# EES Report

ENGINEERING EXPERIMENT STATION • GEORGIA TECH

*Serving Georgia and the Nation*

## Drs. Johnson and Harrison Elected Fellows

Dr. Richard C. Johnson, Assistant Director for Systems and Techniques, and Dr. Gordon R. Harrison, Assistant Director for Applied Sciences, recently were elected to the grade of Fellow in the Institute of Electrical and Electronics Engineers. The grade of Fellow is one of unusual professional distinction conferred only upon a person of extraordinary qualifications and experience.

The IEEE Board of Directors conferred the highest grade of membership to Dr. Johnson with the citation, "For contributions to and leadership in antenna measurements and rapid-scan microwave antennas."

Dr. Harrison's citation was, "For contributions and technical leadership in the development of microwave ferrimagnetic compounds and their application in microwave components and integrated circuits."

Dr. Richard C. Johnson

Dr. Gordon R. Harrison

Dr. Johnson is a Georgia Tech alumnus and has been at EES since 1952.

A graduate of Vanderbilt University, Dr. Harrison has been with EES since 1971.

## Conservation of Fuel by Industry

Unfortunately, new energy sources are not going to be available for use in coming months and in some cases even in the next few years. Until these new sources are available, our only alternative is to make the most efficient use of the energy that is now available from conventional sources.

Fortunately, there appear to be many areas where slight modification of processes or operating procedures can significantly reduce the energy needed. The availability of great quantities of inexpensive energy in the past has often resulted in the adoption of wasteful procedures and processes which were cost-effective until recently. In light of the present energy shortage we must now find ways to eliminate these wastes. There are many examples of processes where significant quantities of energy can be conserved.

A few years ago, the EES became concerned with the efficiency of process energy use. In particular, we were concerned with energy used for drying agricultural products. Georgia's three largest crops—peanuts, corn, and tobacco—all require extensive drying. A small survey program was initiated to determine the current state-of-the-art in agricultural drying, as well as determine the probable efficiencies of currently used techniques. As data became available on agricultural drying, it became obvious that opportunities for significant improvements in drying process efficiency exist. It also became obvious that the program should be expanded to consider all process energy usage in the state. This expansion of the program was initiated in July 1973 and the following are some typical findings.

In the food-processing industry steam from pressure cookers is frequently discharged directly to exhaust vents; this wastes energy and water, and creates a considerable amount of noise. Heat exchangers are commercially available which will condense this steam for reuse. The feed water for the steam boilers can also be preheated if used as the condensing fluid.

Pecans at present are soaked in water to reduce meat damage during the shelling operation, and then subsequently dried to prevent mold formation. If the nuts are dried at a temperature much above 120°F, the meat discolors and the selling price must be reduced. In most pecan-shelling plants visited, it was observed that the dryer air intakes were located such that warm moist air was being pulled into the dryer; this then permitted only a small increase in temperature within the heater. Warm moist air is a poor drying agent. Most of these plants compensate by drying at excessive temperatures or for long periods of time.

The first place to look for possible energy savings is where the most energy is being used. However, frequently, major energy conservation can be accomplished at processes which are not the major users of energy. The EES will provide as much energy conservation assistance to Georgia industry as our resources will permit.

**January, 1975**

## ALUMINA FROM KAOLIN DEVELOPMENTS

Dr. John Husted, and Mr. Bill Ward, of the EES staff were in Boulder City, Nevada, November 18-20 to observe the continuous operation of the nitric acid process for producing alumina from kaolin at the U.S. Bureau of Mines mini-plant operation. Since the duo's first visit last June, changes and refinements have been made to increase the efficiency of the process. Equipment for the hydrochloric acid alumina-from-kaolin process should be installed during the first quarter of 1975, and the Bureau will begin test runs to determine which process is more economical. The Bureau of Mines expects the project to yield definitive data on costs, material balances, and environmental effects. Here at home, an updated version of Husted and Ward's best-selling "Alumina from Kaolin" study for the Georgia Department of Community Development is recently off the press and available upon request.

### Field Test Facility

Facilities are being constructed at the EES Cobb County Field Test Facility in the western section of the county. The 28-acre site is owned by the Georgia Tech Research Institute and is leased to EES. It is approximately 16 air miles from the Georgia Tech campus, off west Sandtown Road, northeast of Powder Springs and southwest of Marietta. Three concrete pads are being built in a triangular pattern for mobile equipment with a concrete block building at one apex.

The site was chosen because it met the requirements of topology and location. These included land relatively high and level, cleared or clearable and distant from heavily traveled roads. Because the site will be used for electronic research, it also needed to be relatively clear for electromagnetic reradiators such as fences, high voltage transmission lines and towers. All utilities will be placed underground at the site for research purposes.

According to EES Assistant Director R. L. Yobs, the site will be used by Station personnel where a remote environment is necessary. Some proposed uses are for a satellite terminal location, antenna pattern range and calibrations, radar reflectivity and backscatter and radio location and direction finding.

### Energy Consumption Monitored

Researchers of EES are aiding the federal government in developing a method of monitoring energy consumption in the ten largest energy-consuming industries.

Working under a contract with the Federal Energy Administration (FEA), EES will monitor the iron and steel, aluminum, petroleum, chemicals, paper, cement, copper, glass, baking and meat packing industries. Project Director Dr. Jack Spurlock says these ten industries consume approximately 20% of the total energy produced: Electricity, natural gas, LP gas, fuel oil and coal.

The FEA, which has responsibility for energy consumption monitoring, is encouraging industry to voluntarily cut energy usage by 15%. In order to meet this goal and to measure the success of this cooperative, voluntary conservation effort, the FEA has contracted with EES to develop and establish a monitoring program. This program is intended to assist the industries in meeting the conservation objectives and to supply conservation data to the FEA.

Dr. Spurlock feels these goals can be met, and his staff is currently meeting with leaders of national trade associations and visiting plants and factories to establish specific energy conservation objectives. In these meetings, the EES staff discusses monitoring and reporting formats for activities and processes offering the best payoff potentials for this national energy conservation effort.

Initial findings were presented to the FEA December 20 with final recommendations due in February.

### EES Aids Southern

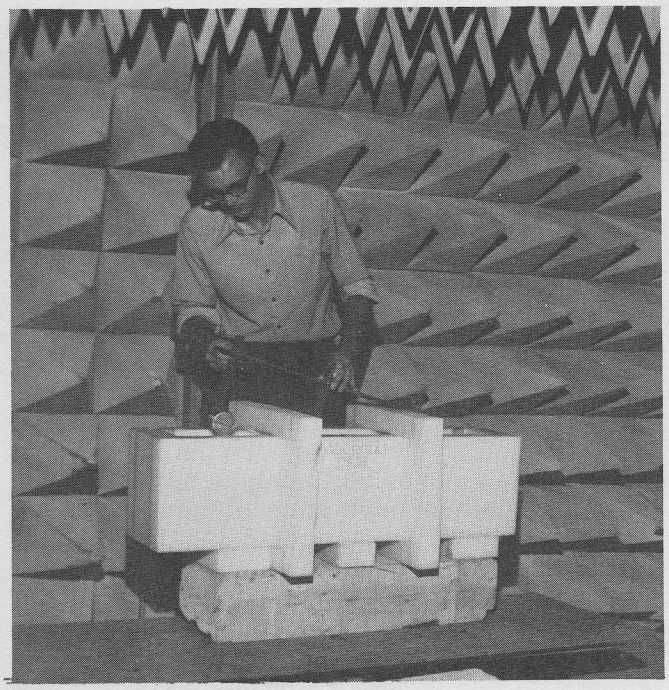
Dr. H. Allen Ecker, Chief, of the EES Radar Division received the following letter from Mr. Sam L. Perry, Supervisor, Facilities Engineering, Southern Airways in November:

Dear Dr. Ecker:

I would like to express my grateful appreciation for the work you and Mr. Jerry Eaves did in your analysis of the potential problem that Southern's new aircraft maintenance hangar might cause to the south radar facility on the Atlanta Airport. We have forwarded your report to the Federal Aviation Administration and have not received any response from them so far.

We advertised for bids on the new facility yesterday. Bid opening is scheduled for January 8, 1975 and construction should begin in early March. We have operated for many years in obsolete and inadequate maintenance facilities and we are all looking forward to the completion of our new facilities which we feel will be better than any other airline. Your work has not only saved our Company a lot of money but has also allowed us to retain the attractive architectural appearance of the hangar.

Mr. Ken Masters and myself would like to schedule a meeting with you sometime soon after thanksgiving to review your analysis. We have many Georgia Tech graduates at Southern including our President, Mr. Frank W. Hulse, who founded the Company 25 years ago. I am sure that they take a great deal of pride in the accomplishments of the Engineering Experiment Station and in the valuable contributions that you make to industry in the State of Georgia.



James C. Toler, Communications Division, testing a pacemaker in the EES anachoic chamber.

## Pacemaker Research Continues

The Electromagnetic Compatability Lab began their tenth series of cardiac pacemaker electromagnetic interference evaluations on 12 August. These evaluations consist of analyzing the pacemaker's functioning during exposure to electromagnetic environments that patients can encounter in their normal day-to-day activity. The evaluations are important because they involve pacemakers which use lithium-iodine as their power source. Pacemakers evaluated during earlier tests used either conventional batteries or nuclear power cells for electrical power. Lithium-iodine is a new chemical way of producing electricity in a smaller sized pacemaker which will have a longer lifetime than the conventional mercury battery units. And there are not the radiation considerations inherent in nuclear models. Researchers are J. C. Toler, F. R. Williamson and B. M. Jenkins. Medical advisor is Dr. W. H. Fleming, Chief of Thoracic Surgery and Assistant Professor of Surgery at Emory University.

To date, electromagnetic evaluations have been conducted on 294 different developmental and commercially available pacemakers. These represent models from eleven different manufacturers in the United States, Europe and the United Kingdom. During these evaluations, the pacemakers have been situated in conditions that simulate implantation in the human body. This has included mounting the pacemakers in saline solutions that were electrically representative of body fluid and tissue as well as implantation in experimental animals. When experimental animals were used, their hearts were operated on to induce heart block and therefore make them dependent upon the pacemaker.

The results of these evaluations are being used in numerous ways. The primary manufacturer's interest is in data that can be used to define improved electromagnetic designs. To the pacemaker patient, the evaluation results define vocational and recreational activities that do not present a safety hazard. Military personnel are using the data to establish exclusion perimeters around their radar sites. For the medical profession, these evaluations provide results that can be used to properly advise patients regarding restrictions with which they should comply.

**The exposure environments have included the following exposure fields and their frequencies: Power lines (60 Hz), military and civilian radar systems (450 MHz, 1.2 GHz, 3.1 GHz and 9.0 GHz), microwave ovens (915 MHz and 2450 MHz), automotive ignition systems, electrocautery devices used for cutting and cauterizing in hospital operating rooms and household appliances such as electric razors, blenders, drill motors, soldering guns, etc. Different fields are used for pacemaker evaluations because of government allocation of frequencies and because pacemaker susceptibility is frequency dependent. Research has shown that at the lower frequencies, the interference problem is more severe.**

## Hughey Joins Staff

Mr. R. L. Hughey, Jr. has joined the Industrial Development Division as director of the Augusta Area Office in Augusta, GA. He replaces L. Thomas Murphy, Jr., who has accepted a position as Macon Area Development Commission Executive Director.

A native of Franklin, GA., Hughey was graduated from Georgia Tech with his degree in mechanical engineering. He comes to Augusta from Atlanta where he had his own insurance agency. Prior to that, he worked as Engineering Manager, Project Engineering Manager and Design Engineer with Southwire Co. in Carrollton, GA. He also has worked for Georgia Power in Atlanta as Power Plant Engineer.

The Augusta Area Office, established in 1966, is one of seven EES Area Offices located across the state. These offices supply scientific information, engineering and management assistance to industries in their respective areas. They also provide industrial development services to communities and area development organizations. The Augusta Area Office serves the 23 counties included in the Central Savannah and the Northeast Georgia Area Planning and Development Commissions. Assisting Hughey with these programs will be R. Lynnard Tessner and Kay P. De Hart.

The Augusta Area Office is located in the Augusta Chamber of Commerce building. It currently is conducting sponsored programs for the Central Savannah River APDC, the Emanuel County Development Authority, the Jenkins County Industrial Development Authority, the Richmond County Development Authority, the Screven County Industrial Development Authority, Columbia and Warren counties and the cities of Louisville, Sardis, Thomson, Wadley and Wrens. These programs include industrial development research, site development, prospect handling and other advisory services.

## Energy Research at EES

Already involved in energy research in several areas, EES will become increasingly active in efforts to resolve a wide variety of energy-related problems. Its departments and divisions constitute an immediately available source of scientific and technological skills and information applicable to energy research, use and conservation.

Some current projects underway at the EES include:

Studies being directed by Mr. J. D. Walton, Chief of the High Temperature Materials Division on the use of solar energy for heating water, space heating and future power generation.

The efficient use and conservation of heat employed to process such Georgia products as tobacco, carpets, peanuts and pecans is being studied by Senior Research Engineer James M. Akridge of the Sensor Systems Division, EES.

And the Waste Utilization Laboratory is doing work on converting wood wastes and other industrial wastes into coal-like fuel. This is a unique process that has been developed at the EES and promises a partial near-future solution to some of the fuel-energy problems. The waste utilization studies are under the direction of Mack D. Bowen of the Technology Applications Group.

Other energy related research projects are developing at the Engineering Experiment Station that will be of increasing importance and wide public interest.

## IDD Helps With Manpower Utilization

Mr. Bill Howard and Mr. Larry Edens, IDD, have been in the midst of an occupational needs study for the City of Savannah. The three-pronged study involves:

1. A survey of industry's skills and training needs —now and in the next two years.
2. Analysis of unemployment by numbers and skills of the unemployed.
3. An inventory of existing training facilities, programs, and services to determine what the needs are.

The results will assist the Savannah Manpower Development Department, the Savannah Area Vocational-Technical School, and others in matching up people and jobs.

The first of Howard's Title I Seminars on "Better Utilization of Human Resources" was held in Monroe on December 4. Others will be scheduled later in Americus, Toccoa, and Vidalia. The idea is to bring community and industrial leaders together to seek common solutions for manpower problems.

## Prospects For Using Solar Energy In Georgia

Mr. J. D. Walton, Chief of the High Temperature Materials Division has stated that about two-thirds of the state of Georgia (south and southeast of Atlanta) receives a sufficient quantity of sunshine that serious consideration should be given to developing solar energy as a supplemental energy source in this area. However, with the exception of water heating and to some degree space heating, the realization of large scale utilization of solar energy in this or any other area of the United States is many years in the future.

Most manufacturers are so far behind in production of solar water heaters that they will not quote prices at this time. For estimating purposes assume 10 square feet of collector are required to heat water for a 50 gallon hot water tank. The price of solar collectors is about $2 per square foot which does not include plumbing and special controls.

For the near future solar energy can be used as a supplemental fuel for space heating. Minor architectural innovations applied to new houses and buildings can significantly reduce fuel requirements without adding substantially to the cost of the structure. Basically, such modifications employ some type of thermal absorber (black panels) behind glass on south facing walls. The glass acts as a thermal trap and supplemental heat is available during most periods of sunlight. This technique has been successfully incorporated in one nine story building in south France and has supplied over 20 percent of the building heat.

Large scale power generation from solar energy is not predicted to be available before the mid 1980's. However, the Engineering Experiment Station is presently undertaking a project to design a prototype boiler to be powered by the 1000 kw solar furnace in France. This boiler will be used to drive a steam turbine and generator to produce 300 kw of electrical energy; first tests are scheduled for 1975. If this program is successful, a solar power plant generating 10 to 30 megawatts of electrical energy could be realized by 1980.

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