Research for joint programs on use of the huge 1000 kw solar furnace located in the south of France in the Pyrenees Mountains.

A modern optical laboratory for advanced studies has been established in the Special Techniques Division and will significantly extend our capabilities in optical technology.

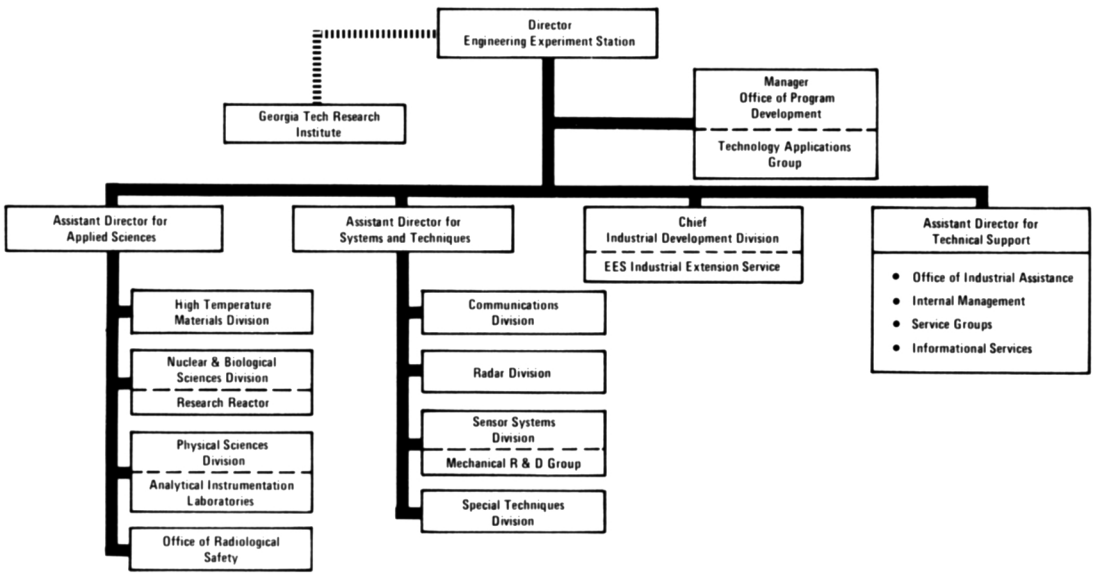
A sponsored thrust was initiated through governmental and industrial support for research with semiconductors and microelectronics. The objectives include improved solid state materials and devices.

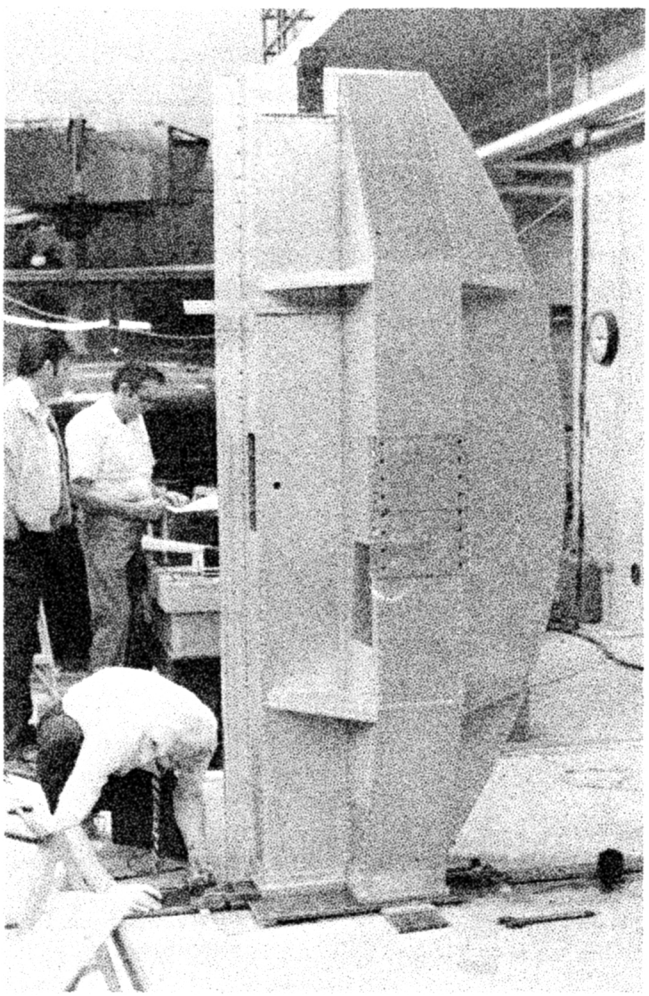
Industrial Research and Extension

EES provides assistance in short-term problem solving to Georgia industry through our seven State-wide offices of the Industrial Extension Service and through the Office of Industrial Assistance at EES in Atlanta. It is estimated that 900 industrial contacts of all types occurred during the year. The types of assistance provided include product and process development, production layout and controls, equipment location, technical information, and assistance on matters relating to environmental quality, health and safety.

EES Area Offices

Organization of the Engineering Experiment Station





Rudolph L. Yobs
Assistant Director for
Technical Support

Serving Georgia and the Nation

Research Operations

Gordon R. Harrison
Assistant Director for
Applied Sciences

Applied Sciences Department

The Applied Sciences Department is completing its first year as a unified operational unit within the Engineering Experiment Station. The Department is composed of the following Divisions: the High Temperature Materials Division, the Nuclear and Biological Sciences Division, the Physical Sciences Division and the Office of Radiological Safety.

The year has been one of holding our position as far as sponsored research is concerned. Prime emphasis has been placed on growth, and less visible progress has been made in the functioning of the staff, improving the organizational structure, identifying some new areas of opportunity and activity, organizing synergistic, unified, cooperative projects and generally learning how to better work together to achieve the desired recognition, and future growth.

Highlights of the year are:

- Much progress has been made in pursuing and conducting cooperative programs (multi-discipline approaches) within the Department, with other units of EES, and the Institute as a whole.
- The formation and implementation of a Program Development Team to provide wider coverage, identification, and pursuits of new contract opportunities. Payoffs from this activity have not yet materialized but much groundwork has been laid for future measurable results.
- The definition of and participation in research programs utilizing solar energy.
- A better defined thrust and participation in programs in the environmental and life sciences area.
- In the latter part of the year, the addition of four new staff members to give emphasis to future activities in semiconductor and microelectronic research and development, particularly to microwave applications. The added capability offers many synergistic growth opportunities for the future.

The Department has continued to improve its awareness of the needs of the State and participation and responsiveness in the servicing of these needs through technology.

Research Activities
High Temperature Materials Division

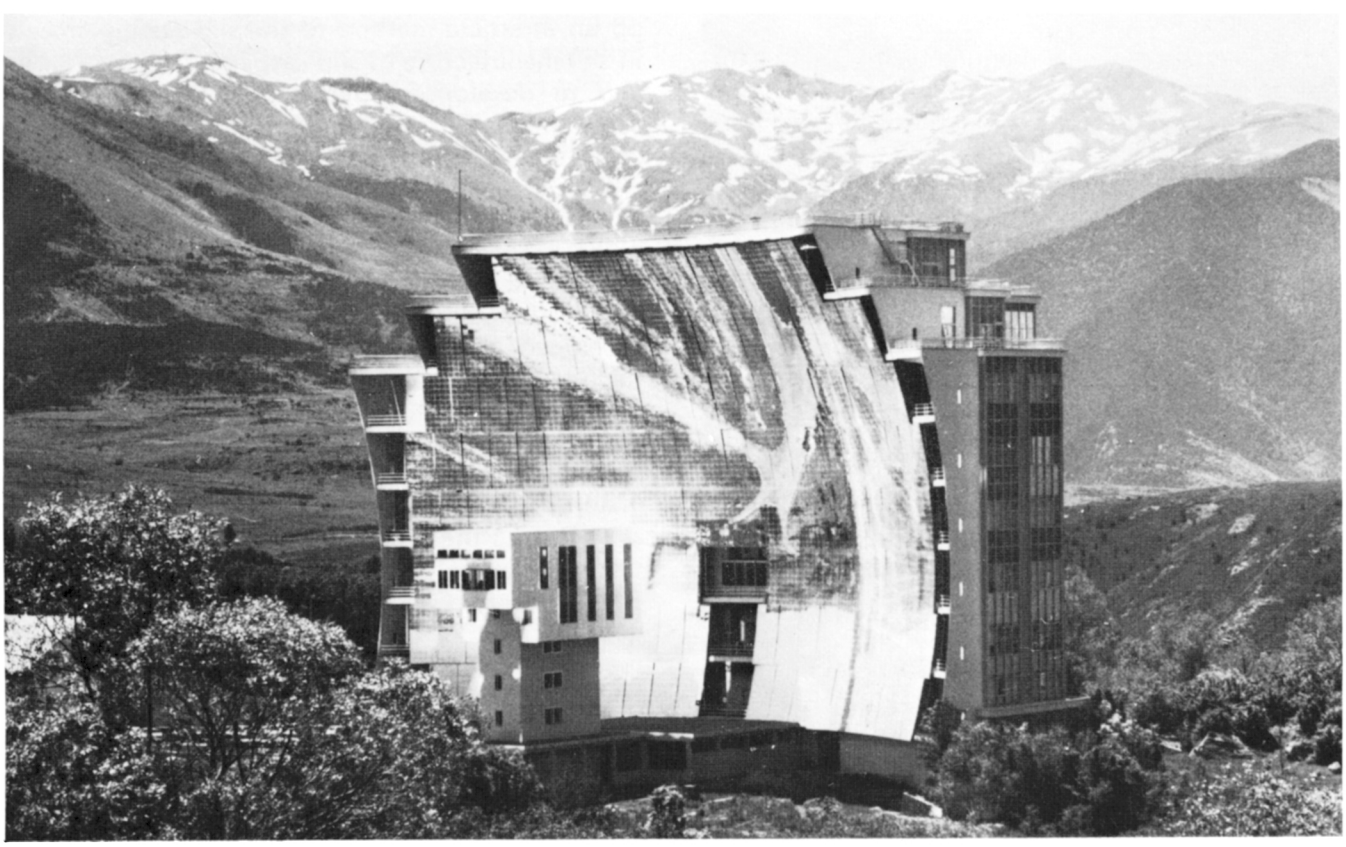
Activities in the field of solar energy were concentrated in two areas: high temperature evaluation of materials, and utilization of solar energy. Research involved with the 1000 kw solar furnace in France continued to grow. The first program to use this furnace was a materials evaluation program with the Army Materials & Mechanics Research Center. This effort provided the first quantitative thermal-dielectric data that had been obtained using a solar furnace. This was also a pioneer effort in developing the equipment and techniques for using the 1000 kw solar furnace to determine the thermal shock behavior of materials in a high energy radiant thermal energy environment. During the course of this program a research services agreement was established between the EES and The Centre National de la Recherche Scientifique (C.N.R.S.) which allows the High Temperature Materials Division to utilize the 1000 kw solar furnace in the development of a broad scope research program in high temperature solar energy.

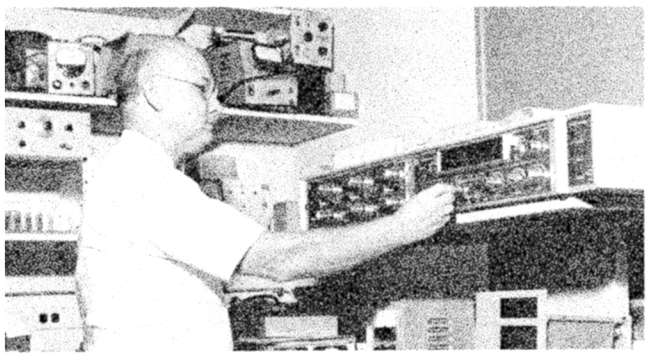
A new program utilizing the solar furnace was initiated with the U.S. Army. The objective of this work is to determine the electromagnetic performance of a ceramic radome while undergoing the heating associated with hypersonic flight.

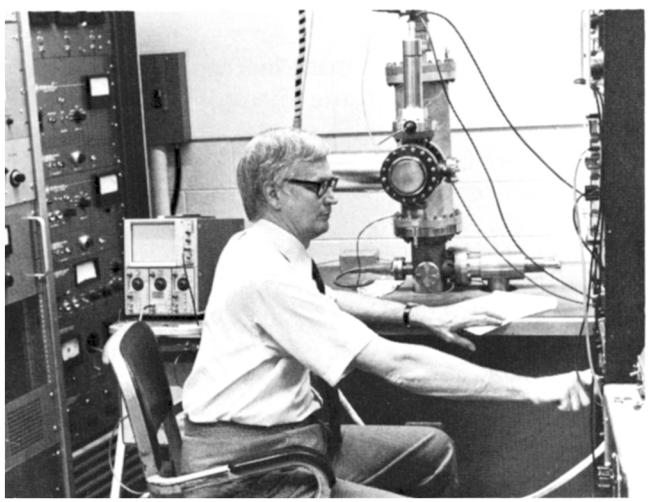
Research activities in the area of biomedical materials were initiated with support through EES and a NIH Institutional Grant. Contacts with medical and dental investigators have revealed a need for the participation of materials people in their activities. One of the objectives, therefore, is to develop experience and competence at EES in the area of biomaterials.

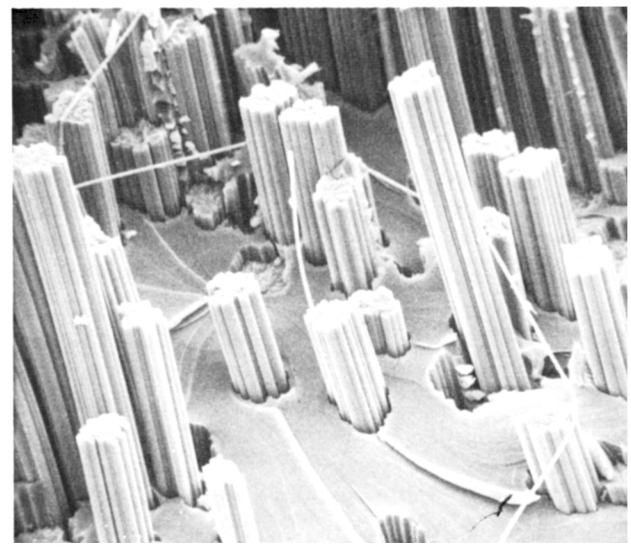
The properties of materials can be varied over considerable ranges if the medical and materials investigators make good use of knowledge in both fields. Materials can be tailored to the medical need rather than selected merely on the basis of availability.

The HTMD is enlarging its capabilities in the field of fire safety. A program, which was successfully concluded this year, was concerned with determining the effect of poke-thru fittings on the fire endurance of a concrete slab floor.









Research on a new manufacturing process for ferrites has continued through the year. In the present program, efforts have been concentrated on producing a gadolinium-yttrium-iron garnet which meets all electromagnetic specifications for a phased array radar system under development by the U.S. Army. These specifications have been met, and at the end of the year, pilot lot quantities are being prepared for demonstration of reproducibility in microwave transmission properties.

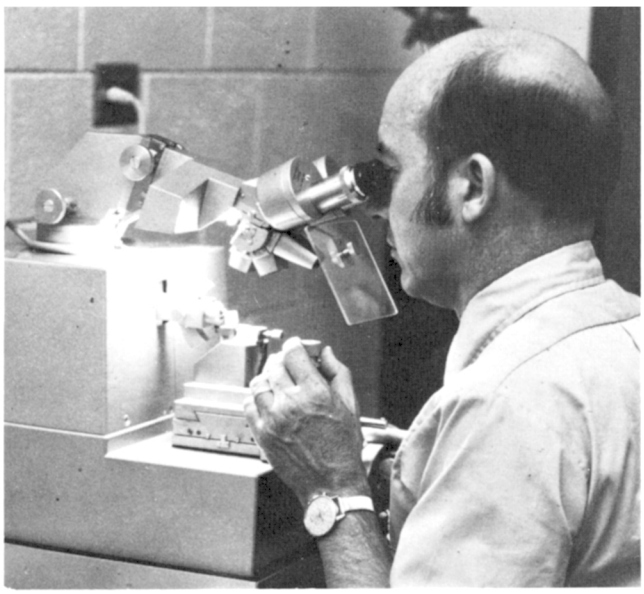
Our work on high temperature dielectric measurements has continued on two contracts this year; this is an area of cooperative effort with the Special Techniques Division. On a program for NASA, candidate radar window materials for use on the Space Shuttle were cycled through ten simulated reentry temperature profiles. Deterioration of dielectric properties with repeated reentry was measured; no catastrophic failure was observed among the candidate window materials. On this program, operating times up to 15 minutes and temperatures up to 3000°F have been the area of interest. Seven candidate radome materials were investigated to measure their high temperature-short time behavior.

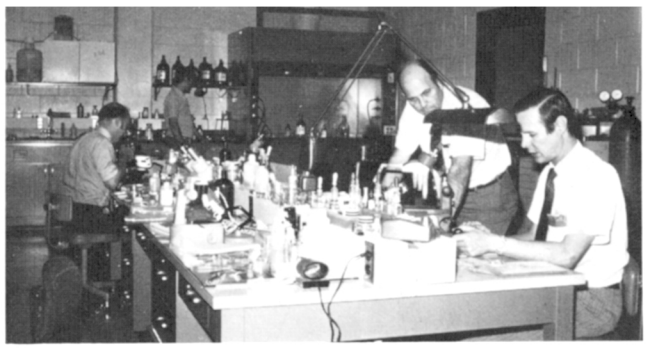
The work in the International field with Selenia Sp.A of Rome, Italy was continued and expanded to study, in more detail, the design of slip-cast fused silica radomes and attachment systems, prior to actual establishment of the capability of manufacturing slip-cast fused silica radomes in Italy.

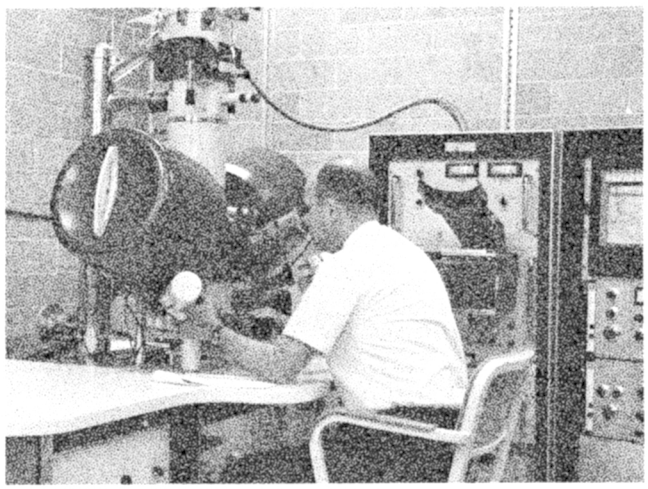
The program with the U.S. Army Missile Command began during the previous year to develop an alternate method to the slip-casting process in the manufacture of slip-cast fused silica radomes and to develop fused silica composites with increased ablation and rain erosion resistance was completed.

A program was initiated with the Department of the Navy, Naval Air Systems Command to investigate reaction sintered silicon nitride as a hypersonic radome material. In this program techniques for slip-casting silicon metal are being developed along with techniques for nitridation. Included in this study are the effects of raw material impurities on the dielectric properties of the reaction sintered nitride, and the economics of machining partially nitrided versus fully nitrided material.

During the year, a program entitled "Development of Ceramic Crafts as an Income Source for Long County, Georgia" was initiated under a subcontract to Coastal Area Planning and Development Commission, Brunswick, Georgia. The work included technical studies on the feasibility of utilizing clays from the alluvial deposits in Long County, particularly in the vicinity of the city of Ludowici, for a ceramics handicraft program for Long County, Georgia.







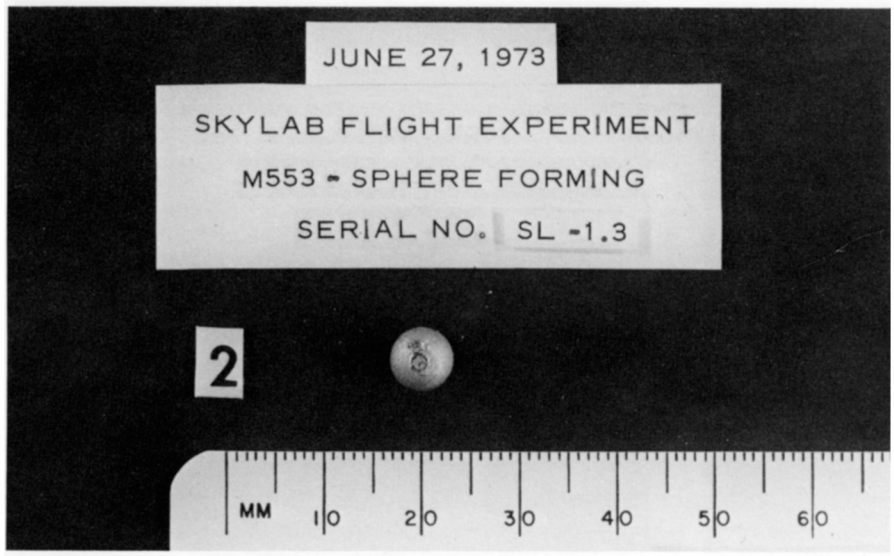
Physical Sciences Division

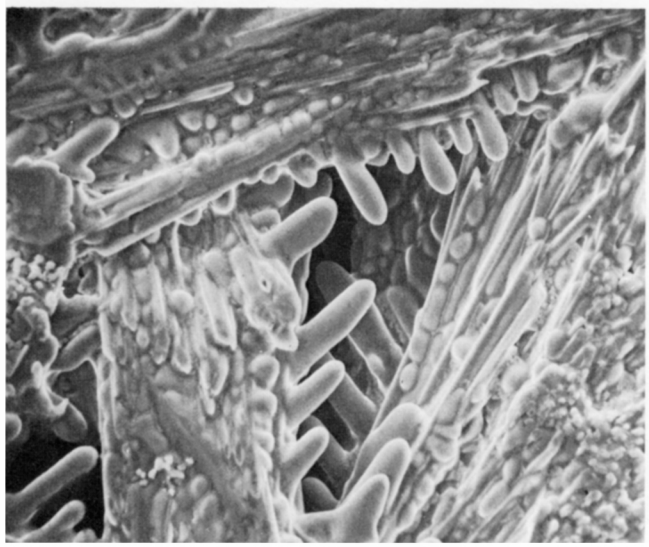
The research in this Division is conducted by six operational units: the Crystal Physics Branch, the Analytical Instrumentation Labs, the Biomedical Instrumentation Group, the Surface Science Group, the Materials Sciences Group, and a new formed Solid State Materials, Devices, and Circuits Group.

The Crystal Physics Branch is conducting investigations primarily on basic research programs dealing with apatites, biological hard tissues such as tooth enamel, and the atomic scale structural aspects of the properties of many compounds and materials. The prime activity of this Branch during the year has been the continued research on "Neutron Diffraction Studies of Tooth Components" under National Institute of Dental Research sponsorship.

In the Analytical Instrumentation Laboratories (AIL) a total of 107 projects were active during the year. This is about the same as fiscal 71-72 but the level of sponsored personal services was higher due to several long term contracts such as the participation in NASA's Skylab program.

Bioengineering and medically oriented research programs are a principal concern of the Physical Sciences Division's Biomedical Instrumentation Group. This group has developed miniature semiconductor transducers and custom-designed electronic instrumentation for use by researchers at Emory University's Woodruff Medical Center and elsewhere in a variety of physiological signal-acquisition and data-processing applications.

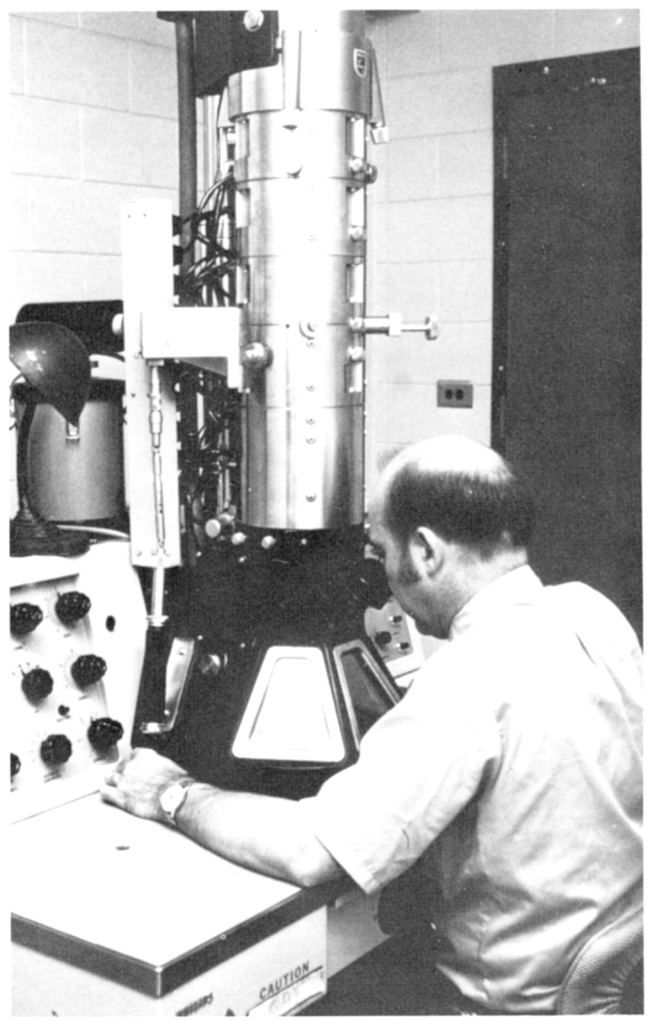




The Applied Sciences Department recently initiated a concerted effort to develop its existing capabilities and interests in the biomaterials area. A major grant application was submitted to the National Institutes of Health on the subject of "Bone-Implant Interface Phenomena," which will involve joint participation by personnel of the Physical Sciences Division and the School of Chemical Engineering (Metallurgy Division) with collaborative assistance from the Director of Research in Orthopedic Surgery at Emory University School of Medicine. A series of related in-house studies is currently underway on such topics as "Bioceramics Technology," "Magnetic and Electric Field Effects on Bone Growth and Implants," and "Analytical Techniques for Biomaterial/Tissue Interactions."

The Surface Science Group has performed research activities mainly related to programs sponsored by the U.S. Electronics Command in the areas of fabricating quartz resonators and evaluating their aging property. The main purpose of this work is to determine mechanisms which create aging of quartz resonators.

The research of the Materials Sciences Group is devoted primarily to the surface and micromechanical properties of materials. The major experimental effort in surface studies during the past year was the development of the capability to do in-depth composition profile analysis. This technique involves noble ion milling and Auger electron analysis and has been applied to a number of interesting systems.



Microstructural parameters which lead to improved mechanical behavior of structural materials are investigated in the Micromechanics Laboratory. Investigations in progress include theoretical calculations of strengthening effects which result from dislocation interactions with surface coatings, environmental effects on mechanical behavior, experimental investigations of high strength multiple layered structures, low and high cycle fatigue studies and multiple layered structures which improve friction and wear behavior. Additional investigations have involved mechanical property studies of fiber materials. This work is involved with tensile and fatigue strengths of individual polymer and graphite fibers. Accelerated wear tests are also conducted on these fibers. These investigations are carried out in the Micromechanics Laboratory which provides the capability for mechanical property measurements on thin samples in environments ranging from corrosive liquids to ultra-high vacuum.

This year's program development activities have centered around integrating the surface analytical capabilities such as Auger electron spectroscopy, electron stimulated desorption, and LEED, along with all of the capabilities of the Analytical Research Laboratory with the unique equipment in the Micromechanics Laboratory. This integration of capability will allow for participation in important research areas ranging from corrosion fatigue studies to the wearing of fibers.

Nuclear and Biological Division

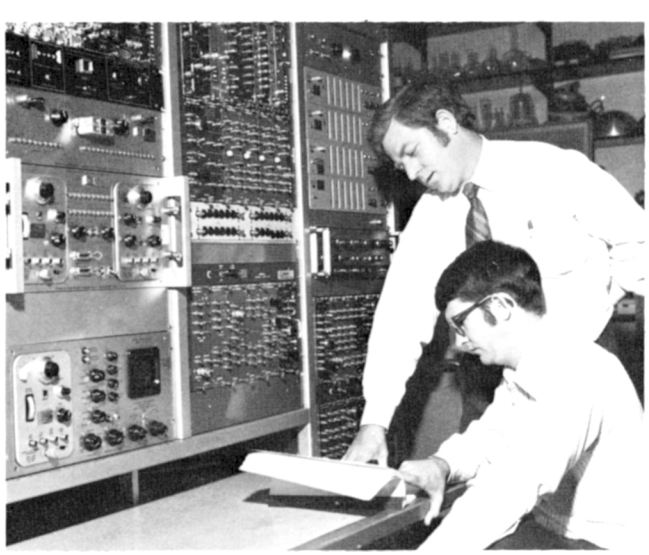
The Division has emphasized research and the development of technology in the life sciences. Ancillary to these interests, it has operated the Georgia Tech Research Reactor to give assistance to the research and educational interests of the students and faculty of the Georgia Institute of Technology.

Many of NBSD's research projects are interdisciplinary. They have been directed to carrying out research and the development of technology to meet the present-day needs of society. These particular activities can be generally described as:

- **Research For Priority Needs in The State of Georgia**
- **Research For State of Georgia Industry**
- **Research For Public Safety Interests In The State of Georgia**
- **Research Sponsored By Federal Agencies**

The Management of The GTRR Facility: Georgia Tech's nuclear reactor, supervised by Division personnel, operated 219 days of the total of 249 calendar days available for operations this period. Operation was primarily on a 2-shift per day schedule; a total of 2,280 MW hours of operation were accumulated. This provided at least 11,754 experiment hours of use for the reactor.

During this year, the Institute received USAEC's permission to plan for the conversion of the GTRR to a 5-MW operational unit.

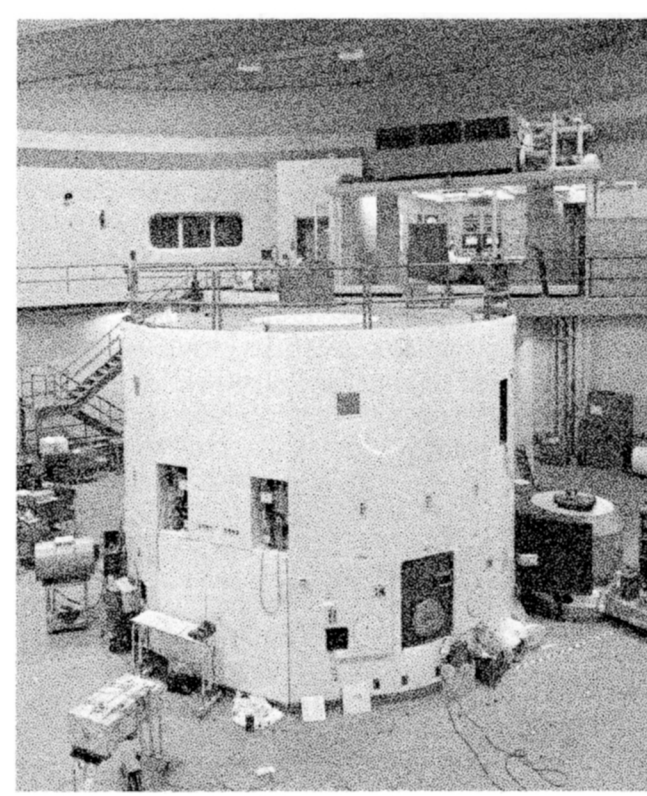


Office of Radiological Safety

The Office of Radiological Safety has continued to administer and conduct a dedicated service oriented health physics and safety program to the entire campus. The year has been without major incidents and the health and safety of personnel were protected and the environment of the campus was not adversely affected by the use of exceptionally high levels of radioactivity.

Other Activities

As in previous years, the Department continues to support opportunities to aid the education and training needs of the academic departments of Georgia Tech. This activity is evident through teaching courses, shared appointments, joint proposals, shared equipment and space, student employment, and serving on thesis committees.



—assistance in short-term problem solving to Georgia industry—

Richard C. Johnson
Assistant Director for
Systems and Techniques

Systems and Techniques Department

The Systems and Techniques Department is engaged primarily in electronics and closely related research, but there is also considerable activity in mechanical research and development. For administrative purposes, the Department is organized into four units: Communications Division, Radar Division, Sensor Systems Division, and Special Techniques Division. The fundamental strength of the Systems and Techniques Department is the ability to conduct high-quality, client-oriented research with a competent and dedicated full-time technical and administrative staff.

Most of the funding for sponsored research projects comes from the Federal Government (primarily DoD and NASA), but considerable support also comes from other sources. Areas of sponsored activities include radar antennas and systems, electromagnetic compatibility, radar reflectivity measurements and analysis, electromagnetic properties of materials, communications/telemetry, radio-location/direction-finding, coherent optics, guidance/control/power distribution, and biomedical electronics. Over 100 sponsored projects were active during the year, but brief mention will be made of only a few:

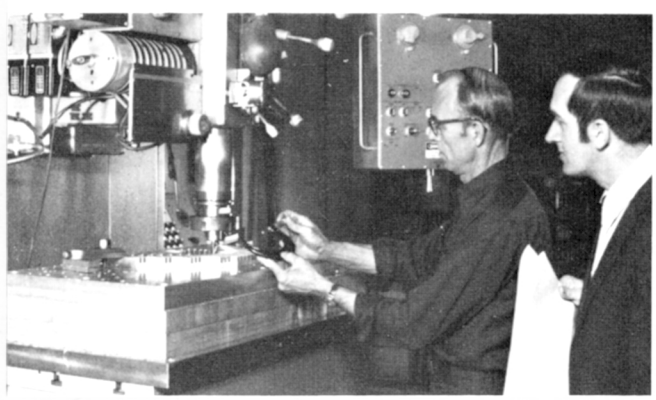
Communications Division

In the Communications Division, efforts to find non-DoD sponsors for whom our experience base would be pertinent have resulted in two major programs. In studies for the Federal Communications Commission, a broad analysis was made of past, present, and projected requirements and methodology for monitoring electromagnetic spectrum users that are subject to FCC control and regulation. This program was completed during the fiscal year and is expected to impact FCC actions over the next several years. A substantial effort now under way for the Federal Aviation Administration is directed toward an extensive survey and review of current practices for installation and operation of electronic facilities with respect to their electromagnetic interference and electrical safety characteristics. The program will lead to the development of new specifications and design guidelines for improved facility control.

Electromagnetic signals, particularly in metropolitan areas, are of major concern to users of cardiac pacemakers. Researchers in the Communications Division are investigating the susceptibility of heart pacemakers to a variety of radiated signals, including automobile ignition sources and typical communications signals.

A Public Safety Communications System is being designed for the City of Savannah. This project is similar to one recently conducted for DeKalb County, and it concerns communications needs of firemen, police, civil defense organizations, and emergency medical services. The results of this project can be useful in assisting other Georgia municipalities with their communication system planning.

The Communications and Special Techniques Divisions are working with the Georgia Forestry Commission on an infrared sensor to detect forest fires. Forest conservation could be improved if such a system can provide early detection and accurate location of potentially destructive forest fires, either as a replacement for or as a supplement to the human observers who man fire towers.



Radar Division

Within the Radar Division, an area of major emphasis has involved the development and automation of near-field measurement techniques for a cluster of related projects involved with the application of electromagnetic near-fields. Far-field antenna patterns have been computed from near-field measurement data and show excellent agreement with conventionally measured far-field patterns. Such patterns have been studied for both in-band and out-of-band frequencies. In addition to the antenna studies, near-zone radar cross-section measurements and predictions are being pursued.

The Radar Division also is assisting the Emory University School of Medicine to investigate the use of microwave radiation to warm cancer tumors in order to enhance the effectiveness of anti-cancer drugs. Also, research on the use of electromagnetic radiation to thaw frozen organs for transplant use is being conducted jointly with the Medical College of Georgia. If satisfactory freezing and thawing techniques can be developed for human organs, improved organ banks for transplants could become a reality.

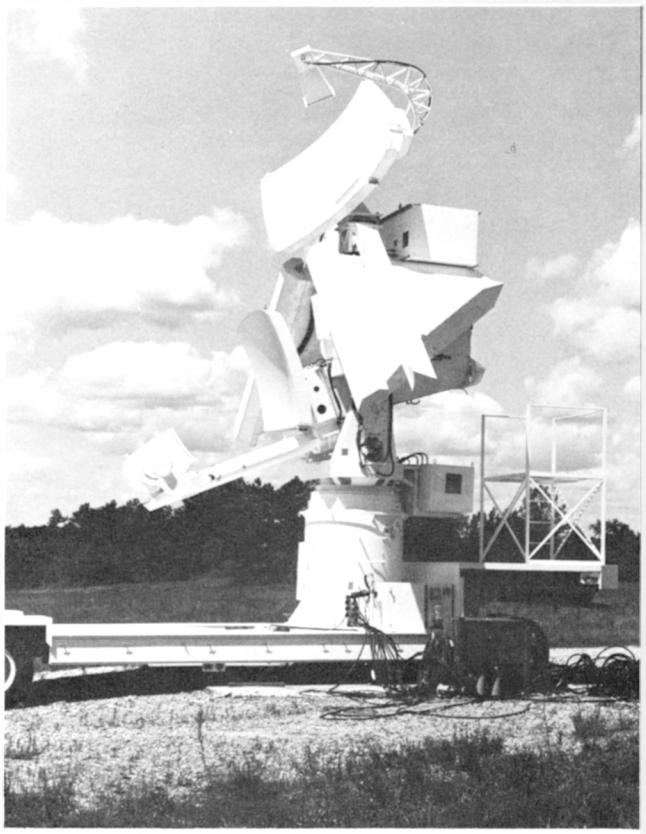
Some preliminary studies of the use of electromagnetic radiation to kill insects and weed seeds have been performed in the Radar Division. Pilot experiments show that insect larvae and pupae as well as weed seeds can be killed as much as 6 to 10 inches beneath the ground. The important question of economic feasibility of the technique is now being investigated, along with continued study of technical aspects.

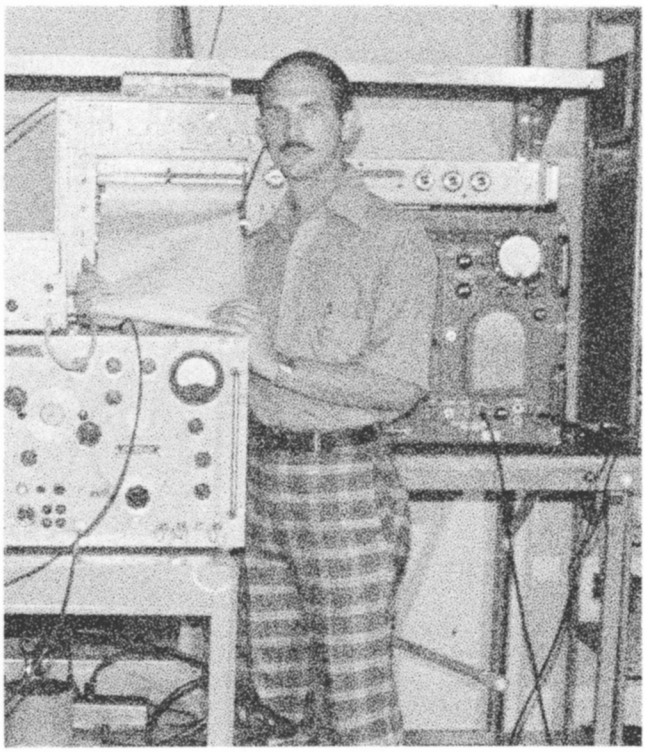
Other work in the biomedical area has been directed toward determining the effects of electric currents on fish. Results of the research showed that selective electrofishing was possible according to the size of the fish, and that the use of optimized-pulse electric currents could greatly reduce the size and increase the efficiency of man-carried electrofishing equipment. These features are important to State and Federal authorities involved with fish population sampling.

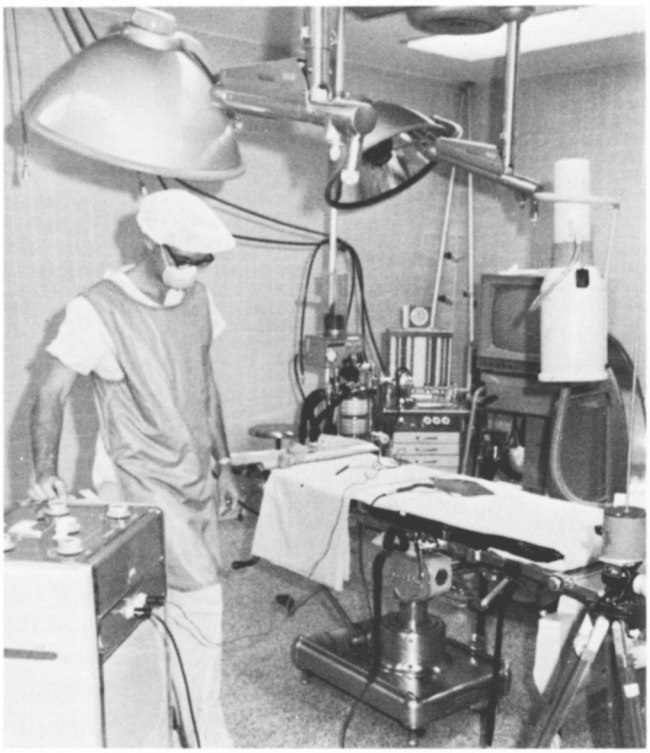
Sensor Systems Division

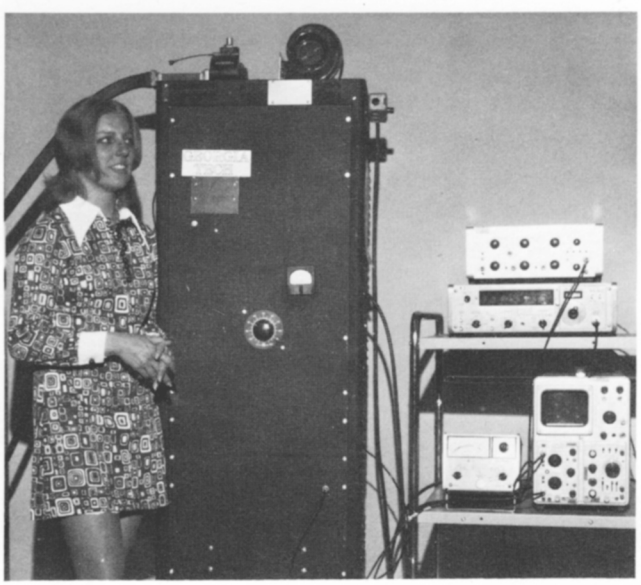
Important research areas in the Sensor Systems Division continue to be analysis and design of sophisticated radar antennas, prediction and measurement of backscatter from radar targets on the sea, and studies of radar sea clutter. The Mechanical Research and Development Group of this Division has a good backlog of work in support of several electronics research programs, and the group is attempting to establish a large support base of mechanically-oriented programs.

The Sensor Systems Division has been working with several Georgia industries. A company that manufactures cubed ice is being assisted in the design of a new type of automatic ice-making machine that could be used either in a manufacturing plant or as a component of an automatic ice vending machine. Another company is being aided in the solving of several mechanical problems related to the manufacture of prefabricated housing modules constructed of urethane foam. The Division also has been working under a continuing program with a wood preserving company to improve both the quality of their product and the efficiency of the wood treatment operation.









Special Techniques Division

The Special Techniques Division , in cooperation with Federal and State agencies, is conducting a program concerned with the State's problem of peach tree decline. This mysterious phenomenon caused the loss of approximately 200,000 Georgia trees in 1972. Color infrared photographs produced by NASA overflights of peach orchards are being used for study after electronic enhancement of imagery. This work may lead to development of a diagnostic technique to identify early decline of peach trees and eventually could lead to a method for preventing this economic loss in the state.

A modern optical laboratory for advanced studies is being established in the Special Techniques Division. This laboratory will significantly extend our capabilities in optical technology and should enable EES to acquire financial support via Federal contracts and provide for the development of new applications of optical technology.

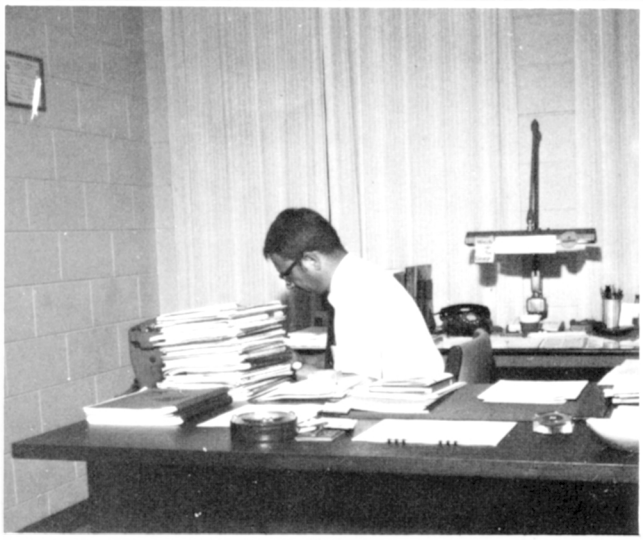
The Systems and Techniques Department has maintained strong and growing research programs, and prospects for continued growth of sponsored research are good. The experience gained in such sponsored activities enhances the ability of EES to contribute to the technical needs of Georgia industry, business, and government.

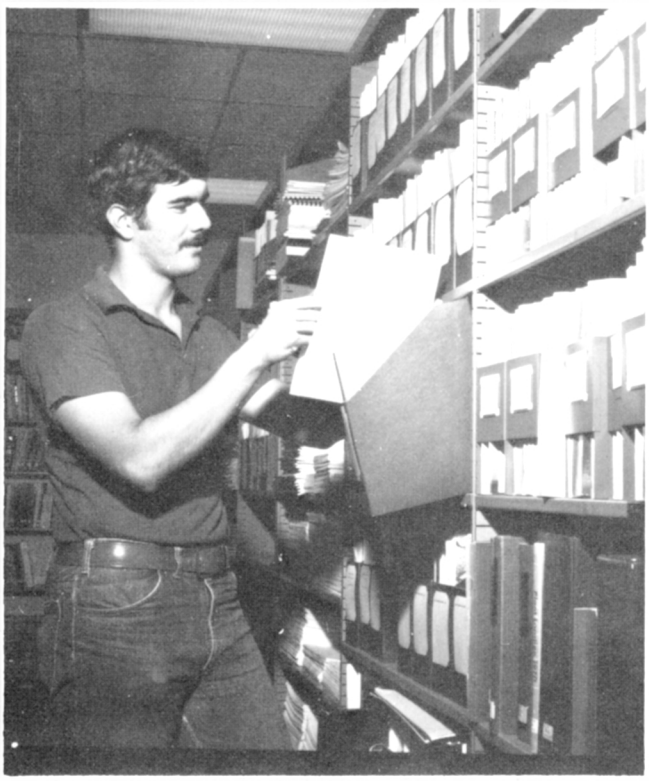
Industrial Development Division

The changing nature of the Industrial Development Division's scope of activities and sources of support is reflected in the fact that three of the Division's major projects during FY 1973 were directed by members of the administrative and Basic Data staffs — units ordinarily involved almost totally in internal service activities. Most far-reaching of these somewhat unusual projects was a five-year program — with a grant from the U.S. Department of State's Agency for International Development to strengthen and broaden Georgia Tech's existing capabilities in employment generation and small-scale industry development. A two-year study, funded by the Southeastern Library Association, was awarded to IDD just prior to the start of the fiscal year on the basis of the professional reputation of the Head of the Basic Data Branch. Completed during 1973 was a detailed study of research priorities in Georgia for the Governor's Science Advisory Council, under a grant from the National Science Foundation.

Cooperative development activities with counterpart institutions in many parts of the world will result from the AID institutional grant program, and Institute-wide participation in the program will lead to closer working relationships between IDD and other units of Georgia Tech, principally the College of Industrial Management, the School of Industrial and Systems Engineering, and Southern Technical Institute. The end product of the regional library study will be a hardback book covering the collection, analysis, and interpretation of data describing and providing measures of library resources and services in the Southeast. Work with the Governor's Science Advisor on the NSF-supported research priorities study hopefully will lead to future input into the development of mechanisms and institutional arrangements for bringing research in Georgia to bear on critical state and local problems.

Ross W. Hammond
Chief, Industrial Development Division





Research in the other Branches of the Industrial Development Division continued in a more traditional vein during FY 1973. The Special Projects Branch conducted sponsored projects in a number of special fields in addition to the continued operation of the Manpower Resources Information Center: an unemployment registration and employment generation program in southwest Georgia, a study of the effectiveness of vocational-technical schools in Georgia, a program designed to increase housing starts for low-income families in the coastal plain of Georgia, a series of workshops throughout the state to assist community leaders in evaluating manpower resources information, a review of vocational-technical training programs in eight southeastern states, preliminary work on a development plan for the Economic Development Administration's eight-state southeastern region, and a manpower registration in Bainbridge for an industrial prospect. Although smallest in terms of time and dollars expended, the latter project had the most immediate and dramatic results. As a direct result, a manufacturer of woven polypropylene carpet backings and fibrillated polypropylene yarns purchased a 67-acre tract in Bainbridge and broke ground for a 500,000-square-foot plant to employ over 500 by 1974 and more than 1,000 eventually. At full operation, the plant will increase the manufacturing payroll in the area approximately $5 million annually — more than 1,000 times the cost of the IDD study that was instrumental in the plant's location in Bainbridge.

After eight years of providing management and technical assistance to business and industrial firms in economically depressed areas of Georgia under an annually renewed grant from the Economic Development Administration, the Industrial Services Branch completed in FY 1973 what apparently will be the last full year of operation of this highly successful industrial extension service program. With the scheduled demise of EDA, the Branch is looking to other sources of support for its nationally acclaimed program of management and technical assistance. During FY 1973, in addition to the EDA program, services were provided to industry under a demonstration project for the Small Business Administration utilizing student assistance, minority businesses were aided under a subcontract arrangement with an Office of Minority Business Enterprise grantee, and the basic program of management and technical assistance supported by limited Institute funds was continued for the thirteenth year. Work was continued on implementing the findings of the alumina-from-kaolin potentials in Georgia in cooperation with EES's Technology Applications Group and the Georgia Department of Community Development.

Two major new projects completed by the Community Development Branch during FY 1973 reflected the current emphasis on environmental considerations in the industrial development process. One involved the projection of industrial growth in Georgia with special reference to water-using industries for the Georgia Department of Natural Resources. The other related study, sponsored by the Department of Interior's Office of Water Resources Research through Georgia Tech's Environmental Resources Center, examined the environmental movement in relation to Georgia water-using industries.

—toward greater contributions to the public, industrial and business needs of Georgia

Personnel of the Area Development Branch and the area offices comprising the EES Industrial Extension Service concentrated during the year in doing the thing that they do best – providing technical services to business and industrial firms and local and area development groups in their geographical areas of responsibility. Sponsored programs of industrial development research and technical assistance were provided for seven area planning and development commissions, one area electric membership corporation, seven municipal governments, one local chamber of commerce, three county governments, and three county industrial development authorities. Other sponsored work included the completion of projects for two private companies and an update of a wage survey for the Savannah Port Authority. In addition, area office field personnel traveled the Southeast to interview manufacturers in connection with a sponsored minerals study directed by EES's Technology Applications Group.

Involvement of the International Development Branch near the end of the fiscal year in the five-year program of employment generation in less-developed countries marked a broadening of the scope of the Branch's activities, which in the past have concentrated almost exclusively in Latin America.

Program Development and Technology Applications

The Office of Program Development continued to press in the direction of increasing Station effort on projects of importance to the State of Georgia, and compared to prior years, a greater portion of the internally funded research effort was applied to that purpose. The administration of these efforts was conducted as part of an evolutionary transition from decentralized discretionary control toward a centralized guidance of internally sponsored research in keeping with the role of EES as determined by its Director.

The Technology Applications Group consists of the Waste Utilization Laboratory (WUL), the Minerals Beneficiation Laboratory, the Industrial Chemistry Laboratory, the Micromeritics Laboratory, and activities in both fertilizer technology and minerals economics. The WUL was the largest activity with the greatest growth and with exceptional promise for rapid future expansion.

In keeping with its charge to assess the technological needs of the State, the Office of Program Development initiated three assessment projects. The first one was a pilot project aimed at developing useful methods and procedures for evaluating the technological needs of Georgia industries. A second project was established to assess the needs of the poultry segment of the food processing industry utilizing some of the results of the first study. Several areas where EES could provide assistance were identified. As a result of this investigation the Georgia Department of Agriculture contracted with EES to provide technological assistance in poultry processing plant automation beginning in FY 1974. The third project is aimed at the public sector. Its purpose is to identify the technological needs of various levels of government within the State. This project is continuing and the results obtained will be used in preparing a proposal to the National Science Foundation R & D Incentives Program.

A portion of the General Research funds available to EES were put into a program of research directed to the needs of Georgia which was administered by the Office of Program Development. Most of the projects funded through this program have multi-year continuity and are concentrated in two general categories – Technology for Industry and Protection and Utilization of Natural Resources – and are being performed by groups and individuals spread throughout the EES administrative organization.

Projects in the Technology for Industry category include several related to Georgia agri-business. One area of work is an investigation of new concepts for nut shelling, primarily pecans, without damaging the meat. A project to examine the energy needs of Georgia industries is underway; in the agri-business sector it has revealed that the processes for drying agricultural products are inefficient users of energy. The use of electronic image enhancement in studying peach blight is one aspect of a remote sensing project. Aircraft overflight color infrared imagery of peach orchards is electronically processed and used to differentiate between healthy peach trees and those in decline. The initial results of this study show that some of the trees that appear healthy when viewed on the ground exhibit characteristics in the enhanced imagery similar to diseased trees.

Other projects in the Technology for Industry category include inventorying of the problems and needs of minority business enterprises in Georgia. The output of this project will be the data base EES needs to provide meaningful technical and management assistance to Georgia minority businesses. Another project, closely related to the assessment studies previously mentioned, is an enhancement of industry/EES interaction. The purpose of this project is to develop effective ways and means of communicating information on the services available in EES to people in industry.

One of the larger efforts in the Protection and Utilization of Natural Resources category is a solar energy study. This work is concerned with the identification of industries or industrial processes where solar energy may be a practical source for all or part of the required energy. An in-depth analysis of the feasibility of a proposed new process to recover alumina from kaolin was the subject of another project. The remote sensing project using satellite and aircraft overflight data has generated interest by the Georgia Department of Natural Resources for land management and related application in addition to the agriculture uses described earlier.

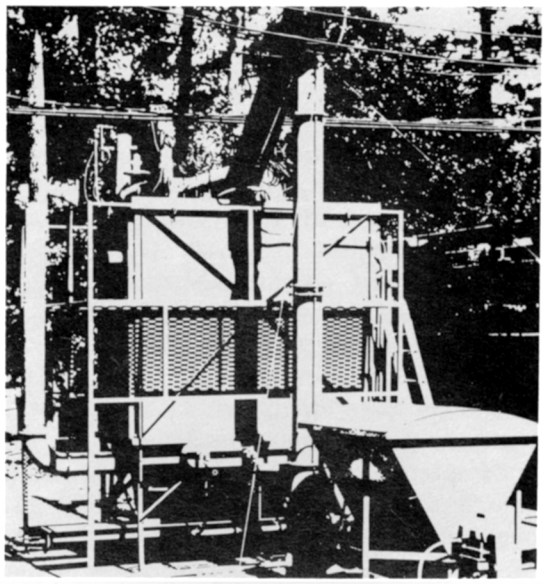
Several projects were funded in the Biomedical Engineering category. These projects are related to development of new bio-materials such as dental implants and implant alloys, and the development of techniques for studying biomaterials. A project to gather base-line data in the application of neutron activation analysis for the identification and matching of glass chips, paint, and soil samples was funded under the public safety category.

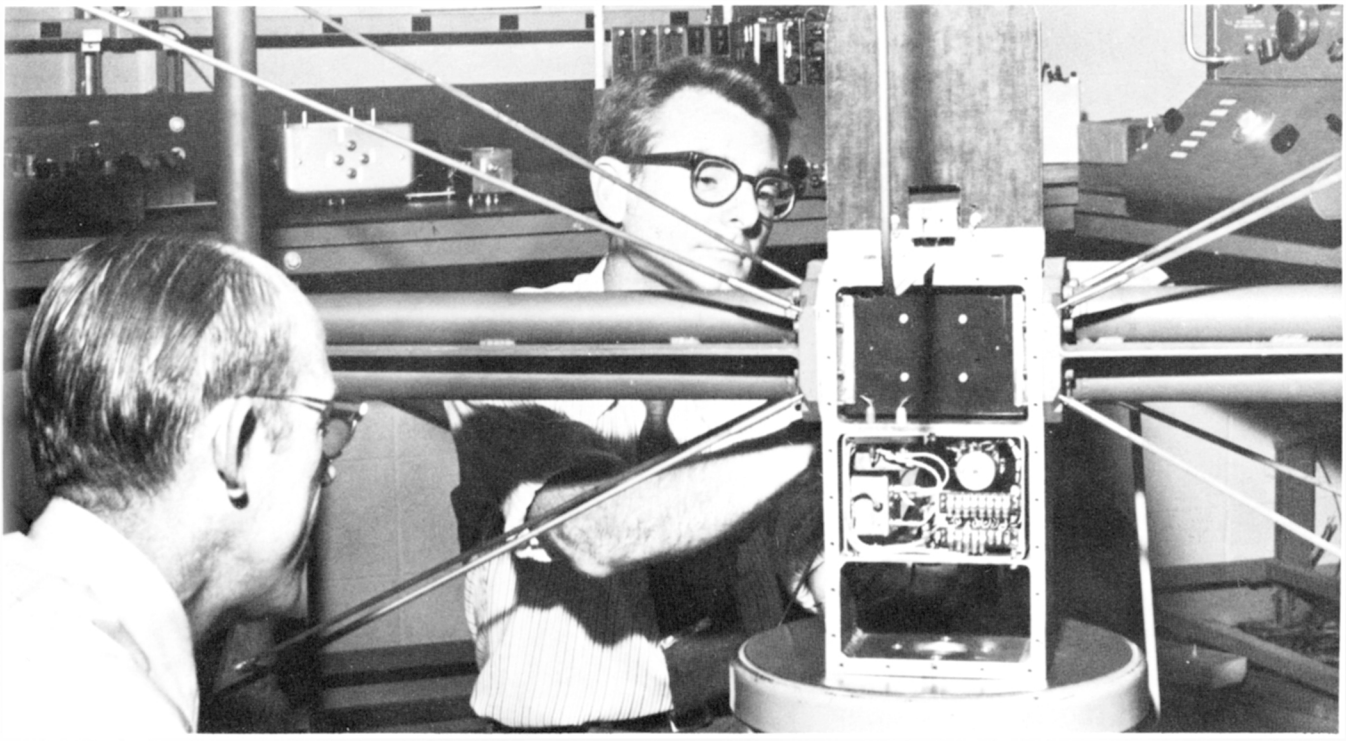
Howard G. Dean, Jr.
Manager, Office of Program Development

A major portion of the Technology Applications Group activity occurred in the Waste Utilization Laboratory (WUL), which continued its initial phase of development. Efforts were focused on performing and increasing the level of sponsored project work, on extending the scope of competence, and on increasing the potential for license income through internally sponsored laboratory and pilot scale development work related to the waste converter and associated processes. In addition to the carbonaceous chars produced by the waste converter, important heat and fuel products were investigated in preparation for applications work.

The work of the Minerals Beneficiation Laboratory was oriented to complement the Waste Utilization Laboratory efforts. In particular, the prior work with waterways sediments led to opportunities to investigate the application of pyrolysis techniques to dispose of the organic fraction of dredge spoils. Another area of investigation was initiated for the processing of high ash content coals for conversion to steel mill grade coke.

The Industrial Chemistry Laboratory completed the development of a process to convert peanut presscake into aflatoxin-free protein for the Georgia Peanut Commodity Commission; a study of the economics of the process showed that it could be set up and operated with an excellent return on investment.





Georgia Tech Research Institute

The majority of research performed at the Engineering Experiment Station is supported by contracts with governmental organizations and private industry. Contracts are based on prior negotiation and formal proposals and are normally established on a cost-reimbursement basis.

The Georgia Tech Research Institute serves as the contract agency for the EES and it handles patent matters in connection with research and development activities. The Research Institute is a nonprofit organization incorporated under the laws of the State of Georgia. The Board of Trustees is composed of four members of the Georgia Tech faculty, four from Georgia Tech alumni, and four from industry at large.

On June 30, the officers and Board members of the Research Institute were: Richard K. Whitehead, Sr., Chairman of the Board; Fuller E. Callaway, Jr., Vice Chairman; Robert H. Ferst, President; Maurice W. Long, Director of Research, Secretary and Assistant Treasurer; Walter L. Bloom, Treasurer; Milton W. Bennett, General Manager, Assistant Treasurer and Assistant Secretary; and Rudolph L. Yobs, Assistant Secretary. The total membership of the Board of Trustees was James E. Boyd, Harllee Branch, Jr., Fuller E. Callaway, Jr., Robert H. Ferst, Vernon Crawford, Charles L. Davidson, Jr., Maurice W. Long, Joseph M. Pettit, Glen P. Robinson, Jr., Thomas E. Stelson, William B. Turner and Richard K. Whitehead, Sr.

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