

Station News

Georgia Tech Engineering Experiment Station

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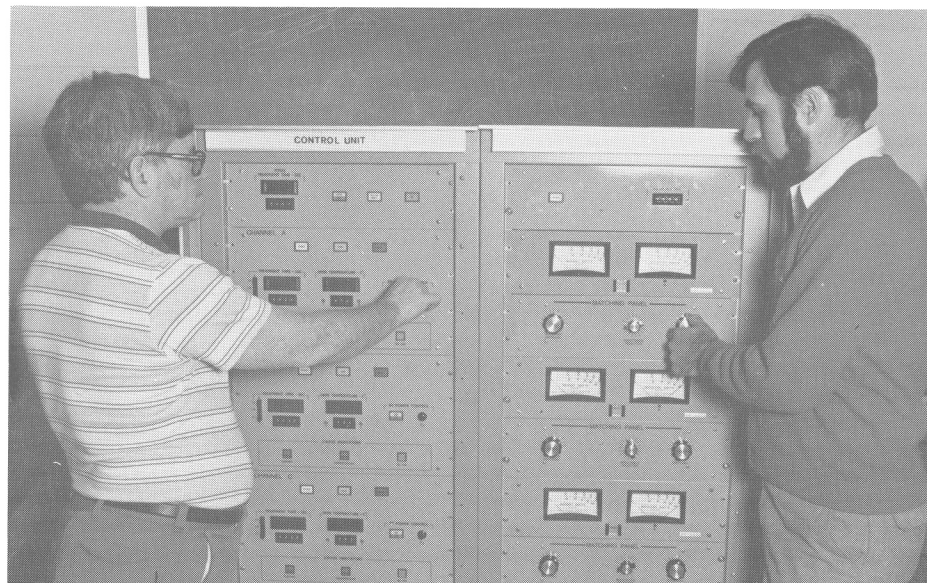
Cancer Therapy Equipment Ready For Evaluation

Cancer therapists may add a new tool to their medical kits if all goes well with tests of hyperthermic treatment equipment designed and built by engineers in the Electronics and Computer Systems Lab (ECSL). The equipment uses nonionizing electromagnetic radiation to selectively heat and kill malignant tissue.

"The idea of using heat to destroy cancer dates back to the Civil War," said Jim Toler, chief of ECSL's Biomedical Research Division. "Physicians noted that tumors regressed when patients had a high fever. But, until recently, no one knew how to heat cancerous tissue high enough to destroy it without also damaging the normal tissue around it. At first, people didn't realize that the different types of tissue — skin, muscle, fat, etc. — have different electrical properties, or varying capacities to absorb electromagnetic radiation. When we came on the scene, there was no good way to measure these properties.

"Cliff Burdette of ECSL developed an antenna-based probe that makes it possible to measure these electrical properties in a living animal, and today his measurement technique has been adopted by research labs across the country. His accurate measurements of electrical properties of living tissues led to the practical design of our electrohyperthermic equipment for cancer treatment."

Cancerous tissues absorb more radiant energy and thus get hotter than healthy tissues. The ECSL equipment takes advantage of this temperature



Red Jenkins (left) and Mike Studwell demonstrate the equipment they built to destroy cancer by microwave radiation. The dials on the left allow selection of time and temperature on three channels, while those on the right automatically "match" the antenna pairs to varying body types. (Photo by Charles Haynes)

differential to beam microwave energy to the cancer site by means of pairs of antennas attached to opposite sides of the body. When thermistors under the antennas indicate that the normal tissue is getting dangerously hot, the radiation is switched to another pair of antennas attached at a different angle. Thus, the tumor keeps getting hotter, while the surrounding normal tissue stays at a safe temperature.

ECSL engineers have built the current prototype system under contract with the University of Maryland Medical Center. They have tested it with phantom modeling material that simulates the electrical properties of various living tissues, and are now ready to test it on dogs. The sponsor has arranged with Dr. Steven Auda, who formerly worked for the National Cancer Institute and is currently in private practice in the Atlanta area, to conduct the first tests on human cancer patients.

Bernard (Red) Jenkins is project director, assisted by Steve Sharp and Mike Studwell. They adapted a basic design and equipment provided by the University of Maryland, and accomplished tremendous improvements over the results originally anticipated. The system, which uses three pairs of antennas, allows the operator to dial in the maximum time and temperature for each antenna pair, as well as the overall treatment time. The system can be operated in a sequential mode or on one channel only. It also has a sophisticated, automated matching capability enabling the antennas to adjust their tuning for fat or thin persons.

Toler warns that their research is still preliminary. "Although the technique seems very promising, its efficacy is yet to be determined," he stresses. "We see it as possibly complementing, **not** replacing, the other therapies now in use."

Water Splitting Experiment In Progress At Solar Site

One day it may be economically feasible to produce hydrogen for use as a fuel and chemical feedstock by running water through a chemical process plant powered by heat from the sun. Water would enter the plant and come out the other end broken down into its components — hydrogen and oxygen. The other chemicals used in the process would be continually recycled back into the system.

GA Technologies, a San Diego-based company, has been working on the chemistry for such a process for ten years. Currently they are testing a solar thermal catalytic reactor used in the high-temperature part of the process at the Advanced Components Test Facility operated by the Energy and Materials Sciences Lab (EMSL).

The U.S. Department of Energy is funding the study as part of its Fuels and Chemicals Program. It is the only large-scale experiment in the United States dealing with the production of fuels and chemicals using solar thermal energy.

"Since sunlight is not available all the time, we look for ways to store its energy," explained Tom Brown, director of Tech's solar thermal test facility. "It's convenient to store energy in the form of a chemical bond. Hydrogen is the fuel of choice because it's non-polluting — when you burn it, you get water. Another advantage is that it can be stored and transported via existing distribution systems (pipelines, tank trucks, etc.). It's also a good feedstock chemical in the petrochemical industry."

The part of the process undergoing test and evaluation at the solar site involves decomposition of sulfuric acid by direct solar heating to a process temperature of 1600°F, using iron oxide as a catalyst. The team installed the experiment during February, and is running it throughout March under varying prescribed conditions of temperature, flow rate, etc. They also are evaluating the survivability of the container and components. Because of the corrosiveness of sulfuric acid, super metals had to be used. Different materials are being tested in different parts of the solar receiver, and they

will undergo metallurgical analysis after the experiment is completed.

"Although this is basically a GA design and program, EMSL has provided much consultation support," Brown said. "We've worked with them for about a year and a half so far. We've helped with design aspects of the solar receiver and on instrumentation. We were responsible for the computerized data collection system and the design and construction of the solar flux modulator."

The following EMSL people have expended major efforts on this program: Paul Allen, Russ Anderton, Everett Chapman, Steve Jackson, Jim Lefferdo, Doug Neale, Art Sales, and C.J. Swafford.

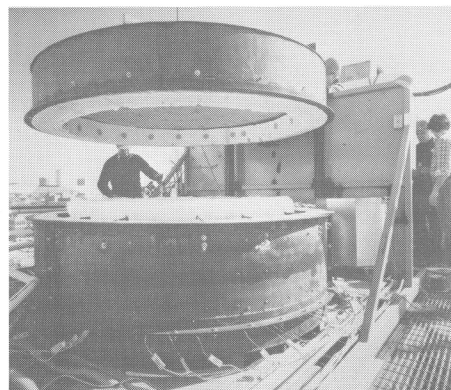
Emergencies Enliven February

Two minor, but potentially dangerous accidents thrust EES into the spotlight in February.

On February 15, a spark from a shorted electric motor ignited urea formaldehyde insulation in a ground-floor mechanical room of the Electronics Research Building. This type of insulation is not supposed to burn. Although the fire was very small and quickly extinguished by the Atlanta Fire Department, the resulting smoke and toxic fumes forced evacuation of the building.

Nine days later, another accident occurred in the Baker Building. The teflon seal on a cylinder of fluorine gas deteriorated to the point that gas began leaking into the third-floor laboratory where it was stored. The building was promptly evacuated. No one was injured, and the small amount of toxic gas released was soon exhausted to the outside atmosphere. Campus Environmental Safety personnel handled the emergency, assisted by the Atlanta Fire Department.

Secretary/Receptionist Brenda King has been commended for her prompt action in notifying the authorities about the chemical leak in Baker and engineering the orderly evacuation of the building via the fire escapes.



The GA Technologies solar thermal catalytic reactor undergoes installation for testing atop the Georgia Tech solar power tower. This is one phase of an experimental process to produce hydrogen from water. (Photo by Tom Brown)

GA plans to come back to Tech in about a year with a high-pressure unit to test. "The current project totals about \$153,000," Brown said, "and the follow-on program promises to be on the order of \$230,000."

Security Coordinator Al Becker also complimented the EES staff members in both buildings who saw to it that the classified material for which they were responsible was made secure before leaving the building.

Facilities Management received high marks on its handling of both incidents. One of its many responsibilities is the safety program for all EES personnel and facilities. This includes accompanying state fire/safety inspectors on their campus rounds to note deficiencies and see to their prompt correction, the conduct of fire drills, disposal of hazardous substances, and provision of safety equipment. The department also assists with security arrangements for classified work and materials.

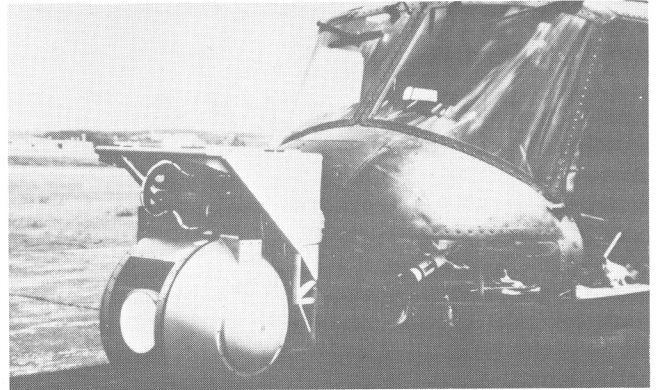
Although the Georgia Tech Office of Environmental Safety is responsible for overall campus safety programs, EES has long had a Safety Committee to oversee conditions in EES facilities and make recommendations for correcting hazardous conditions. Tom Jones, Facilities Management manager, is chairman. Each building furnishes one building representative and a lab representative for each laboratory in the building. In addition, the Safety and Health Division of EDL serves the committee in an advisory capacity.

RAIL Develops State-Of-Art MMW Tracking Radar System

The Development Division of the Radar and Instrumentation Lab (RAIL) has designed and developed a state-of-the-art millimeter-wave tracking radar system for the Lincoln Laboratory at the Massachusetts Institute of Technology. Lincoln will use the radar in its Millimeter Terminal Homing Program as an aid in evaluating various millimeter-wave weapon guidance concepts.

The Georgia Tech radar has been placed on the nose of a helicopter, and it functions in a closed loop tracking mode when coupled with a General Electric data acquisition system. The helicopter flies a flight profile which allows various targets of interest to pass within the radar beam. Detection and tracking data for these targets are then gathered and stored to support later evaluations.

The Georgia Tech millimeter wave tracking radar system is shown mounted on a helicopter nose, ready for a trial run. (Reprinted by permission, *Microwave Journal*)



The Georgia Tech radar uses a 95 GHz solid-state (IMPATT) source which transmits a 100 nanosecond burst of energy every 50 microseconds. Impressed upon this burst of energy is a "chirp" (intrapulse frequency change) of 250 MHz nominal bandwidth. The radar antenna is a four-horn monopulse lens. The lens is 10 inches in diameter and is made of teflon. The resulting radar beamwidth is adjustable between one and three

degrees.

The radar was designed by Jim Scheer and Pete Britt, who are senior research engineers involved primarily in the development of millimeter-wave radar systems. This technology development program was featured in the October 1982 issue of *Microwave Journal* in an article entitled "Solid State, 95 GHz Tracking Radar System."

Rob Michelson

Professional Activities

ECONOMIC DEVELOPMENT LAB

EDL's Southeastern Trade Adjustment Assistance Center hosted the national TAAC conference in Orlando February 20-23. On hand to greet representatives of the 11 TAAC centers were **Hardy Taylor, Bob Springfield, Ed Lindsey and Dianne Lanier. Charles Estes** led a workshop on "TAAC Client Case Reviews," and **Johanna Williams** led a workshop on "Firm Management and Behavior Modification."

Ed Lindsey and **Steve Losser** made a presentation on "Trade Adjustment Assistance and Its Application to Apparel Manufacturing" at the Southern Apparel Contractors Association Regional Meetings in eight southeastern locations during February and March. Losser also recently provided an overview of the Rural Assistance Program to United Minority Business, Inc., in Beaufort, South Carolina.

Ed Bethea gave an overview of the Technology Utilization and Commercialization Center to the board of directors of the National Minority Business Campaign in Phoenix, Arizona, February 23-24.

ELECTRONICS & COMPUTER SYSTEMS LAB

Jim Toler was invited to organize a technical session at the Electromagnetic Compatibility Symposium and Technical Exhibition, held March 8-10

in Zurich at the Swiss Federal Institute of Technology. He also gave the overview paper on the session topic: "Biological Effects of Microwave Radiation."

ENERGY & MATERIALS SCIENCES LAB

At the 15th Biomass Thermo-Chemical Conversion Contractors Meeting held in Atlanta March 16-17, **Jim Knight** and **Charlie Gorton** reported on the current status of their project, "Entrained Flow Pyrolysis of Biomass."

Jim Hubbard gave a paper on "The Use of Electron Microscopes in Materials Analysis" in February at a meeting of the Alabama Microscopy Society in Birmingham.

OFFICE OF THE DIRECTOR

Jim Wiltse is a member of the Technical Program Committee for the '83 MTT International Microwave Symposium to be held June 1-3, and a member of the Papers Committee for the 29th Annual Tri-Service Symposium scheduled for June 21-23.

SYSTEMS ENGINEERING LAB

At the 1983 Tri-Service Conference on Combat Identification Systems, recently held in Monterey, California, **Robert Wohlers** delivered an invited paper entitled "CRIS—A Cooperative Radar Identification System."

Charlie Krebs talked on "Expendable Development and Test" at the February 17 meeting of the Southeastern Chapter

of the Society of Flight Test Engineers. **Donald Gordon** was elected secretary of the chapter for a one-year term beginning in January 1983.

TECHNOLOGY APPLICATIONS LAB

Larry Moriarty presented a paper entitled "Computer Applications in the Poultry Processing Industry" at the 59th Annual Pacific International Egg and Poultry Exposition, held in San Diego March 16-18. **Mike Smith** also attended.

At the Department of Energy Contractors Review in Atlanta March 16, **Tom McGowan, Tony Jape** and **Jim Walsh** presented a paper entitled "Utilization of Waste Streams in Biomass Gasifiers."

Alan Pashkevich spent December-February in Washington, D.C., developing a task and performance oriented training manual that addresses the technical and community development skills needed for the planning, implementation and evaluation of community-based hand pump projects. Developed with the assistance of a professional trainer, the manual can be used worldwide by trainers with basic training skills.

Hank Jackson is coordinating and lecturing at a "Creative Financing for Energy Conservation Equipment" workshop to be held April 20 in Atlanta under the sponsorship of the Georgia Office of Energy Resources and TAL's Industrial Energy Extension Service.

NEWS BRIEFS

EW Study Funding Rises 50%

The contract ceiling for EES's Electronic Warfare Techniques Analysis Program has been increased from \$4.44 million to \$6.65 million. Lloyd Lilly of the Systems Engineering Lab is the project director; however, all EES electronics labs share in the overall effort. The program involves assessing threat systems and their performance capabilities and characteristics. It also includes analyzing and developing advanced countermeasures techniques and components to exploit the deficiencies found in the threat systems. The Avionics Laboratory at Wright-Patterson Air Force Base is the sponsor, and Charles W. Ambuske is the Air Force program engineer.

EDL Adds Industry Service

Industrial companies in the Southeast that need to know where they can buy specific electrical or electronic component parts now can get this information free of charge from the Economic Development Lab (EDL). Harvey Diamond has surveyed the nation's distributors of electronic products and isolated 25 that sell to the six-state Southeast. Results of the 1982 survey have been computerized. With this data bank, EDL can identify all the distributors that handle a specific product, such as ceramic capacitors, along with the specific manufacturers or brands of this product stocked by each distributor.

EDL Helps Select Scholars

The directors of EDL's eight industrial extension field offices recently helped identify and select promising Georgia high school students for the President's Scholarship Program at Georgia Tech. Sponsored by the Southern Railway, the M. & H. Ferst Foundation, and Georgia Tech alumni and friends, the program is designed to attract top-quality high school students to Tech. EDL's field officers worked with the Office of Academic Affairs to find students whose achievements indicated their suitability for consideration; to interview the best students; and finally to determine who would receive offers.

Strictly Personal

ECONOMIC DEVELOPMENT LAB

Rich Combes, former associate director of TAL, is the new chief of EDL's Industrial Extension Division.

At the recent campus Women's Fair, **Joan Meeks** conducted a Time Management Workshop with **Pat Brown** of Georgia Tech's Housing Office.

ELECTROMAGNETICS LAB

Welcome to **Roy Murray**, new research engineer I in the Huntsville office, and to **Le-Tin Sun**, research scientist I. Former GRA **Don Bagwell** is now a research scientist I.

ELECTRONICS & COMPUTER SYSTEMS LAB

The Command and Control Branch welcomes **Charles Pinson**, research engineer II, **Marianne Carlson**, research scientist II, and **Janet Leininger**, research scientist I. The EM Effectiveness Division welcomes **Len Cayce**, research engineer II, back to EES after working for Loral.

Congratulations to **Beatriz Gonzalez**, who has been promoted to administrative secretary.

Carolyn Mahaffey is the new secretary of the Tech Women's Forum.

ENERGY & MATERIALS SCIENCES LAB

Richard S. Zabor has joined the Solar Energy Division as a research engineer II. Welcome!

OFFICE OF THE DIRECTOR

Barbara Turner has been elected treasurer of the Women's Forum.

RADAR & INSTRUMENTATION LAB

Nancy and **James Smith** had a baby girl, Tena Marie, in March.

SERVICE GROUPS

Facilities Management: **Tom Jones** thanks his friends for their many cards and visits during his recent hospital stay due to pneumonia.

Mechanical Services: Congratulations to **Donald Long**, who has been pro-

moted to research machinist.

Becoming proud parents of baby girls in February were Sibyl and **Carlton Osborne**, who welcomed Angell, and Earl and **Candice Martin**, who welcomed Kleya Marie.

Personnel Services: New employees are **Ruby Wiley**, clerk typist II, and **Sheila Sazhen**, personnel assistant I.

Research Security: **Paula Wilcox** has replaced **Gwen Bridges** as clerk II.

SYSTEMS & TECHNIQUES LAB

Congratulations to **Robin Parks** and her husband Keith (Chemical Engineering), whose daughter, Stephanie Nicole, was born February 28.

SYSTEMS ENGINEERING LAB

New to the Concepts Analysis Division are **Jean Swank**, programmer III, and **Gary Turner**, research scientist I. **Gale White** has joined the Countermeasures Development Division as administrative secretary. Research engineer I additions to the Defense Systems Division are **William Kuhn** and **Neil Lareau**. The division has lost **Ronnie Camp**, **John Doss** and **Jose Rugama**. **Clinton Earnest** is a new research engineer I in the ESM Division.

TECHNOLOGY APPLICATIONS LAB

Congratulations to Gina and **John Adams** on the birth of a daughter, Jill Whitney.

The Applied Engineering Division has gained **Nancy H. Watts**, research engineer II, and **Constantine Soulaikos**, research engineer I. **Lamar Griffin** is a new research engineer I in the Energy Conservation Branch. Additions to the Technology Transfer Branch are two research associate II's, **Claudia H. Huff** and **Virginia A. Thomas** (transfer from EDL), and **Connie Miller**, part-time staff assistant.

Virginia Keller has been elected publicity coordinator for the Georgia Tech Women's Forum.

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Editor

Martha Ann Stegar 3405

Graphics

Gerald K. Webb 3405

Associate Editors

Dee Ramunno, OOD	3400
Anthony DeCurtis, EDL	3844
Gail Tucker, EML	3500
Gayle Hudson, ECSL	3542
Charlotte Sanders, EMSL	3460
Ginny Gross, EMSL	3589
Maggi Harrison, RAIL	424-9621
Janice Manders, SEL	3519
Cindy King, STL	424-9647
Keith Nelms, TAL	3623
Beadie Lloyd, Service Groups	3445