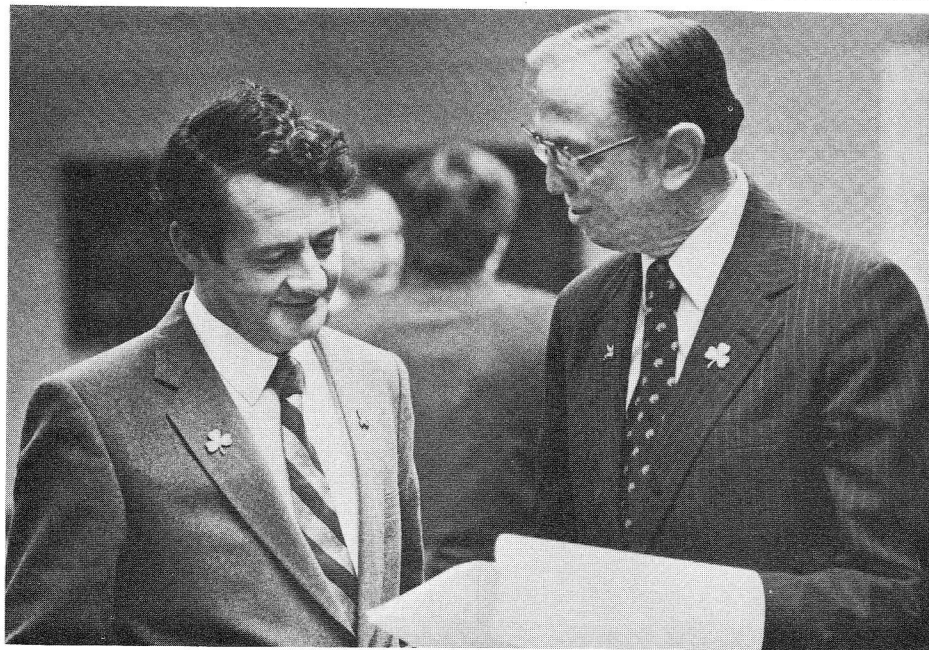


EES Report

ENGINEERING EXPERIMENT STATION • GEORGIA TECH



DESMOND O'MALLEY, Minister of Industry Commerce and Tourism for the Republic of Ireland (left), meets informally with Georgia Tech President Dr. Joseph M. Pettit at a news conference announcing Tech's partnership with Ireland in developing the European Research Institute of Ireland. EES will manage the Institute.

EES to manage research institute based in Ireland

EES has entered the high technology research market in Europe with its decision to develop and manage a research and development institute for the Republic of Ireland. This non-profit R & D corporation will be known as the European Research Institute of Ireland or "ERII". Its home base will be in Limerick, Ireland, a city which has a high concentration of industries with advanced technology product lines, such as Varian Associates, Wang Laboratories and Westinghouse. Georgia Tech's involvement in ERII marks the first time an American university has helped establish such an R & D center overseas.

Ireland has already built one of Europe's most dynamic high technology industrial bases. However, Irish leaders believe an active research and development component is the missing ingredient needed to stimulate this industrial sector to even faster growth. This observation is certainly borne out by experience in the United States. In America, R & D programs such as the one flourishing at Georgia Tech have had a very positive effect on local economies, by enhancing innovation in existing industries and attracting corporations to relocate plants. Tech itself has also spun off a number of thriving new companies, the most prominent being Scientific Atlanta, a manufacturer of earth satellite stations with sales of around \$200 million a year.

Irish officials sought the assistance of EES in this venture because of the Station's recognized expertise in areas which ERII will emphasize. Like EES, the European Research Institute will actively market its services on a contract basis to industrial sponsors in Ireland and other European countries.

Airborne labs developing active anti-radar system

Stealth is only one technology which military planners are exploring to make U.S. aircraft less detectable by radar. The Stealth program is a "passive" attempt to meet this objective through design of a plane which reflects radar energy poorly. EES is testing a different anti-radar technique which would allow an aircraft to send out an electronic signal to deceive enemy tracking units about the plane's position in the sky. Station engineers have spent much of the last decade helping the Air Force develop this "active" radar disruption system.

EES's Airborne Electronics Laboratories (AEL's) are playing a critical role in this program. These laboratories are used by a highly experienced group of flight test engineers whose specialty is electronic defense. Researchers in this group can develop test plans, modify aircraft, in-

stall equipment, collect data, and do analysis, evaluation and reporting work. The AEL's themselves are two Convair aircraft which have been outfitted to do a wide variety of flight test work. These aircraft are owned and operated by the Station. They are large enough to provide airborne laboratory environments for many types of experimental work but are sufficiently small for relatively economical operation.

EES's anti-radar program began approximately six years before its first airplane was secured. The Avionics Laboratory of the Air Force Systems Command initially sponsored the development of radar disruption technology. EES measured characteristics of operating equipment, developed techniques, then

Continued on page 2

Continued on page 3

Station now has two flying laboratories

Continued from page 1

built up improved equipment on a mobile test platform. Following these programs, the Air Force decided that actual flight testing was needed to make further refinements in the system, so they suggested that the Station acquire an airplane for these experiments.

After a search of several years, EES found a suitable plane in Air Force surplus: a modified Convair 240 (or T-29) twin-engine, transport type, pressurized, all-weather aircraft. Because of Georgia Tech's status as a non-profit educational institution, the plane was donated by the Federal government and brought to Georgia Tech in January 1977.

Under an initial flight test program, the Avionics Laboratory formally sponsored 104 flight hours of testing with the plane. The Air Force later added 96 hours to the contract, making it a 200-hour program, an effort which represents roughly a year's work for the EES airplane. The latest generation of anti-radar equipment developed by Tech was installed in the aircraft for this program.

The tests began in January 1979, and ended nine months later. Of 66 missions planned, 65 were flown on schedule. "We really shocked the Air Force with the reliability of our aircraft," said AEL group leader Lee Edwards, "and the technical results were equally as successful."

After the 200-hour program ended, the Air Force told Station officials that

there was potential for additional flight testing work with Georgia Tech. Georgia Tech decided that another aircraft was required to handle additional research programs. The search for the second aircraft took another year and ended in late 1980, when a government surplus Convair 340, previously owned by NASA, was donated to the Station.

"NASA's maintenance on the plane was superb," said Edwards. "It's really in top-notch condition. It's a beautiful plane and it comes to us with a tremendous stock of spare parts."

The Convair 340 can carry external pods on its underside, fuselage and wings. The aircraft has optical glass windows on the underside for photography. It is slightly larger than the first Convair, has a large cargo door, and can carry somewhat heavier loads. This plane gives EES the capability to carry out two flight tests simultaneously or to perform tests requiring two aircraft flying cooperatively.

A number of American research centers do flight testing but few have the natural advantages which allow Tech's work with its AEL's to be exceptionally economical, timely, and reliable.

"We're a small operation but we have exceptionally good people," said Edwards. "Our chief pilot is a very experienced retired airlines captain with 37 years at Eastern and 33,000 hours of flying time. Our maintenance chief is equally well qualified as a mechanic and inspector and he also serves as

our co-pilot. Our chief pilot helps maintain the planes, too, so we really have the usefulness of four people in two. We expect soon to reach the point where we will need an additional flight crew so that the two planes can be operated simultaneously."

These two flying labs can work for sponsors economically for several reasons. One is that the acquisition costs were small because the two planes were donated to the Station. A large stock of spare parts has also been donated to Tech in addition to those which came from NASA. Another reason why Tech's flight operation is so economical is that Tech's flight test group is kept at minimum size but consists of extremely well qualified people. A group of five Tech personnel performed about 90 percent of the work involved in conducting the flight operations, operation of the experimental equipment, the data collection and all support functions during the recently completed Air Force Test program.

"When the airplanes are modified we rely on our maintenance chief, our pilot, several aerospace professors at Tech and the plane's manufacturer," said Edwards. "These are people we can fully trust, and we follow their recommendations very carefully."

Until now, the Airborne Electronics Laboratory has worked solely in the field of electronic defense, but Edwards likes to describe his group as a "flying lab" which is ready to do any kind of flight test. The AEL's may get a chance to branch out into new fields soon. In the near future, the labs may do atmospheric sampling programs for Georgia Tech's School of Geophysical Sciences. Later, the AEL's may measure electrical emissions from power lines around commercial electrical power generators and substations.



EES REPORT

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DR. THOMAS STELSON

Georgia Tech leader opposes drastic energy conservation budgeting cuts

In testimony before a congressional subcommittee March 4, Georgia Tech Vice President for Research, Dr. Thomas Stelson, argued strongly against drastic cuts in some government energy conservation programs. Stelson's remarks to the House Subcommittee on Energy Development and Applications came in reaction to the Reagan Administration's proposal that federal spending for conservation be curtailed by 76 percent in the new fiscal year. Stelson served as the nation's Assistant Secretary for Conservation and Solar Energy under former President Carter and helped to formulate the energy conservation

budget under scrutiny. He urged Congress to reject the requested reductions, because the programs under consideration have been among the most effective and economical in Washington.

"Oil importation into the United States has declined from a peak of 8.8 million barrels per day to about 5.6 million in a period of about two years," Dr. Stelson testified. "This incredibly effective development by the United States has astounded the world...To abandon the greatest energy achievement of the United States, if not the greatest achievement of any nation in energy use in modern times, is almost beyond belief."

Stelson said that the Department of Energy has spawned many technologies which reduce energy demand for large industries in very cost-effective ways. He testified that many of these conservation methodologies can be implemented for costs of less than \$6 for each barrel of oil that need not be bought. In contrast, OPEC producers are now selling crude oil at approximately \$34 per barrel. This means that companies which save 1,000 barrels a month through conservation may be in the enviable position of paying \$6,000 to achieve a \$34,000 fuel reduction.

Stelson questioned the wisdom of an approach which leaves the development and dissemination of practical energy conservation technologies to private industry and business. He said that even companies which use large amounts of energy in their operations seldom have anyone on staff who is an energy conservation expert. Research and development branches within firms focus their attentions almost exclusively on new product development rather than conservation technologies. Stelson added that it is unlikely one business could justify capital investments necessary to develop effective energy conservation systems. Furthermore, he said that several companies could not band together to produce a system which meets their common needs because of the restraints of federal anti-trust laws.

"It takes more than economic incentives," Stelson said.

EES to guide R&D Center

Continued from page 1

Moreover, ERII will stress electronics technologies and energy research, two fields in which EES has pioneering experience.

The Station will guide ERII for its first 10 years. Georgia Tech President Dr. Joseph M. Pettit will have a direct advisory role, serving as a member of ERII's initial board of directors. The Institute's first managing director will be Dr. Daniel J. O'Neil, a senior staff member at EES who spent five years in the early 1970's working in Limerick, Ireland. His associate director will be Charles Hilbers, a senior research engineer in the Station's Systems and Techniques Laboratory, a research group of national stature in defense electronics. O'Neil and Hilbers will work full-time for ERII but will remain Georgia Tech employees, reporting to EES Director Dr. Donald Grace. One of their principal roles will be to access the latest in European and American technology for dissemination to Irish industry, in order to keep these companies innovative. This export of technology is likely to result in additional research programs for Georgia Tech from sponsors in Ireland and Europe.

Funding for ERII is coming largely from the Industrial Development Authority of Ireland. IDA is giving just

under \$2 million dollars in grants to start the Institute, with the remainder of the initial investment, a figure of about \$1 million dollars, to be given by a consortium of Irish-based companies, led by Guinness Ltd. During its first three years of operation, ERII will function out of offices and laboratories provided by the National Institute for Higher Education in Limerick. After that, the operation will move to a new 27,000 square foot laboratory and office facility to be provided by IDA at a cost of some \$3 million dollars. O'Neil projects that ERII will be self-supporting by the end of its second year of operation.

Public announcements of the ERII venture were made in March in Ireland and the United States.

In summary, the European Research Institute is a program of major significance for Ireland, Georgia Tech and the state of Georgia. Ireland will use the Institute to continue the development of employment-intensive high technology industries. Georgia Tech will gain a "window" on the flourishing European research market. Georgia will benefit from the association of Tech with Europe, both from the money flowing into the state from applied research contracts and from the increasing levels of investment here by European business interests.

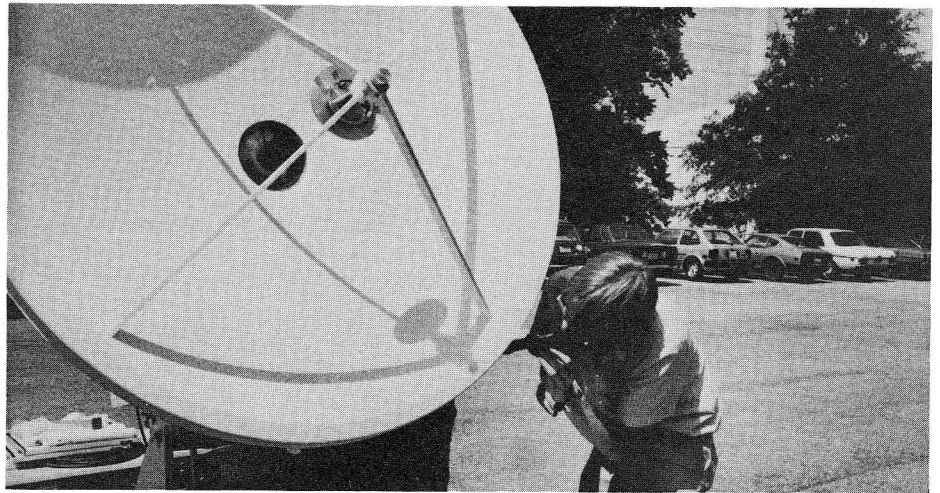
Station does testing for space shuttle

On future Space Shuttle missions, a radiometer developed by engineers in EES' Electromagnetics Laboratory (EML) may be standard launch-pad equipment. In tests recently conducted for NASA, the EML 35/95 GHz instrumentation radiometer demonstrated that it can detect accumulations of ice or frost on the external fuel tank of the shuttle orbiter.

This icing results from the extreme coldness of the liquid hydrogen and liquid oxygen fuels carried in the tank. If significant amounts of ice accumulate just prior to the Space Shuttle launch, NASA could postpone the takeoff for the time necessary for the air to warm up enough to melt the ice.

NASA scientists have already developed computer modeling techniques to predict the atmospheric conditions which would allow icing on the tank to occur. However, they would like to install an instrument for use on future flights which would detect actual accumulations of ice before liftoff. The EML radiometer is one alternative under serious study to meet this need.

EES engineers proved the effectiveness of their radiometer in this regard during static firings of the Shuttle Orbiter cluster engines at the National Space Technology Laboratory in Mississippi in late 1980 and early 1981. Station staff members analyzed the data collected in these tests to determine: 1) the likelihood of ice forma-



A RADIOMETER developed by EES took measurements of ice accumulations on the Space Shuttle external fuel tanks during static firing tests before the recent successful launch. Here, EES engineer Marc Foster works with the hardware used to take the radiometer's measurement.

tion and 2) the location of possible ice patches on the liquid oxygen section of the external tank.

Since then, NASA has asked EES to make radiometric icing measurements prior to the second Shuttle launch, scheduled for later this year.

The EML radiometer was built in 1979 to provide data for the U.S. Air Force. In that program, it was used at Aberdeen Proving Grounds to make armored vehicle target detection measurements from distances of 100 to 150 feet. Since the initial use of that radiometer ended, the instrument has been used for several other purposes. One such program has involved the Shuttle. Another program used the

radiometer, with some frequency modifications, to make target detection measurements over a distance of approximately one kilometer.

Few research institutions in the U.S. do more contract work in radiometry applications than EES. The main thrust of the Station's research in this field recently has focused on the development of radiometers operating at millimeter wave frequencies. Sensing devices working in this area of the spectrum can penetrate rain, fog or dust with more effectiveness than hardware using IR frequencies. Most of EES' contract work in the last few years has involved military or meteorological applications.

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