

the GTRI connector

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Solar Heating of Salt Holds Promise for Power Generation

by Martha Ann Stegar

Personnel of EMSL's Advanced Components Test Facility (ACTF) again have played a key role in experiments on the leading edge of solar thermal technology. In mid-November, they successfully completed testing a solar receiver for heating molten salt by direct absorption of sunlight. The technique has great promise as a cost-competitive source of energy for electric power generation.

Using molten salt as a heat transfer medium is not a new concept. The steel industry, for example, has been using it for years. What is new is the **direct absorption** method for heating the salt. Most solar receivers in the past have channeled the heat transfer fluid through tubes; the heat has to get through the tube first to reach the fluid. But in this advanced concept, the molten salt cascades down an absorption panel much like a waterfall or lava flow and is exposed directly to the sun's rays.

"This has several advantages," says Co-Principal Investigator Tom Brown. "When the fluid is inside a tube, the rate at which the heat can be absorbed is limited by the ability to get the heat through the tube—the tube has to be hotter than the fluid. The higher the temperature, the greater the chance of burning out the tube.

"One of the objectives of our research was to determine whether a molten salt mixture can absorb and distribute solar energy at high temperatures without damaging the salt itself. By obtaining higher energy density, we can make

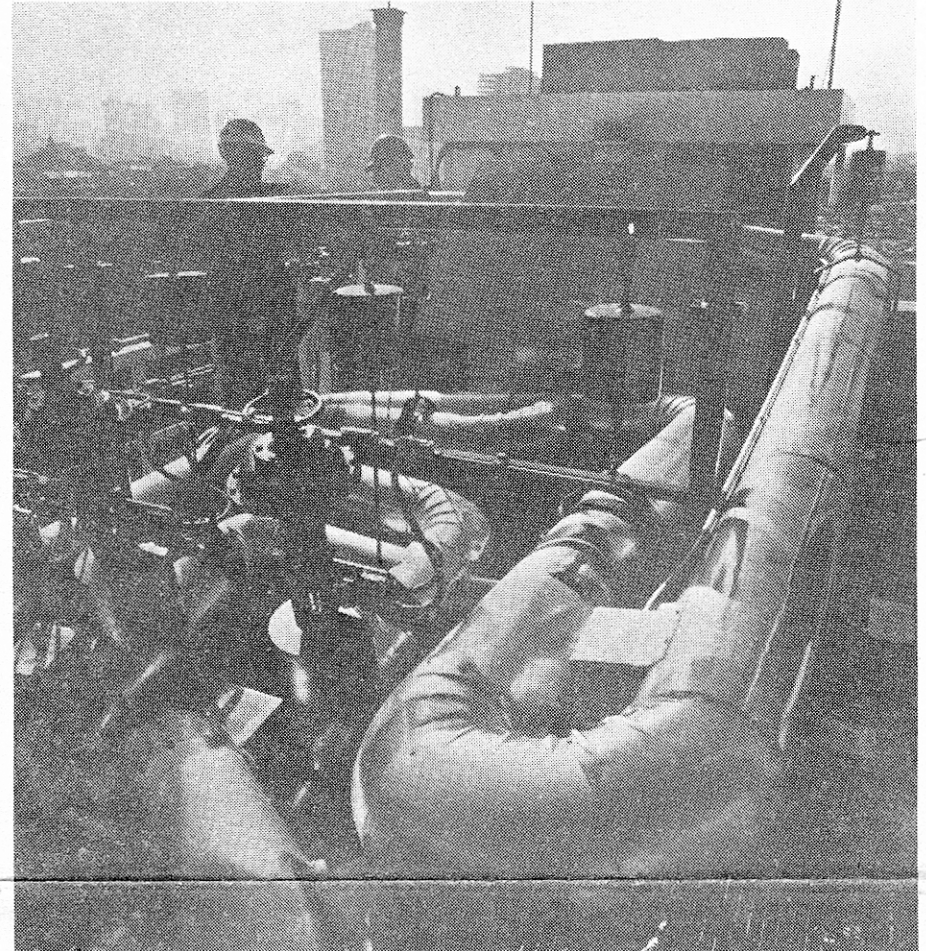
the solar receiver smaller, lighter in weight, and thus less expensive. And, by eliminating a maze of tubes, the apparatus becomes less complicated, thus reducing maintenance costs," Brown explains.

The project began more than two years ago, when researchers at the Solar Energy Research Institute (SERI) asked for Georgia Tech assistance in assessing the technical feasibility of the molten salt heat transfer process. "They contracted with us for the conceptual and detailed design of the hardware," Brown says. "We also wrote the specifications package for fabrication of the major hardware. Martin Marietta was a subcontractor to us during the design phase."

SERI brought the absorber panel and associated equipment in on a tractor/trailer in late August, and the 'salt loop' underwent four weeks of ground-level checkout and testing. GTRI personnel, who were responsible for designing and fabricating the ceramic solar cavity apparatus, spent the next three weeks installing it around the absorber panel. It took an 80-ton crane to hoist the huge assembly (12 1/2 feet wide, 26 feet long, and weighing 11,000 pounds) onto the tower. Finally, on October 20, the four weeks of actual solar testing began.

Brown says the Advanced Components Test Facility's sophisticated data collection system was an essential part of the experiment. "The complexity of the experiment and the number of things to be monitored required a data system like ours," he explains.

"We are pleased with the



High atop the Georgia Tech solar tower, the "plumbing" for the molten salt loop looms in the foreground. After absorbing heat from the sun, the molten salt gravity drains from the absorber panel into two tanks, then is pumped back to the absorber panel to repeat the cycle. (Photo by Charles Haynes)

test results," Brown says. "The experiment proved the validity of our approach, although we did have a few 'surprises' that will require further work. One surprise was that the transparency of the salt allowed the back panel to get too hot, creating dry spots where the salt evaporated instead of flowing. A blackening agent can be added to the salt to prevent this."

In order to get as high a temperature as possible (up to

900°C), they used a eutectic (low melting point) mixture of carbonate salts. SERI also will be looking at other salt combinations to come up with a better one—preferably one that is liquid at room temperature so that the plumbing won't 'freeze up'.

"Our concept is geared to electric power generation, although it's adaptable to other industrial applications," Brown says. "Utilities generally are

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Watt Selected STL Director

Charles K. Watt, president of the International Test and Evaluation Association, has been appointed director of GTRI's Systems and Techniques Laboratory (STL). He assumed his new position in early February.

"Georgia Tech is extremely pleased that a person of Mr. Watt's caliber has joined us as a laboratory director," said Gerald Carey, GTRI associate director. "He starts with a full plate of challenges and oppor-

tunities. We look forward to great things from him."

For the past four years, Watt also has been one of the top administrators in the Office of the Secretary of Defense (OSD). In his last assignment at OSD, Watt served as acting director of Defense Test and Evaluation. Before joining OSD, he directed technical operations at the Naval Electronic Systems Engineering Center. He also led a special Congressional task force which

predicted the impact of new telecommunications technology on society through the year 2000.

Watt currently serves as chairman of Clemson University's Professional Advisory Board. He holds a BS degree in electrical engineering from Clemson and advanced degrees in engineering and management from George Washington University. He is a graduate of the National Defense University.



Shown at the Retirement Reception are (left to right): Don Grace, Marion Knight, and retirees Jim Knight, Lewis Elston, and Bob Wohlers. (Photo by Charles Haynes)

Five Retirees Honored at January Reception

GTRI bid adieu to five well-known, highly valued employees on January 22 at a retirement reception held in their honor at the Alumni/Faculty House Ballroom.

Friends and coworkers attended the event to toast, roast and pay tribute to EMSL's Lewis "Pete" Elston and James Knight, SEL's Robert Wohlers, STL's Berry Pyron and FMD's Wardell "Steve" Stephens. At the reception, they were recognized and thanked for their contributions to Tech through speeches by coworkers, individual congratulations and by the award of a special plaque from GTRI.

Lewis "Pete" Elston joined GTRI in 1957. During his

28-year career here, Elston was primarily engaged in studies on coal desulfurization, biomass pyrolysis, analytical chemistry and laboratory apparatus design. He holds five patents and has authored more than 20 major publications. EMSL Associate Director Dan O'Neil said that he will be fondly remembered as "a versatile, brilliant experimentalist—a Rube Goldberg who can and has created just about everything needed in the course of his research."

About Dr. James Knight, who began his career at Georgia Tech in 1950, O'Neil said, "He is a world authority in the field of biomass conversion. . .in the pyrolysis of agricultural,

forestry and industrial wastes. His exemplary work has literally brought in millions of dollars in contracts to Georgia Tech. It has been a privilege and a pleasure to be associated with a scientist of Jim's caliber—he will be impossible to replace." A principal research scientist at the time of his retirement, Dr. Knight holds a patent for his well-known entrained pyrolysis/gasification process. He also authored more than 80 scientific reports during his 35 years at Georgia Tech.

Affectionately dubbed as the "SEL staff curmudgeon" during a "roast" by Associate Lab Director Lee Edwards, Robert Wohlers has been a senior research engineer with GTRI since 1979. A former staff scientist with Calspan, he has extensive experience in radar systems, microwave electronics, and electromagnetic scattering. Wohlers holds 16 patents and has authored more than 38 professional publications during his career. Known as "Uncle Bob" to SEL staffers, Wohlers was also given a special diploma at the reception which detailed his "SEL battle scars" and awarded him an honorary degree as a "Doctor of Sophistry."

Retiring STL Assistant Director Berry Pyron's career at Georgia Tech began in 1950 as a physics instructor. He joined GTRI as a full-time researcher in 1952. During the past 33 years, he has brought distinction to GTRI both as a manager and as an expert in all aspects of foreign radar and missile systems. For the last six years, Pyron has served in a dual role, as STL assistant

director and director of the lab's "A" Program Office. He has authored 48 scientific reports and publications. In remarks honoring Pyron, GTRI Director Donald Grace said, "We deeply appreciate his service to GTRI. He will be greatly missed." STL's Charles Wilson accepted the retirement plaque for Pyron, who could not attend the ceremony.



Retiree "Steve" Stephens accepts best wishes from his former boss, Tom Jones. (Photo by Charles Haynes)

"For 18 years he has been my source of where and how to find things, and my expert on how to do just about everything," said FMD Manager Tom Jones during his toast to Wardell "Steve" Stephens. "He's helped all of us at GTRI—and given a lift to our daily lives—by fixing things in our offices and taking care of us all. He will be sorely missed." A mechanical technician II at retirement, Stephens plans to enjoy his free time after 31 years of service to Georgia Tech.

RSTF Trains 1,900 Students in First 18 Months

In its first 18 months of operation, GTRI's Research Software Training Facility (RSTF) has provided more than 9,980 hours of classroom instruction to 1,900 students from the Tech community.

"These statistics are very exciting to us," says GTRI senior staff member Fred Dyer. "They show that RSTF is providing a valuable and much needed service to the Tech community. In fact, RSTF's growth has been so phenomenal that the staff has trained more students in the last six months than in the entire first year of its operation."

"RSTF hopes to expand even further with the addition of several desirable services, including upgraded training computers, a product evaluation facility, a public domain software library, a self-paced training facility, and at least one

more specialized classroom training area," says Dyer.

In July 1984, RSTF's first month of operation, 68 students attended two courses, Beginning DOS and Beginning dBASE II. Today, as many as 196 students attend 18 RSTF courses each month, as well as eight special courses which are taught every two to three months.

Among the 33 courses now taught by RSTF personnel throughout the year are: PROFS, LISP, Lotus 1-2-3, DisplayWrite 3, Computer Literacy, Volkswriter, Access 204, Superproject, Presentation Graphics, Wordstar, Survey of Communications Packages, Videoshow, and the Symphony group—Spreadsheet, Word Processing, Database, Graphics and Integrated Environments. Several courses are also offered on demand, such as Per-

sonal Editor, USCD Pascal and 8088 Assembler. According to Pat Mathiasmeier, who manages the training operations, the most well-attended and frequently held classes are Beginning DOS, Beginning dBASE II, and Beginning Lotus 1-2-3.

"There are many reasons for the success of the software training facility," says Dyer. "Perhaps the most important is

the staff's flexibility and willingness to meet the ever increasing demand at Tech for a variety of software training courses."

Dyer says RSTF staff members not only teach classes, but they also actively recruit instructors from other units at Tech. Thus, the facility is able to offer a wide variety of practical experience in many areas of software applications.

Software Training Schedule

Beginning Symphony (9-4:30): Mar. 12.
Symphony Database (1:30-4:30): Mar. 7.
Beginning PROFS (10-12): Mar. 6, 27.
PROFS Scheduling (10-12): Mar. 13.
Computer Literacy (9-4:30): Mar. 3, 18.
Beginning dBASE II (9-4:30): Mar. 11.
Advanced dBASE II (9-4:30): Mar. 17.
Beginning Lotus 1-2-3 (9-4:30): Mar. 5.
Advanced Lotus 1-2-3 (9-4:30): Mar. 20.
Beginning DOS (9-12:30): Mar. 7, 21.

(1-4:30): Mar. 4.
Advanced DOS (1:30-4:30): Mar. 31.
Beginning Wordstar (9-12): Mar. 4.
Volkswriter (1:30-4:30): Mar. 13.
LISP (9-4:30): Mar. 24-26.
Videoshow (1:30-4:30): Mar. 14.
DisplayWrite 3 (9-12): Mar. 10.
On-Line Catalogs (9-11:30): Mar. 19.
AI Power Tools (9-12): Mar. 28.
Call ext. 6206 to sign up for classes.

QUESTIONS, ANYONE?

by Charles McCullough

People do the most unusual things some days. They tumble down stairs. They fall out of chairs. Their hands / knees / heads make sudden, unplanned contact with saw blades / hammers / file cabinet drawers. And on company time!

Fortunately, GTRI's accident incidence is low, but when one of our rare on-the-job (OTJ) injuries does occur, it's important that everyone be alert to the correct administrative procedures that must be followed.

One of the most frequently asked questions that we hear at HRD concerning OTJ injuries is: "If medical care is not required for an accident that occurs on the job, must the accident be reported?" The answer is YES.

Employees should keep in mind that the full effects of injuries suffered in an accident may not be apparent immediately or even within a few days after an accident. This makes it very important that a tumble down the stairs, for example, be reported via an "Employer's First Report of Injury or Occupational Disease" form even if the would-be gymnast does not require—or refuses—medical attention. Thus, when an employee discovers two weeks later that both legs are fractured, the authorities are already aware of, and prepared to act on, the injury without the need for appeals, justifications, explanations or other unnecessary paperwork.

Employees also should be aware of a major change in current procedure that's anticipated in the near future.

When an OTJ injury is severe enough to warrant emergency medical care, GTRI employees, for many years, have gone to health-care providers of their choice. This will soon change, due to a new requirement that treatment for injuries suffered on the job be obtained from an authorized health-care provider listed with the State of Georgia's Department of Administrative Services (DOAS). When this change takes place, employees obtaining emergency care for OTJ injuries from a clinic or physician not on the authorized list may find that their coverage and rights under the Worker's Compensation Act have been jeopardized.

Dot Curry, Georgia Tech's manager for staff benefits, says a major information campaign will be launched to announce this procedural change prior to its implementation.

For more information on how to properly handle an OTJ injury claim, please consult Procedure 10-14 in the *GTRI Procedures Manual*. Then, if you still have questions, call HRD. We'll be happy to help!

Editor's Note: Charles McCullough is an administrative coordinator for GTRI's Human Resources Department. Through "Questions, Anyone?," a new Connector column, he will regularly answer the most frequently asked questions about employee benefits and other personnel matters.

Regional Offices Recruit Students

GTRI's regional offices helped alumni committees throughout the state to select high school students for the President's Scholarship Program in January. The regional offices, administered by EDL, have played a key role in this program for several years.

According to Dr. E. Jo Baker, associate vice president for academic affairs, "Four years ago, the campus alumni committee was struggling with statewide recruitment. People outside metro Atlanta seemed to feel that Tech wasn't interested in them. So, after learning about the regional office network, the selection committee sought and obtained approval to use the outreach potential of these offices."

GTRI regional office personnel participate in the President's Scholarship Program in several ways. They identify and recruit alumni who may wish to serve on the screening committees. They organize and coordinate committee efforts, supply information, and provide liaison with the campus

scholarship committee. The regional office directors also talk with high school counselors and build rapport among the schools and area alumni.

In 1981, six students were selected to receive President's Scholarships. This year, approximately 20 to 25 students will be selected from more than 200 qualified applicants who want to receive these top awards of some \$6,000 annually. Many others in the program will receive lesser awards.

"We make a substantial investment in these students, so the screening process is very important," says Dr. Baker. "There's no question that GTRI's involvement has contributed to the success of the program."

"This work is very rewarding," says George Lee, director of the Macon Regional Office. "We get the alumni involved and keep them informed. And we keep our young people thinking about Tech. We want to keep Georgia students in Georgia."

Salt (from page 1)

comfortable with the molten salt approach. The salt would be heated in a central receiver on a solar tower, then piped to the ground, where a heat exchanger would transfer the heat to generate high-pressure steam. The steam would turn a turbine to generate electricity. Excess salt could be used for buffer storage to take care of small cloud transients. Such a plant probably would be built next to an existing conven-

tionally fueled plant, such as coal-fired, which would take over during extended periods of cloud cover."

A Georgia Tech graduate, Mark Bohn (mechanical engineering, 1972), was the principal investigator for SERI. David Asbell and Tom Brown directed the project for GTRI. Other EMSL/ACTF staff members with significant involvement were Doug Neale, Paul Mackie, C. J. Swafford, Rick Zabor, Art Sales, and cops Russ Anderton, Will McGeorge, and Doug Peace.

PROFESSIONAL ACTIVITIES

ECONOMIC DEVELOPMENT LAB

Carrollton Regional Office Director **Harris Johnson** is conducting a 55-hour short course at the Southwire Company.

Costas Soulakos and **Chris Thompson** participated in the "Applying Machine Vision to Your Manufacturing Process" workshop in Orlando.

Deborah Lockman has received an award of merit from the Society for Technical Communication for her IEES brochure on "Improving Industrial Efficiency."

Division Chief **John Nemeth's** article on "Environmental and Workplace Protection: Georgia Tech's Role" will appear in an upcoming *Tech Topics* magazine.

In February, several EHSD staff presented to state experts an overview of a hazardous material emergency response course. EHSD will conduct the course this summer.

ELECTROMAGNETICS LAB

John Gilmore and **Kirt Pulaski** presented a paper and demonstrated EML's Generic Expert

System Tool at the recent IEEE Conference in Miami Beach. The paper was entitled "A Survey of Expert System Tools." Gilmore also conducted an "Artificial Intelligence/Expert Systems" Continuing Education course in February. **Gilmore, Kurt Gingher** and **Steve Tynor** attended the Automatic Target Recognizer Working Group held at Martin Marietta Aerospace.

Microcircuit reliability expert **Billy Livesay** recently was quoted in *Science News* in a major article on "Sick Chips."

T. S. Srivatsan's paper, "Microstructural Analysis of Aluminum-Lithium Alloys," appeared in the December/January issue of *Aluminum*. He has two other papers in press: "Micro-mechanisms Governing Elevated Temperature Fracture Resistance of an Al-Cu-Li-Mn-Cd Alloy," which will appear in the *Journal of Materials Science Letters*, and "Microstructural Characterization of Two Lithium-Containing Aluminum Alloys," to be published

in the *Journal of Materials Science*.

ENERGY & MATERIALS SCIENCES LAB

Wally Shakun co-hosted the WAGA-TV science program, "Of Bees and Dogs," which aired in late December.

Ginny DiSalvo has been appointed the new EMSL associate editor for *The GTRI Connector*.

David Asbell presented a paper to the Antenna Measurement Techniques Association meeting in Florida on "Feasibility of a Large Outdoor Compact Range." The paper was co-authored with **Ed Joy** of EE.

Tom Starr recently presented a paper on "Packing Density of Ceramic Fiber/Powder Blends" at the National Bureau of Standards Symposium on Composite Materials.

In January, **Tom Brown** participated in meetings at Texas Tech University as a member of DOE's Technical Advisory Board on the Crosbyton Solar Bowl project.

RESEARCH COMMUNICATIONS

"The Pioneering Spirit," a

videotape produced by **Ray Moore**, RCO Director, and **Russ Moore**, Tech News Bureau, has won a Grand Award from the Council for the Advancement and Support of Education. In the same contest, "Research at Georgia Tech," a booklet produced by **Jackie Erney**, **Henry McDonald**, and **Charles Haynes**, won an Award of Excellence. *Research Horizons*, a magazine produced by **Mark Hodges**, won an Award of Merit from the Society for Technical Communication. **Charles Haynes** captured an Award of Merit in the same contest for his photography.

Ray Moore has been named 1986 state chairman of the Business Council of Georgia's Student Teacher Achievement Recognition (STAR) program.

SYSTEMS & TECHNIQUES LAB

Donald Bodnar recently participated in the Administrative Committee meeting of the Antennas and Propagation Society. He also chaired the IEEE Antenna Standards Committee meeting at the URSI Conference in Boulder, CO.

In Memoriam: Ronald Bradford

Ronald R. Bradford died on February 13 after being hospitalized for pneumonia, leukemia and tuberculosis. A ten-year employee, he was a research engineer with RAIL's Technology Development Division.



Bradford joined GTRI in 1975 after receiving his BS degree from Georgia Tech's Electrical Engineering School. He was an expert in radar systems, digital circuits, and foreign technology. He served as a task leader for RAIL on several projects involving simulation and exploitation of foreign technology, especially radar receiver and control systems.

He was a veteran of the Vietnam war, where he received the Purple Heart and the Silver Star for gallantry in action. Even though he was severely wounded, he was credited with saving the lives of several of his comrades by returning hostile fire and fighting off the attacking enemy.

At the time of his death, Bradford was a colonel in the Civil Air Patrol and was the commanding officer of the DeKalb County Cadet Squadron. He had served in the CAP for more than 15 years at various levels. His honors included the meritorious service award for accomplishments at the state level and an exceptional service award for work at the national level.

A dedicated and well-liked employee, Bradford leaves behind many deeply saddened friends and co-workers in GTRI.

Tax Reform Bill May Adversely Affect Educators' Annuities

If you are contributing to a tax-sheltered annuity, you need to know that the tax reform bill (HR-3838) now before the U.S. Senate contains unfavorable changes to 403 (b) tax-sheltered annuity (TSA) plans.

The bill, which already has passed the House, proposes to add a 15% early withdrawal penalty and restrict withdrawals prior to age 59 1/2. There currently are no such restrictions, but the bill would apply them retroactively to deposits made prior to change in the law. Many educators complete 30 years of service in their early to mid-50's and need to withdraw large amounts before they are eligible for Social Security payments.

The proposed legislation

also substantially reduces the contribution limits. Even the valuable "catch-up" options would be reduced substantially. This penalizes educators who were on low fixed incomes early in their careers and who now would like to make up for years they did not contribute to a TSA plan.

There is still time to write or call your senators:

- Senator Sam Nunn
303 Senate Dirksen Office Building
- Senator Mack Mattingly
320 Senate Hart Office Building
Washington, D.C., 20510.

For further details, contact your TSA account representative.



Berry Pyron (left) and Sam Alford were honored recently by the Systems and Techniques Laboratory staff for their years of dedicated service to the Lab and GTRI. (Photo by Kay Lindsey)

Personal Notes

EDL: Congratulations to Ken Kucera on his marriage to Dixie Chester.

SEL: Heartfelt condolences are extended to Janice Manders on the death of her father, Richard Porter.

Best wishes to Phil West of CAD on his recent marriage to Chris Hammernick.

THANKS!

The editor thanks Jackie Erney, RCO, for assisting as guest editor for the February issue of the *Connector* while she was in Egypt on a Georgia Tech assignment.

PERSONNEL NEWS

ECONOMIC DEVELOPMENT LAB

Ken Johnson has been named associate chief of the Environmental Health and Safety Division.

The Industrial Education Group welcomes Lynn Holt, staff assistant, and John Willis, a new training consultant.

ELECTROMAGNETICS LAB

Congratulations to David Ho and Kirt Pulaski on receiving their MS degrees from Tech's ICS School.

EML welcomes Dr. Richard Sanford, who is working with the AI Branch during a six-month sabbatical from the University of Alabama.

Marion Jane Haraway, artist I, and Robert P. Lilly, electronics technician III, are now full-time staff members.

Dan Winester, GRA, has resigned his position in EML.

ELECTRONICS & COMPUTER SYSTEMS LAB

John Hothkiss, a former ECCL co-op, has joined the lab as an RE I. ECCL also welcomes new student employees Rita Harder, Sharon Matson, Dale Huff, Morgan McRae, James McLaughlin, Ashley Slappy, Stephen Kim, and Lynn Kues.

The Computer Technology and Applications Division welcomes Henry Hexmoor, RE I, and Benjamin White, programmer III.

The Antenna Development Branch welcomes John Estrada, RE I.

Vergil Daughtery, word processor operator, has transferred to ECCL's Office of the Director from HRD.

Congratulations to Eric Barnhart on receiving his MSEE and to Louis Haller on his promotion from co-op to RE I.

Casey Lang has resigned and Mike McCracken has transferred to Tech's ICS School.

ENERGY & MATERIALS SCIENCES LAB

Dan O'Neil has been appointed associate director of EMSL. He will continue to serve as chief of the lab's Chemical Systems Division.

Congratulations to Arleen Edmiston for making the Dean's List at Georgia State while pursuing her degree in social work.

EMSL welcomes Walter Jackson ("Jack") Lackey, PRS, to the Materials Sciences Branch, where he will be working on ceramic coatings. Daniel W. Plonk, RE I, has joined the Thermophysics Branch.

HUMAN RESOURCES DEPT.

HRD welcomes Maude Bruce, senior secretary, and Anicia Lane, word processor operator.

Gay McLarin has been promoted to administrative assistant, and Cathy Dunnahoo has advanced to staff assistant. Cathy Yearwood has transferred to Tech's Budgets Department.

MECHANICAL SERVICES DEPT.

MSD welcomes new machinists Mark Bishop and Chris Ketchum.

Congratulations to James Nowell, Clay Donaldson and Jimmy Ross on their promotion to machinists.

OFFICE OF THE DIRECTOR

Robert ("Mike") O'Bannon has joined the senior staff of OOD. A former management psychologist with the consulting firm of Bleke and Boyd, he will create new management development programs for GTRI. O'Bannon earned his Ph.D. in clinical psychology at the University of Alabama.

Marie Harden, senior administrative secretary to Associate Director Gerald Carey, has retired after 10 years of service to GTRI.

RADAR & INSTRUMENTATION LAB

Herman Pardes, SRS, has joined the staff of the lab's New Jersey Office. Pardes has more than 30 years experience in military systems and optics research.

Maureen Hennessey is now a full-time secretary with this office.

The Modeling and Simulation Division welcomes Marty Alexander, SRS, an expert in radar systems, EW and missile seekers.

RAIL also welcomes Lynn Baxter, part-time clerk typist I, and Annette Weinberger, part-time clerk II.

David Odom, RS II, has resigned his position.

SYSTEMS ENGINEERING LAB

Congratulation to David Flowers on being named SEL's December "Employee of the Month."

SEL welcomes Michael Cooper, co-op with the CAD/Sensor Performance Branch, and Sandy Wilson, word processor operator with the Human Performance Branch.

Cecilia Kilpatrick, systems analyst, and Brian Butka, RE I, have resigned. David Zurn has transferred to ECCL.

Congratulations to Ken Trussell and Ron Strickland on respectively obtaining their MSEE and MSIM degrees from Tech.

SYSTEMS & TECHNIQUES LAB

Jerry Phelps, Richard Ivy, and Sheron Boyd have resigned.

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