# The *GTRI* Connector

**There's many a slip 'twixt the tongue and the lip...**

"Before you give somebody a piece of your mind, make sure you can get by with what you have left."
—*Anonymous*

"Mincing your words makes it easier if you have to eat them later."
—*Franklin P. Jones*

"Speak when you are angry and you will make the best speech you will ever regret."
—*Ambrose Bierce*

## Mr. Watson, come here, I need you!

**By Martha Ann Stegar, RCO**

*A busy executive is making the rounds of his senior associates' offices to check on urgent matters. He's expecting an important phone call, but his secretary doesn't know where he is at any given moment. No problem: the phone rings—he extracts a small box about the size of a pocket calculator from his coat pocket, flips it open, puts it to his mouth and ear, and takes his call.*

*Later, he catches lunch and runs an errand at a nearby shopping mall. He suddenly remembers something he needs to tell the office immediately. Again he whips out the little box, dials the office, and relays the message.*

Science fiction? No, just Personal Communications Services (PCS) technology, and it may be here sooner than you think.

The concept is simple: Today's small, portable cellular telephones transmit roughly 0.6 watts. A battery pack that will support several hours of talk time is large enough to prevent the construction of a shirt-pocket sized unit. By reducing the output power to the milliwatt range, one can use smaller batteries and develop a handset that is truly 'shirt-pocket' in size and weight. These 'microcellular' telephones would work as part of a very short-range network in which cell radii are on the 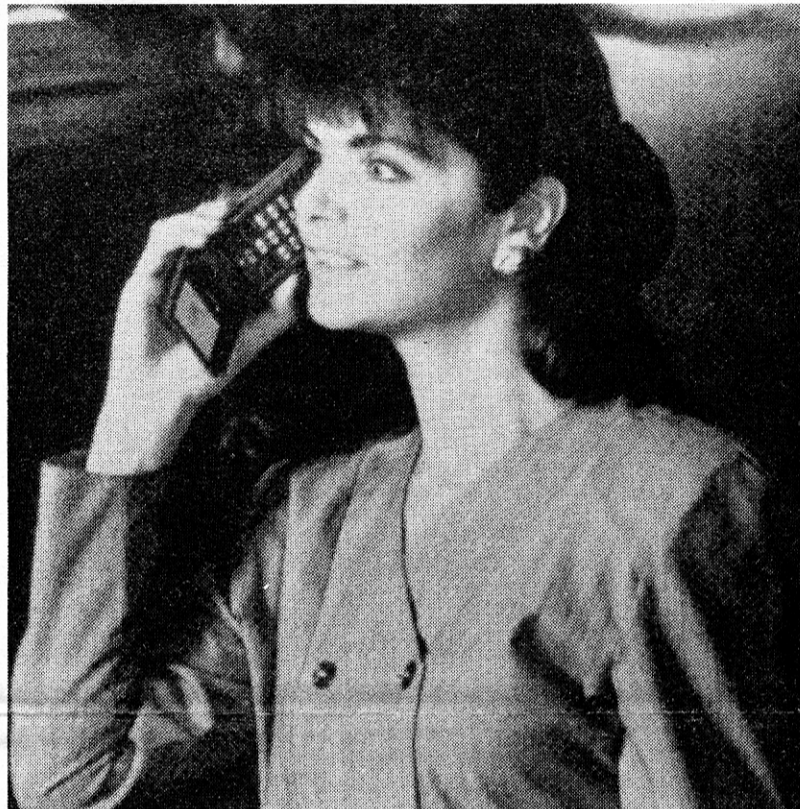order of a few hundred meters or less. These pocket-sized communicators would connect through a microcell base to the landline network, much as cellular radio does today.

### GTRI and BellSouth team up

BellSouth Enterprises, Inc. is one of several companies in the U.S. that are exploring PCS technology, and organizations in Europe are well along in similar research. Last month, GTRI's Communications Laboratory began a research program to support BellSouth in the development of PCS technology, systems, networks and services. According to project director Eric Barnhart, GTRI will conduct analyses and experiments to characterize the radio propagation channel inside office buildings to support development of a PCS testbed. "The office environment appears to offer the highest potential density of users, which makes it the most economically attractive option," he says.

"We expect that the attenuation or weakening of the radio signal in the bands proposed for PCS, due to absorption by building materials, will make microcellular voice communications practical," Barnhart says. "Hopefully, the attenuation will allow the same frequencies to be reused by microcells in different buildings within a small area or on different floors of the same building so that enough subscribers can be supported to make the service economical and feasible."

The analog cellular phones in use today operate over a distance of several miles, and available capacity to assign to new subscribers is in short supply, Barnhart explains. The soon-to-be introduced digital mobile cellular systems will provide more capacity in the same portion of the electromagnetic spectrum, but demand for service continues to grow rapidly. Even this extra capacity eventually will be exhausted. The third-generation PCS technology will create additional capacity because of its short range and associated frequency reuse.

Barnhart and his colleagues, Les Pickering and Mike Witten, are excited about this opportunity to advance the body of knowledge in indoor radio frequency propagation. "We hope to learn enough about how building structural elements, such as metal framing, suspended ceilings, and reinforced concrete floors, affect attenuation to make the result generally applicable," Barnhart says. "And we're not only concerned with radio frequency losses, but also with the impact of other radio frequency emissions on communications receivers."

*Lightweight, pocket-size handsets like this one will make personal communications services convenient. GTRI is working with BellSouth Enterprises to determine the feasibility of developing and commercializing this technology. (Photo courtesy of BellSouth Enterprises, Inc.)*

## Observed & Noted

The deadline for Research Award nominations is October 3! *See page 2.*

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Don't forget to attend one of the "GTRI--Present and Future" meetings. Dates are October 9-12. *Details are on page 3.*

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IEEE Software Engineering Advisory Group meets at GTRI. *Details on page 2.*

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GTRI-developed software tools help the Air Force automate and improve the testing of circuit cards for electronic equipment. *Read about it on page 3.*

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This month THE GTRI CONNECTOR spotlights our student employees and the mutual benefits to GTRI and students of involving them in our research activities. *Centerfold stories and pictures are on pages 4 and 5.*

■

Do we use a lot of paper at GTRI? *See recycle update on page 6.*

■

"Why should it matter whether I charge to vacation or sick leave?" *Charles McCullough tells you why on page 7.*

■

*Also on page 7, learn 10 tips for productive desktop publishing.*

Congratulations to Nile Hartman (Physical Sciences Lab) for receiving a U.S. patent on his "Optical Sensing Apparatus and Method." *Catch up on other staff activities on page 8.*

# News & Notes

## BellSouth

The Federal Communications Commission will assign experimental frequencies to BellSouth. The company wants to build a PCS testbed and put it to use to see how subscribers would use it.

"The development of Personal Communications Services is a major initiative for BellSouth," says Neale Hightower, operations manager for wireless technology research, strategy and planning. "PCS will have a significant impact on the telecommunications world over the next several years." He adds, "We believe that PCS will complement services already available and will make current cellular, wireline and long-haul services more effective by allowing efficient access through PCS. BellSouth is already in a number of related businesses, and we are working hard to bring PCS to the public."

### Possible follow-on research

Beyond characterizing the propagation channel, GTRI may help BellSouth with follow-on R&D. Work could include supporting BellSouth in developing the base and mobile terminals for PCS, assisting them in characterizing the tradeoffs among several potential multiple-access strategies, and examining potential modulation formats with regard to their performance in data transmission, frequency reuse considerations, security, privacy, and performance in the presence of anticipated channel anomalies such as reflective multipath.

"A key factor," Barnhart says, "will be the ability of the modulation type chosen to perform well in the harsh reflective multipath office environment, due to the reflective surfaces of the building itself as well as the furnishings, fixtures, and other equipment installed in the building. As a result, there can be significant signal fading at certain frequencies," he explains.

"We'll also have to consider ranges to be encountered within buildings, and on links between points within buildings and the immediate exterior, as well as the limitations of communications approaches utilizing single base stations and antennas."

Barnhart stresses: "This program is part of an ongoing effort to establish collaborative ties to the telecommunications industry in the Atlanta area. We're trying to diversify our project base and increase our industry support. We want to apply the skills we have developed in working with Department of Defense sponsors to commercial applications, as well as to develop commercially applicable skills and use them in our DoD work." ❑

*"We want to apply the skills we have developed in working with Department of Defense sponsors to commercial applications, as well as to develop commercially applicable skills and use them in our DoD work."*
*—Eric Barnhart*

## GTRI in the news

*(Editor's Note: This is the first of a series of monthly roundups of significant GTRI publicity in the national media compiled by the Research Communications Office. Readers who know of any other significant news coverage that we fail to mention are asked to contact John Toon, RCO, 894-6986. Following is a summary of June activity.)*

In June, GTRI received significant national research publicity in the following areas:
• The laser-induced fluorescence technique developed by Tony Hynes with Senior Technology Guidance Council funding continued to draw attention. Articles appeared in *Ceramic Industry* (circulation of 10,000), *Elec-*



*The GTRI Program Development Office had a reception for the federal field office managers August 27, while they were on campus for a meeting. Shown left to right are Joe Harrison (Eglin, FL), Bob Mobley (Warner Robins, GA), Dick Stanley (Huntsville, AL), Sal Nasci (Rome Air Development Center, NY), Joe Johantgen (China Lake, CA), Dave Erikson (Dayton, OH), Herman Pardes (Ft. Monmouth, NJ), plus Don Wilmot and Bob Zimmer (Program Development Office-campus). (Photo by Joe Schwartz)*

*tronic Design* (150,000), *Electronic Packaging & Production* (50,000), *Microcontamination* (30,000), and *OE Reports* (75,000). Information about this work has appeared in eight publications with a total circulation of more than 250,000. The project involved a new diagnostic technique for studying silicon deposition in plasmas.
• An article about the conductive sealants being developed by Jan Gooch and John Daher appeared in *Aerospace Engineering* (68,000).
• Ergonomics research by Mike Kelly and Dan Ortiz was the subject of articles in *Daily News Record* (24,000) and *Industrial Engineering* (47,500). The story has now reached over 350,000 readers.
• *Defense News* (30,000) wrote about the sensor fusion simulator project headed by Nick Faust. This project also is an STGC effort. ❑

## Nominations due October 3!

If you haven't already recommended an outstanding co-worker or two to your lab director or service unit manager for a GTRI Research Award, please do it now! They must submit their nominations with supporting materials to the Research Awards Review Committee by October 3.

The awards committee will select 17 award recipients from the numerous nominations (up to 282 are possible under the rules) that are expected to be submitted. Each of the awardees will receive a personal engraved wall plaque, a $100 certificate for dinner for two at a restaurant of his/her choice, and a letter of commendation from GTRI Director Don Grace. The honorees' photographs also will be displayed all next year in the buildings where they work.

The Eighth Annual Research Awards presentation and reception will take place December 6, from 3 to 5 p.m., in the Student Center ballroom. Mark your calendars now!

## GTRI hosts IEEE technical advisory group meeting

GTRI's Threat Systems Development Laboratory (TSDL) hosted a meeting of the IEEE Computer Society Technical Advisory Group for Software Engineering August 13-14 at the Cobb County Research Facility. Richard Ivy, a research engineer with TSDL, acted as host, and TSDL Director Joe Parks gave the opening address.

The Technical Advisory Group is concerned with the development of international standards in software engineering. It provides the technical leadership for determining and developing the U.S. positions and inputs for international software standards development activities. It also supplies delegations and technical experts to represent the United States and accept leadership positions, through the American National Standards Institute (ANSI), on associated international software engineering standards committees.

Richard Ivy has been the GTRI representative on the committee for about three years, and has accepted several leadership positions on both the national and international levels. He also has represented the U.S.A. during several international meetings and plenary sessions.

The committee's members represent a broad cross section of U.S. educational, governmental and industrial organizations. They include GTRI, Carnegie Mellon's Software Engineering Institute, several components of the Department of Defense, the National Institute of Standards and Technology (formerly the National Bureau of Standards), Bell Communications Research, Boeing Computer Services, Computer Sciences Corporation, General Dynamics, General Electric, Grumman Data Systems, GTE, IBM, Lockheed, Logicon, MITRE, NYNEX and Unisys. Many professional associations, including IEEE, ANSI and EIA, also participate. The committee continually strives to identify and recruit additional representation from all specialties within the U.S. software engineering community.

For additional information, contact Richard Ivy, TSDL/GTRI, 528-3266. ❑

# Annual GTRI meeting coming in October

Next month you will have your annual big chance to find out how GTRI has been faring and what the outlook for the future may be. Dr. Grace will make his customary "GTRI—Present and Future" presentation at meetings scheduled for October 9-12, and you will have an opportunity to ask questions and make comments.

All GTRI employees are expected to attend one of the following meetings, each of which will be held from 3 to 5 p.m.:
- Cobb County, Building 1 Auditorium: October 9 and 10
- Campus, Student Center Ballroom: October 11 and 12

Refreshments will be served.

This year's sessions should be of greater interest than usual, due to the restructuring. Don't miss the opportunity to attend one of these meetings. It's YOUR future that's at stake! ❏

*See you at the GTRI meeting!*

# AIDS education offered at Georgia Tech

**By Pamela Richmond**
**AIDS Task Force**

Over time, AIDS will undoubtedly have an impact—either directly or indirectly—on every member of the Georgia Tech community. The way members of the Tech community understand and deal with these issues affects the Institute's ability to attract and retain a high-quality work force and student body. We must address the fear, anger, resentment, guilt and denial, as well as the feelings of helplessness and loss associated with AIDS and HIV infection as we develop strategies to deal with the presence of AIDS on campus.

Four AIDS education sessions will be offered for vice presidents, deans and directors. The time will be 9:30-11:30 a.m. Dates and places are:
- Oct. 15 & 24: Rm. 228, Ivan Allen College
- Oct. 30 & Nov. 7: Poole Board Room, Wardlaw

Three open sessions will be offered during the fall quarter for individuals who haven't been able to attend a program arranged through a student group or campus department. Employee sessions include:
- Oct. 19: 10-12 a.m., Room 343, Student Center
- Nov. 5: 2-4 p.m., Room 227, Student Center
- Nov. 15: 10-12 a.m., Room 227, Student Center

AIDS exists at GT and inevitably sparks a wide range of emotions. The sensitivity and support we extend to employees and students affected by AIDS to continue work and study will declare emphatically that GT values all members of the campus community.❏

# Passing the test for circuit cards

**By John Toon, RCO**

As military electronic equipment grows more complex, so do the problems of testing and maintaining it. GTRI engineers have developed a set of software tools to automate and improve the testing of analog and hybrid circuit cards.

Developed for the U.S. Air Force and currently in use, the Automatic Test Equipment Software Support Environment (ATESSE) will help boost aircraft readiness — while reducing maintenance costs. The tools may eventually help designers produce electronic equipment that is easier to test.

"Trying to design test programs for mixed analog-digital circuits is a difficult problem," explains Fred Cox, of the Software Research Branch in the Engineering Sciences Laboratory. "What we have put together is a set of tools that help test engineers develop their programs on computer-aided engineering workstations."

The ATESSE tools help engineers (1) simulate normal circuit performance, based only on design information, (2) determine proper tolerances for testing, (3) simulate the operation of faulty circuits, (4) automatically produce software code for test programs based on flow chart information, and (5) compare circuit simulations to actual circuit operation.

## Isolating faulty parts

Test engineers face a complex problem: detecting, isolating and replacing faulty components in malfunctioning circuit cards. With the rising cost of circuit cards and the components on them, the Air Force would like to replace only the malfunctioning components. But isolating those parts can be difficult, particularly in analog circuits, where the number of ways faulty behavior can be expressed is fairly large. "It's very difficult for an engineer to understand the full range of possible fault behaviors for a complex analog circuit," Cox says.

To find the faulty part, engineers calculate what tolerances are acceptable in the circuit's electronic operation, then design a sequence of diagnostic tests designed to single out the malfunctioning parts.

"The test sequence is normally documented in a flow chart," Cox explains, "and once that design is done, the engineer translates it into a program written in the ATLAS language." But ATLAS can be difficult to use, particularly for electronic engineers not accustomed to programming.

To help them, the ATESSE can convert a test flow chart directly to ATLAS code, eliminating the need for engineers to learn ATLAS programming. Cox believes that will help engineers produce better test programs — with fewer bugs. "The engineer can focus his competence on the testing rather than the programming," he says. "It reduces the amount of time that it takes to write the code, and eliminates many of the errors that are introduced through the manual coding process."
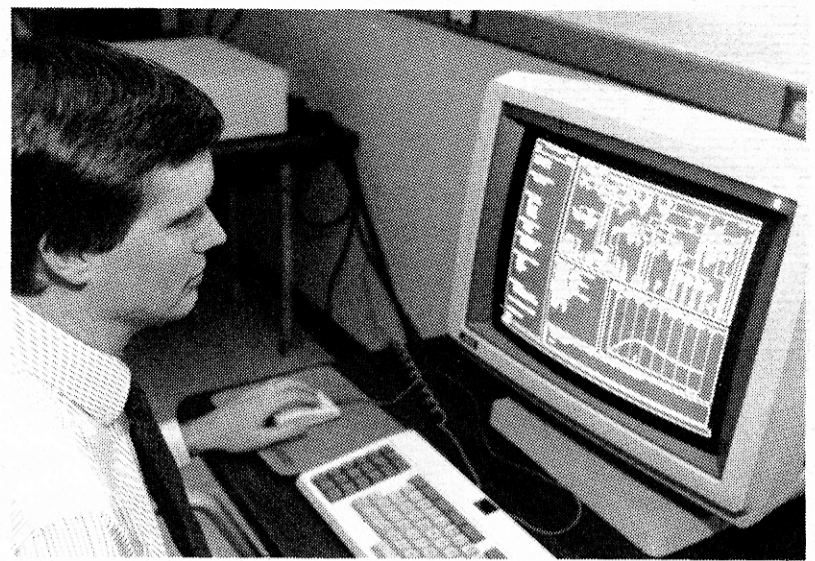


*Bryan Williams uses the ATESSE developed by GTRI for the U.S. Air Force to simulate the electronic performance of a circuit card. (Photo by Joe Schwartz)*

The ATESSE also helps calculate the tolerance values, combining specifications from the various components involved and the test equipment itself. The software can even perform its simulation at different levels of circuit abstraction, reducing simulation time.

## Automating the test design process

GTRI recently received additional funding from the Air Force's F-16 System Program Office and the Warner Robins Air Logistics Center to begin Phase III of the ATESSE project. During this stage, Cox hopes to partially automate the test program development process, using artificial intelligence to design the test sequence from a schematic diagram of the circuits and basic performance data.

Because of the circuit card's complexity, engineers often overlook test opportunities that could help pinpoint problems. Cox expects that an automated system could detect significantly more testing opportunities, producing a more efficient test program able to pick out a higher percentage of electronic faults with a smaller investment of time.

What will this mean for the Air Force?

"We believe that the ATESSE will pay for itself very rapidly during the test program development cycle," Cox says. "But the largest cost savings should come during the maintenance cycle because the ATESSE can eliminate a large portion of the errors that result in maintenance cost. We expect higher quality software, lower development costs, better productivity of the test engineers, and significantly reduced maintenance costs."

Ultimately, Cox hopes to extend the ATESSE to help design engineers, because he believes analog circuit designers need the simulation capability. Also, he notes, if designers were more aware of testing needs, they could produce circuits that are easier to test — and cheaper to repair.

"One of the problems test engineers have is that although a given circuit design may work very well, it may be difficult to test," he notes. "We would like to take some of the concepts we are developing for testing and incorporate them into the design environment. We should be able to give the designers immediate feedback on the testability of their designs and suggestions for improving them." ❏

*Automatic testing helps the U.S. Air Force cut maintenance costs and boost readiness.*

# Profile & Insight

**All photographs on these two pages are by Anita Edwards.**

**Top:** *AE senior Kevin Massey and ME senior Torsten Wegner install pipe and load cell connections on a recently acquired thrust measuring rig.*

**Middle:** *GRA Holly Bryan (AE) tests her laser-based strain gauge device.*

▼

# Aeroacoustics: learning by doing

*(Editor's Note: GTRI is a large employer of Georgia Tech students—both co-ops and graduate research assistants. Throughout GTRI, students are assisting in research programs, gaining valuable experience under the guidance of senior researchers that is an important part of their education. The program described below is only one of the opportunities available to students.)*

**By Martha Ann Stegar, RCO**

As the visitor steps into the research lab, the smell of baby oil permeates the air. *Baby oil?* What's going on here?

The aroma is coming from three miniature wind tunnels in the Small-Scale Experiments Facility of GTRI's Aerospace Laboratory, located in Cobb County. Here Georgia Tech students working in the area of air flow visualization study the smoke patterns created when oil is atomized or vaporized, then carried in an air stream past an airfoil or similar object being tested for patterns of turbulence responsible for flow-related noise. A laser sheet helps with flow visualization.

These wind tunnels, built by students under the direction of Dr. Krish Ahuja, a senior faculty research leader and head of the Acoustics Branch, are only two examples of amazingly simple and ingenious methods devised in the lab to study complex problems.

Dr. Ahuja believes that an important part of a student's education is hands-on experience in solving experimental problems. He is currently mentor to nearly a dozen Tech students, on both the undergraduate and graduate levels. They do much of the work on the major sponsored research projects Dr. Ahuja has brought in since he came to GTRI last year.

Dr. Ahuja screens and selects them carefully, looking for ways their background and interests will dovetail with his aeroacoustics research needs. In addition to assisting with major projects, each one is assigned his or her own small research project to design and conduct.

"My philosophy is to treat students as responsible members of the research family," Dr. Ahuja says. "I delegate to them not only the responsibility to run their projects, but also the authority to make decisions on their own."

In so doing, he is replicating what was a life-molding experience for him. When he finished secondary school, he was chosen by Rolls-Royce Ltd. in England for its prestigious apprenticeship program. "I alternated between working in the Aero-Engine Division plant for six months and attending university for six months. We were treated like adults and given meaningful and rewarding work to do." At the end of five years, he not only had earned a college degree, but was an experienced mechanical and aeronautical engineer.

"Rolls-Royce's program was essentially like our co-op program. But the company made a point of giving its apprentices work that trained them in their field, rather than using them for clerical and 'gofer' tasks, as sometimes happens with some of our co-op employers," he says.

The students spend an average of one day a week on their small projects, which Dr. Ahuja supports with funds from his Senior Faculty Leadership Grant. Most of their effort is expended on the larger, sponsored projects, which they work on in teams.

They help each other with their projects, and the more experienced ones guide the neophytes. "I invest my time in training students who then train others," Ahuja explains. Although most of the students are aerospace engineering majors, one is a physicist, another is an electrical engineer, and a couple are mechanical engineers, giving a useful spread of expertise.

Dr. Ahuja has an open-door policy and spends a great deal of his time acting as a mentor to his students. In return, he expects them to give him no less than their very best. "As an incentive, I tell my students that they will have at least one publication to their credit by the time they leave. I take only serious students, and I take them seriously," he says.

They work on projects of mutual interest, and the graduate students generally conduct research that will culminate in a thesis or dissertation. Each student must leave behind at least one 'product'—experimental apparatus or results that can be used or further developed in the lab. Even a high school student who worked in the Aeroacoustics Lab for only three weeks this summer left behind an experimental acoustic levitation device that he designed, built, and succesfully operated.

Dr. Ahuja pairs students who are co-ops so that while one is in school, the other is continuing with the project. Co-ops, of course, work full time during their work quarters, but Dr. Ahuja requires his students to come in one day a week during their academic quarters just to keep up with the progress of the research.

Hard work, yes, but stimulating—and the students love it for the sense of accomplishment they gain. "I used to struggle to understand some of my reading and lectures," Tim Hamel comments, "but since I started working for Dr. Ahuja, my classwork seems so clear and simple now."

Dr. Ahuja is very busy building up his year-old program of acoustics research for Georgia Tech right now, but when things settle down, he wants to develop and offer a practicum as a course in the School of Aerospace Engineering. "Practice must go along with theoretical knowledge," he says.

He teaches his students how to design and build simple experiments with materials ready at hand (such as furnace motors and ductwork, scrap metal and plexiglass). "These experiments may be simple and inexpensive," he says, "but they have enabled us to develop and demonstrate advanced concepts to prospective clients. Some of them, like Ford Motor Company and NASA, have been so impressed with the imaginative and innovative approach to problems shown by these experiments that they have awarded us large contracts for proprietary research." ❑
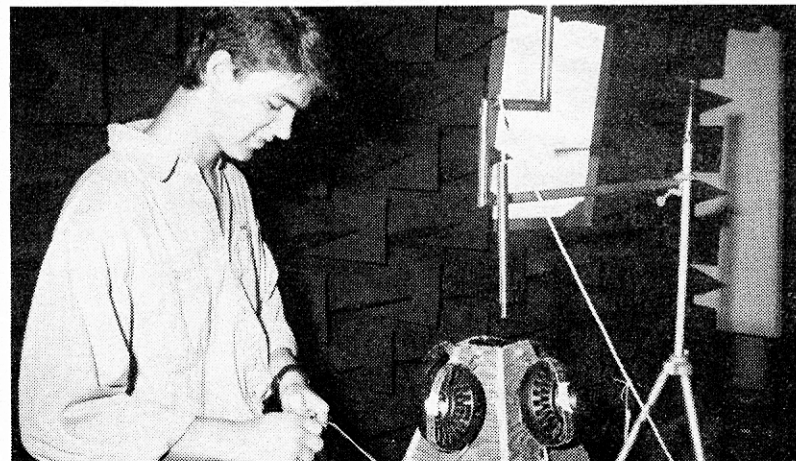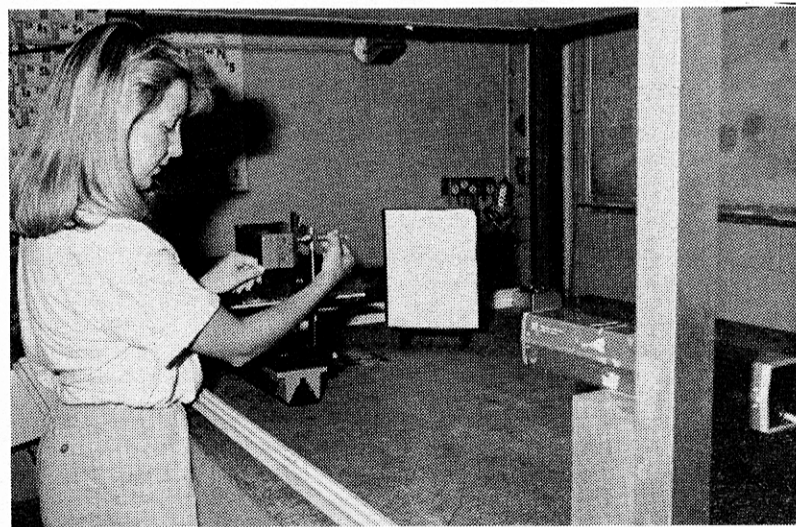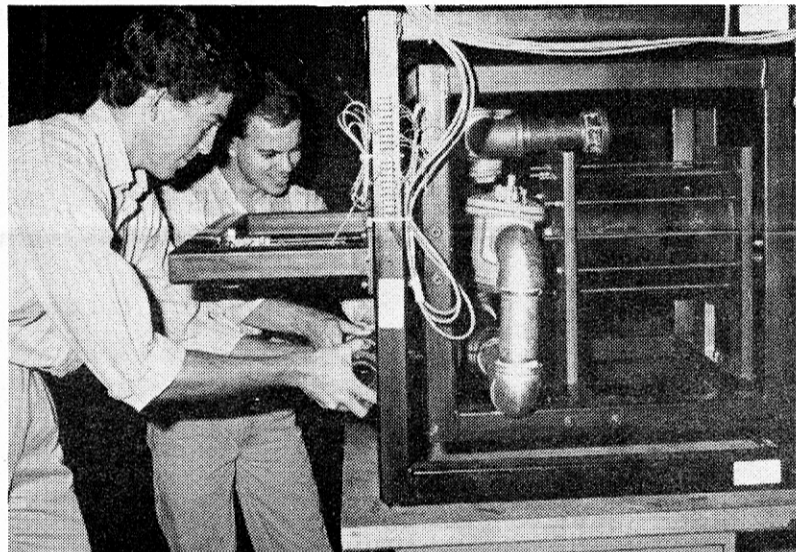
**Far left:** *AE freshman Alex Fleming makes connections to high-intensity acoustic drivers which will be used in an AEDC project to determine plume sensitivity to sound.*

**Left:** *AE junior Jack Manes calibrates microphones for their frequency response before installing them in the anechoic chamber to measure noise of a rectangular jet nozzle that he designed.*

◀

# Students work on varied acoustics problems

By Martha Ann Stegar, RCO

Here are some of the research projects in progress at the Aerospace Laboratory's aeroacoustics facilities in Cobb County:

• **Ford Motor Company—Air Flow and Noise Study:** As automobiles become more luxurious and engines become quieter, passengers hear noises they didn't hear before. What causes this wind noise? Where does it occur? AE co-op Tim Hamel is the key person on a contract with Ford to tackle this problem. He and mechanical engineering co-op Torsten Wegner are performing wind tunnel measurements of the effects of high-speed travel on side windows, using a quarter section of a Taurus as a test vehicle. At high speeds, Hamel explains, the pressure difference between the exterior and interior surfaces of the side window increases, causing the window to bulge outward, thus breaking the seal and allowing noise to enter the interior of the car.

Jeff Martin, who graduated this September with a master's in aerospace engineering, participated in a study attempting to reduce wind noise from roof racks and antennas, and mechanical engineering co-op Brian Miller is continuing the work. The experiment involves spiral wrapping these components to prevent formation of turbulent patterns that cause a whistling sound. The new concept seems to be working, and Dr. Ahuja says that Ford may apply these concepts on cars of the future.

In fact, Ford is so pleased with GTRI's work that it intends to give the Acoustics Branch a multi-year grant "to extend the lessons learned from the aerospace industry in the area of aeroacoustics to the auto industry," Dr. Ahuja says.

• **NASA—Supersonic Jet Noise Reduction:** One of the main impediments to developing an environmentally acceptable supersonic civil transport plane is noise. Under a grant from NASA-Lewis, aerospace engineering co-ops Jack Manes and Kevin Massey are investigating various jet exhaust nozzle configurations to suppress noise. Jack has designed a rectangular coaxial nozzle, and Kevin has designed a nozzle with two tabs projecting into the exhaust area. The tabs slow down the jet exhaust, reducing the supersonic area and consequently the noise levels. Both designs show promising preliminary results. They are the authors, along with former co-op Andrew Calloway, of a paper to be presented in October at the AIAA Aeroacoustics Conference in Tallahassee.

*Top: GRA Debi Saliga (AE) makes an adjustment to a microphone in preparation for studies in twin jet coupling.*

*Middle: High school student Tim Sipp demonstrates the acoustic levitation device that he designed and built during a three-week stay with Dr. Ahuja.*

*Bottom: GRA Clarke Stevens (EE) is acquiring an expertise in active noise control and is developing a high-speed digital processor for acoustic data acquisition and processing.* ▶

Unfortunately, a quieter nozzle generally means reduced thrust and, consequently, a less efficient engine. The thrust generated by the new nozzle designs is being measured in a specially constructed thrust rig with a suspension system that allows measurement of nozzle movement in three dimensions. Kevin, Torsten and freshman AE student Alex Fleming are conducting these tests.
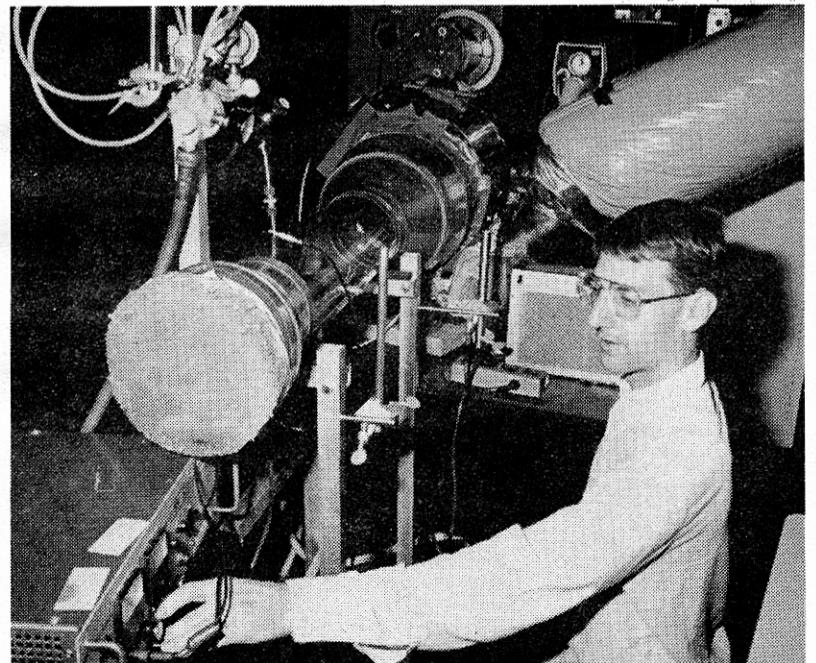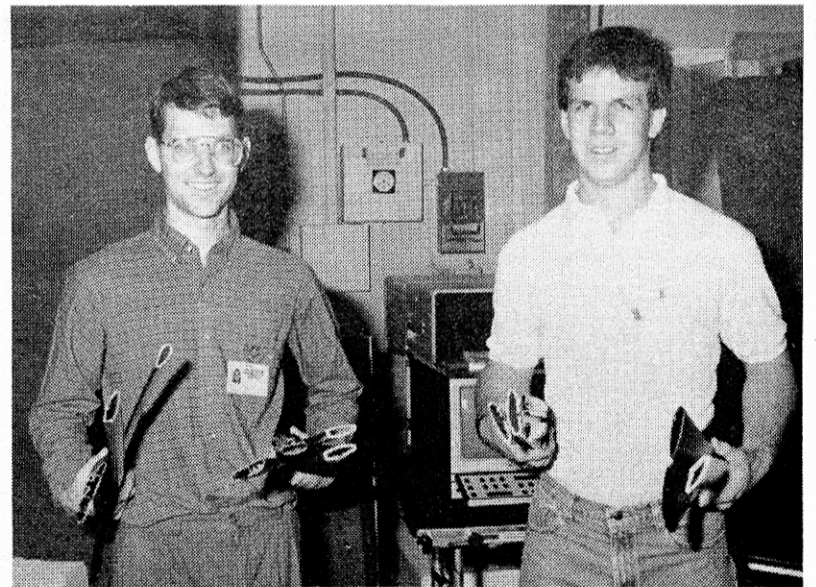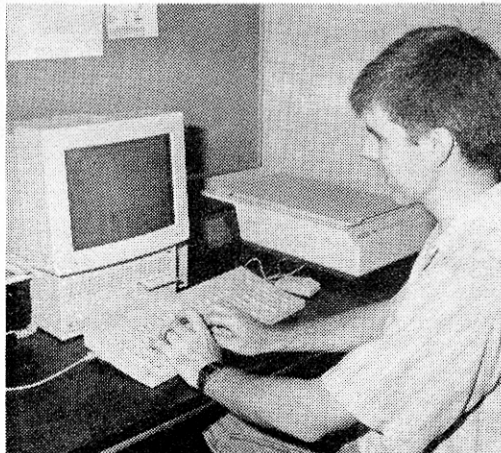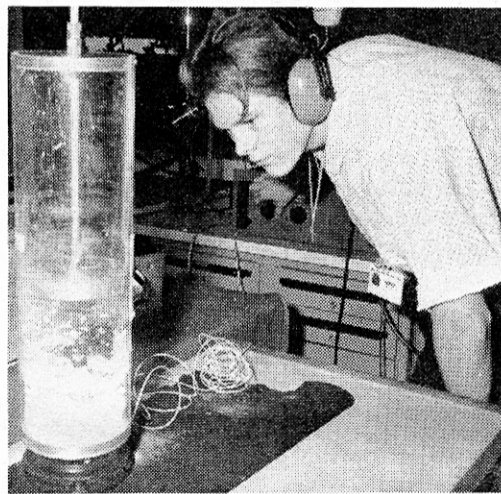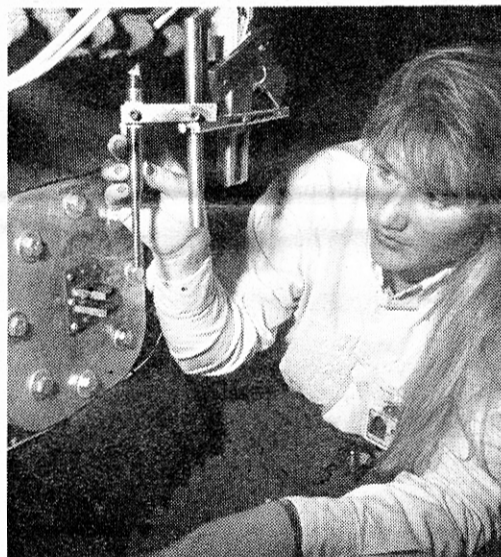
• **Active Noise Control:** The idea of cancelling a sound as it propagates in space by repeating the sound 180 degrees out of phase is not a new one—it was patented in 1934—but it is difficult to implement. It has recently become a hot topic because high-speed computers can perform the phase shift automatically, learning and adjusting for errors during the process. Clarke Stevens, a doctoral student in electrical engineering, is trying to devise a general way to cancel broadband noise. "This is harder to cancel than narrow band noise," Clarke says. It includes random noises from such sources as radio, television, and jet engines. A new high-speed digital signal processing system has been installed on the lab's computers for use in running tests of adaptive filtering techniques utilizing several 'error' microphones. Clarke will present a paper on active noise control, coauthored by Dr. Ahuja, at the Aeroacoustics Conference in Tallahassee next month, and his research will be used for his doctoral dissertation.

• **NASA—Sonic Boom Effects:** Clarke also is setting up a system to simulate sonic booms and other low-frequency noise for a study of the effects of sonic booms on buildings and possibly humans. The team will measure the structural effects on a wall in an empty house at the Cobb County facility of vibrations caused by an array of rock-concert sized speakers at volumes up to 130 decibels at one meter. The speakers are being custom built to create sounds to 3 Hz, the lowest of any in the world for this high an intensity and too low for the human ear to hear. Alex Fleming is trying to develop a nonintrusive way to measure structural effects in real time by taking holographic pictures of the wall as it vibrates with the boom.

• **AEDC—Effects of Sound on Jet Exhaust Flow:** The Arnold Engineering Development Center (AEDC) has a huge static test bed at Tullahoma (TN) Air Force Base where it tests jet engines, simulating sound and air flow at different altitudes. Jets exhaust into 20-foot-diameter test collectors. These collectors are like organ pipes, and the sound of

*Top: AE sophomore Tim Hamel and ME senior Torsten Wegner measure noise produced by flow over the side glass of an automobile cutout that has been mounted in a wind tunnel.*
*Middle: GRA Jeff Martin (AE) and ME junior Brian Miller show off a variety of roof racks they are evaluating for acoustic performance.*
*Bottom: Jeff Martin acquires flow visualization of wakes of car roof racks and antenna sections in a facility that he designed and built.* ▼

*Do you know a student with outstanding human relations skills? Read column 3 to learn how to nominate him or her for a scholarship.*

## Students

high-speed jets causes them to resonate. This resonance modifies the jet flow and also shakes the test cells. AEDC asked GTRI to investigate the physics of this phenomenon to determine how a high-level sound modifies their test data. Kevin Massey and Alex Fleming are designing and checking out a small-scale simulator utilizing a high-intensity driver with a small opening in an attempt to get a high sound level (up to 170 decibels). They will use flow visualization techniques to identify the effects of jet and sound interaction.

• **Crack Propagation:** Holly Bryan, a doctoral student in AE, has two projects going in her field—structural analysis of aerodynamic systems. Under a special grant, she is conducting a state-of-the-art review of research on crack propagation under high-intensity fluctuating loads. This is a difficult area of study, though an important one, especially with the use of ceramics in engines. Her paper will be presented at a Structural Dynamics and Materials Conference in Baltimore next April. Holly also is experimenting with the use of lasers to measure strain on materials.

• **Small Projects:** Other small projects are supported by Dr. Ahuja's Senior Research Leadership Grant. For instance, Kevin Massey is studying the effect of sound on plant growth. Torsten Wegner is experimenting with acoustical methods to separate sulfur from coal slurry, a new concept that holds promise not only for alleviating acid rain, but also for pharmaceutical applications. And high school junior Tim Sipp designed, built and successfully operated an acoustic levitation apparatus for experimentation with a technique that may be used in the future for containerless processing. He also refurbished a small-scale wind tunnel for flow visualization and added a sound driver to see how sound modifies air flow over an airfoil (wing).

• **New GRAs:** With the start of fall quarter, two more GRAs have joined Dr. Ahuja's stable. They are Jennifer Seckinger (physics), who is being supported under the Georgia Tech/GTRI GRA placement program, and Debi Saliga (aerospace engineering), supported by a grant from Ford Motor Company. Debi worked for Dr. Ahuja as a Lockheed co-op in her undergraduate days at Auburn University. Jennifer plans to work in the area of architectural acoustics, and Debi on noise from vortices of delta wings. ❑

## GTRI establishes mentor program

The Program Development Office of GTRI has started a mentor-'mentee' program and announced the first ten awards. According to Bob Zimmer, the program "represents an investment in shaping a program development culture as well as support for training promising young, enthusiastic scientists and engineers by our experienced personnel."

Laboratory directors submitted nominations, and the following pairs were selected:

| Lab | Mentee | Mentor |
|---|---|---|
| ASTL | Marilyn Smith | Robert Englar |
| ATL | Scott Gleason | David Milliron |
| CAL | Mike Cooper | George McDougal |
| CMDL | Tom Pratt | David Flowers |
| CSIT | Margaret Ray | Jeff Grover |
| EEEL | Ralph Hikert | David Millard |
| ESML | David Loftus | Terry Tibbitts |
| MAL | Martha Willis | William Holm |
| MSTL | John Hanigofsky | Jack Lackey |
| RIDL | Tracy Wallace | Nick Currie |

OOD will fund each of these pairs with $5,000 of personal services and $3,000 travel, with the mentee as project director. The laboratory is expected to support the mentor. ❑

## New short course deals with real estate environmental concerns

Environmental issues—asbestos, indoor air quality, waste disposal, water quality—increasingly affect our lives, and standard business operations must pay greater attention to these concerns—even in routine real estate transactions. On August 28, the Environmental Science and Technology Lab presented a new continuing education course focusing on environmental audits and air assessments. It looks at relevant federal regulations, addresses contaminant identification, and discusses roles and responsibilities of consultants and property owners. The one-day course drew a capacity attendance of 70, including attorneys, engineers, real estate developers, insurance representatives, geologists and government officials.

A related five-day course, aimed at professionals who conduct such audits and evaluate environmental hazards as they affect property transactions, will be offered in October. It will cover many of the same topics, but go into greater detail, especially concerning contaminants, resources and liability. ❑

## Human relations scholarship set

The Office of Human Relations is now accepting applications and nominations for the 1990 Gregory H. Nobles Human Relations Scholarship. It was established in honor of Dr. Nobles, associate professor of history at Georgia Tech, who is the first recipient of the annual Employee Human Relations Award.

The $1,000 scholarship will be awarded to the student who demonstrates exemplary human relations skills on and off campus. Applicants must be enrolled in school full time at the time of the application. Selection will not be based on the student's GPA; however, he or she must be in good standing at the Institute. Strong emphasis will be placed on letters of recommendation from individuals familiar with the applicant's campus and community activities.

All nominations and applications must be submitted to the Office of Human Relations by October 17; all letters of recommendation and responses to nominations must be submitted by October 29. If you are interested in applying, or if you know someone you would like to nominate for this scholarship, forms are available at the Office of Human Relations, Carnegie Building, 894-8337, Mail Code 0325. ❑

## Facilities Management News

## CRB recycles more than 5 tons of paper

Since the beginning of this year, the paper recycling pilot program in the Centennial Research Building has generated 10,640 pounds of paper. The breakdown by type of paper and weight is as follows:

• White office paper    2,647
• Computer printout    445
• Corrugated cardboard    700
• Mixed    6,848

The pilot program covers one half of one floor of CRB at present, but Facilities Management head Tom Jones says, "We plan to enlarge the program over the next few months to include all of CRB and Baker." In addition, the recycling program at Cobb County should start in October. ❑

## "Earning for Learning"

The Techwood Tutorial Project has requested the help of all campus employees in acquiring computers for the elementary schools near Georgia Tech. Kroger will give a school a computer for each $200,000 worth of Kroger receipts collected. According to Tom Jones, in the first two weeks of the campus effort, more than $2,000 worth of cash register tapes were collected in Baker and CRB.

Help get a computer for a needy elementary school! Save and turn in your receipts at the collection point in the lobby of your building or send them through the campus mail to the Techwood Tutorial Project, Campus Mail Code 0458. ❑

# Questions, Anyone?

**By Charles McCullough, HRD**

**Is there any real difference between using a day of vacation and using a day of sick leave? If an employee is out for a day, charging that day to sick leave doesn't cost GTRI any more than charging that day to vacation.**

The differences between sick leave and vacation are far from subtle and far more pronounced than just V-100 versus V-500. Admittedly, the abuse of sick leave is often the butt of jokes (like the old cartoon showing two employees standing at the water fountain discussing their co-worker, one saying to the other, "Cathy's used so much of her sick leave that she had to call in dead this morning"), but it's not a laughing matter.

Vacation time that you earn is an actual, definable employee benefit. It belongs to you just as definitively as the salary dollars you've earned. Upon leaving the employ of Georgia Tech, your unused vacation time is convertible to hard, cold cash.

While sick leave is included in discussions regarding employee benefits, it's an element that you don't really own. Sick leave has to be looked at more as a courtesy gesture from the employer to continue paying your salary during the inevitable hour here and hour there that you have to dash off to the doctor or the dentist, the day here and the day there that the flu bug bites you, or even the month or so here and there that you're recovering from surgery or 60 hours of labor.

Talk to the people who use sick leave in the manner in which it is truly intended and you'll hear endorsement after endorsement of the advantages of not using it capriciously. An unplanned major surgical procedure is plenty of trauma in and of itself; waking up in the recovery room to the realization that you just went into an unpaid status because your sick leave balance expired last Wednesday adds more than a little insult to your injury.

Vacation time is yours to do with as you wish. You can use it to run those errands your weekends don't allow, take a long (or short) trip, or just chill out around the house. The only restriction regarding vacation is that the time you take off must be approved by your supervisor. Most supervisors are quite agreeable about letting you have the time-slot that you want, but just because you have three weeks accrued doesn't mean you have a right to any three-week time of your own choosing. Supervisors have every right to say "no" to a request for vacation at a particular time.

Sick leave is entirely different. It has very limited, distinctly defined purposes. It's meant only to accommodate illness or injury involving you and/or a member of your immediate family (including trips to the doctor or dentist); and to allow bereavement leave in the event of a death in your immediate family. That's all it's there for. And don't forget that when you charge V-500 sick for more than 40 consecutive hours (even if those 40 hours are split between two pay periods) you must have with you on your return to work a doctor's statement certifying that you are ca-pable of returning to work (refer to the GTRI Procedures Manual, Procedure 20-14, for complete details).

**Personnel tip of the month:** When you were first hired, one of the many pieces of information you provided HRD and Georgia Tech's Personnel Division was the name and telephone number of the person who should be contacted in the event of an emergency involving you. Is the information you provided us still correct? If you've had any major change in your family status, your emergency contact name probably should be changed. If your emergency contact is still the same, is the telephone number you provided us still correct? If you'd like to change your emergency contact name and/or telephone number, just send us a PROFS note (PROFS address: PSFS) or a brief memo. We'll take care of getting the information in your file and the applicable databases corrected. ❑

# Ten tips for productive desktop publishing

**By Stephanie Babbitt, ESTL**

**1.** **Analyze your needs.** If you plan to use DTP to produce mostly reports and other text-intensive documents, you may be better off choosing a high-end word processing program with graphics capabilities than buying a difficult-to-learn page layout program. If you're planning to do a four-color annual report with lots of photographs, bleeds, and other complex features, you might do better to stick with traditional methods (since it will take months to develop the skills needed to produce this type of work using DTP). You will waste time (and money) in the long run if you buy the wrong technology.

**2.** **Buy smart.** If you do decide to purchase DTP equipment and software, don't choose just on the basis of lowest price. The higher-priced programs and equipment are almost always worth it. If your printer is too simple to produce high-quality output from your page layout program, or if your scanner can't save in a format your graphics programs can import, you will have wasted your money. Research any major purchase thoroughly before you buy! Check for compatibility with other programs and equipment you use and with your print shop's programs and equipment.

**3.** **Take the time to learn.** You can't expect yourself (or your employees) to load a program on the computer and instantly put out professional-quality material. The learning process takes time. Most first-time users make the mistake of developing entry-level competence with a program, then sticking with the simplest techniques instead of learning more complex (but more accurate and efficient) ways of accomplishing the same task. Don't be afraid to take courses to push yourself to learn more and be more productive.

**4.** **Ask for help when you need it.** Not everyone has the combined skills of a designer, an editor, an artist, and a press operator. If you try to play all these roles without the skills, your work will be lacking.

Don't be afraid to hire a designer to develop a template for your newsletter, or to ask an artist to create a graphic of the piece of equipment you are describing in your report. Otherwise, you'll have to resort to inferior methods, defeating the purpose of your DTP investment as well as looking shoddy.

**5.** **Make sure others review your work.** Unless security measures absolutely dictate otherwise, let someone else (preferably another communicator) review your efforts. DTP allows one person a lot of control over a document; unfortunately, having this control tends to foster protectionist tendencies. If you write, design, and lay out a publication, you tend to be too close to view it objectively. In ESTL, each of us has had others point out hilarious gaffes in our work that we did not notice ourselves.

**6.** **Set limits on changes.** An unfortunate consequence of DTP's ease of use is that it feeds people's natural urge to change their own and other people's work. Unless you (and your supervisor) set limits on the number and nature of changes allowed after first draft, you will never get to press with your work, and politics may triumph over readability.

**7.** **Stay up to date.** Keeping up with the technology is crucial if you ever plan to upgrade your equipment or try more challenging tasks. Magazines such as *Publish*, *Macworld*, *Byte*, and *PC Magazine* are excellent sources of information about changes in the industry that will affect you. (For example, if the company that manufactures your page layout program is going out of business, you'd better switch programs if you need technical support!) User's groups are another excellent way to learn more about DTP. You can attend meetings of local groups, or you can converse electronically with user's groups via bulletin boards such as CompuServe.

**8.** **Expect the worst.** No sensible skydiver would jump without a reserve chute. Likewise, you would be naive to expect that nothing will ever go wrong with your system. Back up your important files frequently. Don't wait until the last possible second to produce a document. Expect occasional trauma, and remember that old adage: The first 90% of a job takes 90% of the time allotted, and the remaining 10% of the job takes the other 90% of the time allotted.

**9.** **Produce the best.** The convenience of DTP is not an excuse to produce hurry-up, poorly planned, unattractive work. Not only does it make desktop publishers as a whole look bad, but it also reduces your boss's motivation to invest in better equipment and software for you. Make sure you always adhere to rule #10.

**10.** **The reader comes first.** No matter how gorgeous it looks or how many elegant photos and graphic elements it contains, if your publication is not carefully designed to be understandable, your message will be ignored. Make sure your reader knows where your message starts and where the eye should go next. Be sure the graphics don't interfere with comprehension. Choose readable type. Be courteous to your reader, and your investment in DTP will pay off with a message delivered. ❑

## Focus on Folks

## Professional Activities

### Advanced Technology Lab

**Scott Gleason** received his MSEE from Georgia Tech September 7.

### Concepts Analysis Lab

**Mike Kelly** presented a paper, "Human Factors in Advanced Apparel Manufacturing," at the International Conference on Human Aspects of Advanced Manufacturing in Honolulu August 15. Coauthors were **Dan Ortiz** (EDL), **Dennis Folds**, and **Ted Courtney** (EDL).

### Economic Development Lab

**Phil Wofford** of the Rome Regional Office has been certified as a Manufacturing Technician by the Society of Manufacturing Engineers.

**Art Ford** of the Albany Regional Office recently completed the three-year program at the University of Oklahoma's Economic Development Institute. His thesis concerned the impact of rising demand for water on the economic development of southwest Georgia.

**Rick Duke** was a grader for the Certified Industrial/Economic Developer exam sponsored by the American Economic Development Council at the University of Oklahoma.

At the recent annual meeting of the Georgia Department of Technical and Adult Education, **Charles Estes** made a presentation on technology transfer and technical assistance programs available through GTRI.

### Electronic Support Measures Lab

**Chris Fowler** and **Tim Strike** presented a briefing and demonstration of the Reprogramming Software Support Tool and the Reprogramming Test Fixture to the Strategic Air Command at Offutt Air Force Base (NE) August 3. This unit uses many of the systems GTRI develops.

On August 29, **Kathy Schlag** presented a paper at the Neural Network Workshop in San Diego.

### Environmental Science & Technology Lab

**Steve Hays** spoke on OSHA compliance August 12 at the American Rental Association's convention in Jacksonville (FL).

**Mike Lowish**, leader of ESTL's Safety Programs Group, recently made a presentation to the Atlanta chapter of the American Society of Safety Engineers on OSHA's new lockout/tagout standard, which established guidelines on control of hazardous energy sources and affects millions of employers and employees throughout industry. On August 28, he made a presentation on confined-space entry procedures to the Georgia Department of Labor's three-day Inspector In-Service Conference in Atlanta.

On July 30, **Ted Courtney** lectured on "The Current State of Industrial Ergonomics" at a meeting of the American Industrial Hygiene Association in Atlanta.

### Materials Science & Technology Lab

A paper by **Rosemarie Szostak, Kristin Sørby**, J. Ulan, and R. Gronsky, "Small Pore VPI-5: Identification of Stacking Faults," has been published in *Catalysis Letters.* Szostak also was in Puna, India, September 12-25 as a UNIDO Science Advisor to the National Chemical Laboratories.

### Modeling & Analysis Lab

**Jim Echard** has had a paper accepted for publication in the August 1991 issue of *Transactions on Signal Processing.* The paper, entitled, "The Quantization Noise Spectrum of a Sinusoid in Colored Noise," was coauthored by M.L. Watt.

### Office of the Director

**Dan O'Neil** (OOD) and **John Handley** (ASTL) traveled to Israel in late July in conjunction with the Atlanta Jewish Federation. The purpose of the trip was to assess potential collaborative R&D activities, including use of the Weizmann Institute of Science's 3-megawatt solar thermal research facility. The Weizmann Center for Energy Research has invited O'Neil to return and participate in a closed international workshop on solar energy in November. Other institutions visited included the Technion—Israel Institute of Technology and Ben Gurion University.

### Physical Sciences Lab

U.S. Patent No. 4,940,328 was granted to **Nile Hartman** in July for "Optical Sensing Apparatus and Method."

GRA **Brent Wagner** was selected to attend a two-week advanced NATO summer school on Low-Dimensional Structures in Semiconductors July 1-14 in Erice, Sicily. While there, he made a poster presentation on "New Growth Techniques for II-IV Semiconductors," coauthored with **Rudy Benz, D. Rajavel,** and **Chris Summers.**

GRA **Rudy Benz** presented a paper on "Chemical Beam Epitaxy of CdTe of HgCdTe," coauthored by Wagner, Rajavel and Summers, at the Sixth International Molecular Beam Epitaxy Conference in San Diego August 27-31.

### Signature Technology Lab

**Rod Beard** recently completed his MS in Electrical Engineering and was elected president of the local chapter of the Association of Old Crows.

### Threat Systems Development Lab

**Joe Parks** was an invited participant in the Crossbow-S Conference in Arlington (VA) June 26-28. ❏

## Personnel News

### Concepts Analysis Lab

**Ivan Howitt** resigned August 18 to pursue his doctorate in neural networks at Davis University in California.

### Economic Development Lab

**Robin Greene** is transferring to the School of Materials Engineering, and **Charlotte Jacobs-Blecha** to the Computer Science and Information Technology Lab. **Susan Griffin** has moved from the Energy Resources Branch to the Southeastern Trade Adjustment Assistance Center.

### Electronic Support Measures Lab

**Scott Petty**, who passed the Bar Exam last spring, has resigned to accept a position with a law firm specializing in patent law.

### Microwave & Antenna Development Lab

**Susan Park** has resigned.

### Physical Sciences Lab

**Ed Daykin** has resigned.

### Signature Technology Lab

**Rod Beard** has transferred to STL from OOD. His areas of emphasis are radar, electronic warfare, and Air Force operational force employment. ❏

## Personal Notes

### Serving Our Country

**CAL:** **Ann Dunehew**'s son, U.S. Navy Lieutenant Charles C. Dunehew, is assigned to the USS Saratoga, currently stationed in the Middle East. Chuck flies a prowler, the EA6B.

### Wedding Bells

**CAL:** **Ronald Prado** and **Kathie Coogler** were married June 16 at Peachtree Christian Church in Atlanta.

**TSDL:** **Tedd Toler** was married to Shelley DeMoss August 31.

### Cradle Roll

**ESML:** **Shawn Malone**'s wife, Toni, gave birth to a girl, Christy, June 14; **Terry Tibbitts**' wife, Susan, gave birth to a girl, Allyson Victoria, July 8; and **Michael Willis**' wife, Judy, gave birth to a girl, Lauren McCarty, August 21.

**MATDL:** Barbara and **Rick Moser** had a baby girl, Helen, August 6, and Annette and **Rickey Cotton** had a son, John, born August 10.

**TSDL:** Deborah and **Harold Knouse** had a baby girl, Dorothy, August 14.

### Our Sympathy

**EDL:** **Dave Swanson**'s wife, Suzanne, died in early September after a long illness.

**ESTL:** **Lois Nelson** and her husband, Art, died in an auto accident August 14. Lois began as a staff assistant with EDL's Management Services Branch in 1984 and in 1986 transferred to the Environmental Health and Safety Division's Training Programs Office (TPO). She became program coordinator for several of TPO's short courses in 1988. Lois will be missed by all her colleagues in EDL and ESTL.

**TSDL:** **Robert Kerr**'s stepfather, Millard Myers, died August 24.

### Miscellaneous

**CAL:** **Judy Wiesman** is presenting her original watercolors, acrylics and prints in several art shows this fall, including Art in the Park in Marietta, the Roswell Arts Festival, and in Louisville (KY).

**MSTL:** A photo of student employee **Tyrus Royal** in his Buzz costume recently appeared in the Atlanta newspapers along with the following news item: "The boys behind Buzz, Georgia Tech senior Tyrus Royal and sophomore Dave Piech, were named champions during a mascot competition sponsored by the Universal Cheerleading Association. They were judged on things like mascot walk and crowd rapport. They also won the contest's equivalent of Miss Congeniality." ❏