The GTRI Connector

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It never fails!

• Your boss walks by your desk only when you've just taken a break from your work.

• Everyone has his or her day, and some days last longer than others.

Wind shear radar

By Jim Kloeppel, RCO

At 6 p.m.. on August 2, 1985, Delta Air Lines Flight 191 was on final approach to Dallas-Fort Worth International Airport. Although showers and thunderstorms surrounded the airfield, the landing appeared routine. But as the huge Lockheed L-1011 aircraft neared the runway, it was suddenly buffeted by violent winds. Flight 191 plummeted toward the pavement, striking the ground more than a mile short of the runway. Flaming wreckage skidded across a highway and slammed into two water tanks on the airfield. In the fiery aftermath, 134 of the 163 persons on board perished, along with the driver of an automobile struck by the debris.

Probing the still-smoldering wreckage, investigators from the Federal Aviation Administration (FAA) attributed the crash to a sudden, violent change in wind speed and direction called a wind shear. Nearly impossible to detect, these unpredictable and deadly vagaries of the atmosphere have been cited by the FAA as a contributing factor in a growing number of recent air disasters.

Mark Richards and his colleagues in the Modeling and Analysis Laboratory, in conjunction with the NASA-Langley Research Center and the Research Triangle Institute, are exploring new ways to locate and identify wind shears before they can endanger aircraft.

A deadly puff of wind

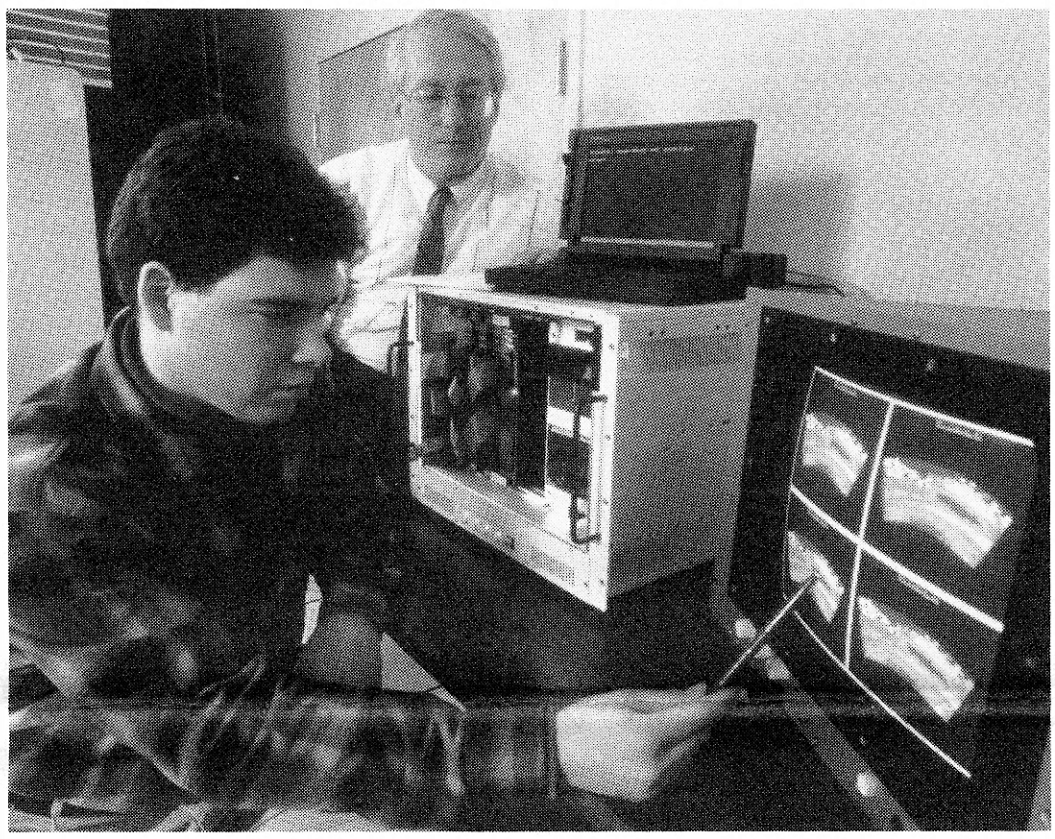
The most dangerous type of wind shear, called a microburst, is a strong but slender downdraft typically formed near a thunderstorm. Upon striking the ground, the microburst mushrooms into a fast-moving swell just a mile or two across.

"An aircraft passing through a microburst would first strike a strong headwind," says Richards. "Quickly reaching the other side, however, the aircraft would meet a sizeable tailwind. The rapid shift from headwind to tailwind causes a rapid change in air speed resulting in a sudden and dangerous loss of lift."

Encountering similar areas of turbulence at high altitudes, where pilots have plenty of room to maneuver and time to recover, poses little risk, says Richards. "But during takeoff and landing, when the aircraft is low and slow, there simply may be no room to recover."

In the case of the Dallas crash, while approximately 900 feet above the ground, Flight 191 encountered a headwind which resulted in a sudden increase in airspeed. To maintain the proper glidepath, the pilot correctly eased back on the throttle. Moments later, however, the headwind abruptly reversed to a strong tailwind, and the plane's airspeed dropped dramatically. Although the pilot applied maximum thrust almost immediately, it was too late. In barely 12 seconds, the aircraft plunged 600 feet to the ground.

Continued on page 2



Senior research engineer Mark Richards and co-op student Tim Shelling (seated) work with the wind shear signal processing system that will be installed in the cockpit of testbed aircraft. Displayed on the screen is an airborne weather radar map showing hazardous microburst conditions. (Photo by Gary Meek)

Observed & Noted

A unique speaker system will help scientists understand sonic boom effects on humans and buildings. *Read about the Aero Lab's studies on pages 2 and 3.*

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Studies show that inside air can be improved without raising energy costs. *Details about ESTL's indoor air study are on pages 3 and 4.*

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The Russians are eager to sell their technology, as two GTRI research engineers discovered on a recent trip to Russia. *See page 4.*

■

Congratulations to Chuck Ryan and Johnson Wang, who have joined the ranks of GTRI researchers who have been awarded IEEE Fellow status. *Read about their achievements on page 5.*

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Have surplus State property on your hands? Do someone else at Georgia Tech a favor—advertise! *See page 5.*

■

The second and final part of Ann Campbell's article on patents in *on page 6.*

■

Also on page 6, MAPS managers describe the myriad services MAPS provides to project and lab directors.

■

Bob Cassanova has been appointed director of the Aerospace Lab. *See page 7.*

■

Announcements of 10 babies, including twin boys born to Anita MacDonald (COML), are *on page 8.*

■

Also on page 8, read about ESML's basketball and wallyball teams. (That's right: "wallyball." Do you know what that is?)

■

St. Patrick's Day will soon be here. Get ready!

News & Notes

Wind Shear *From page 1*

Microbursts are all too common at some of the world's busiest airports. At Denver's Stapleton International Airport, for example, 20 aircraft are likely to encounter these dangerous weather phenomena in a typical summer. Each encounter is potentially life-threatening to the passengers and crew.

"To improve safety, pilots need a convenient means of locating and classifying wind shear," says Richards. "They need information such as where the wind shear is, how strong it is, whether it is stationary or moving, and whether it is growing bigger or dying away. We are assisting NASA in the search for better ways of acquiring and providing the necessary information."

Existing systems not enough

Currently, pilots and air traffic controllers must rely upon the National Weather Service's weather radar network and a special Low Level Wind shear Alert System (LLWAS) installed at many airports for timely information concerning potential microbursts. But accurately detecting or predicting the presence of these dangerous thunderstorm anomalies is uncertain at best.

Microbursts are too small to be resolved by typical weather radar, says Richards, and therefore usually go undetected. Similarly, the network of ground-based anemometers that the LLWAS comprises often fails to detect microbursts since these narrow downdrafts can occur in regions of the aircraft approach path not covered by a sensor. In addition, winds a few hundred feet aloft are often much stronger than those measured by the network. Unfortunately, weather radar and LLWAS are simply not enough to ensure that an airplane won't be at the wrong place at the wrong time, as evidenced by a terrible jetliner crash at New Orleans in 1982.

Around four o'clock on the afternoon of July 9, Pan American World Airways Flight 759 was departing New Orleans International Airport. Heavy showers skirted the runway. Amid gusty winds, Flight 759 cleared the runway and climbed approximately 100 feet. Suddenly ensnared by a powerful microburst, the big plane lost altitude and fell heavily back to the earth, blazing a half-mile path of destruction through trees and homes. The crash claimed the lives of all 145 persons on board the airplane and eight others on the ground.

Analysis of the plane's flight recorder showed a sudden 15-mile-per-hour increase in headwind as lift-off speed was reached. Almost immediately upon becoming airborne, however, this headwind was replaced by a 35-mile-per-hour tailwind. The drastic change in airspeed and resulting loss of lift apparently forced the plane into its fatal fall.

Although the New Orleans airport was equipped with a Low Level Wind shear Alert System at the time of the accident, the LLWAS was not alarming as Flight 759 rolled. Unfortunately, however, two previous wind shear advisories had gone unheeded. One of these, given in response to a request for wind information from Flight 759, was issued just four minutes before departure. A few minutes earlier, the flight crew of another plane had informed the departure controller of a minor encounter with a wind shear during takeoff. Sadly, the pilot's report was not passed to flight controllers in the tower or to the crew of Flight 759.

The ensuing tragedy pointed out the limitations in existing ground-based and airborne wind shear detection and reporting systems. Pilots, who are ultimately responsible for the safety of their passengers and aircraft, need better information to draw the occasional fine line between go and no-go situations.

A safer alternative

The FAA has worked for years to develop better ground-based microburst alert systems such as the LLWAS. A new terminal Doppler radar, with much finer resolution than conventional weather radar, is being deployed as part of the overall air traffic control system. But the FAA also has recognized the need for pilots to have their own onboard instrumentation in order to call their own shots. In fact, as of December 30, 1993, the FAA will require all commercial aircraft carrying more than 30 passengers to be equipped with a wind shear warning device. But exactly what that device should be or how it should operate has been left up to the individual airlines and aircraft manufacturers.

"Many airlines will simply install devices which better analyze the data coming in from existing indicators such as airspeed, altitude, and pressure, to recognize when the aircraft may have entered a wind shear," says Richards. "But this *reactive* system does not warn you in advance, it merely tells you that you are now in a wind shear and that recovery maneuvers must be initiated. To avoid a potential accident, the pilot must react within seconds."

A safer alternative, says Richards, would be a *predictive* system: one that would look 5 to 10 kilometers ahead of the aircraft, recognize an area where wind shear conditions exist, and then warn the pilot in plenty of time to avoid the area. To provide this kind of wind shear avoidance capability, NASA is modifying an existing aircraft X-band weather radar system. Richards and his colleagues are assembling a more powerful computer processor for the system and enhancing the signal processing algorithms to better identify wind shear.

The new unit, called the Wind Shear Radar Signal and Data Processor, will replace part of an existing flight system developed by NASA and the Research Triangle Institute. The processor combines signals from an aircraft's weather radar with input from other aircraft instruments and provides a visual display for the pilot, audibly warning him when dangerous areas lie ahead.

"NASA's prototype processor was based on a personal computer which simply could not keep up with all the incoming information in real time," says Richards. "Not only was much of the data discarded, the unit lacked the computational horsepower required to experiment with advanced algorithms for recognizing wind shear."

The new processor is designed to handle more of the incoming data, and will run more elaborate algorithms to identify elusive microbursts. "Our role is to assemble and program the processor, and develop five algorithm suites to analyze and display the data," says Richards. Nearing completion, the system will soon undergo flight testing on a NASA-owned 737 aircraft.

Beating the odds

Technological achievements over the past 40 years have brought about tremendous growth and change in the aviation industry, says Richards. Innovations such as weather radar, weather satellites, and jet aircraft which fly faster, farther, and higher have permitted people to travel above or around most weather hazards. However, air travelers must still take off and land through the lower regions of the atmosphere, where adverse weather is not as easily avoided. And as the number of flights continues to increase, so do the odds of an unwanted encounter with wind shear.

"Many pilots have flown through severe storms and experienced very little turbulence," says Richards. "Consequently, they may fail to anticipate an encounter with a deadly microburst or underestimate the danger of flying into one. An active, onboard wind shear warning system that essentially cries out 'Danger ahead, fly around!' should help beat the odds and make air travel safer than before." ❑

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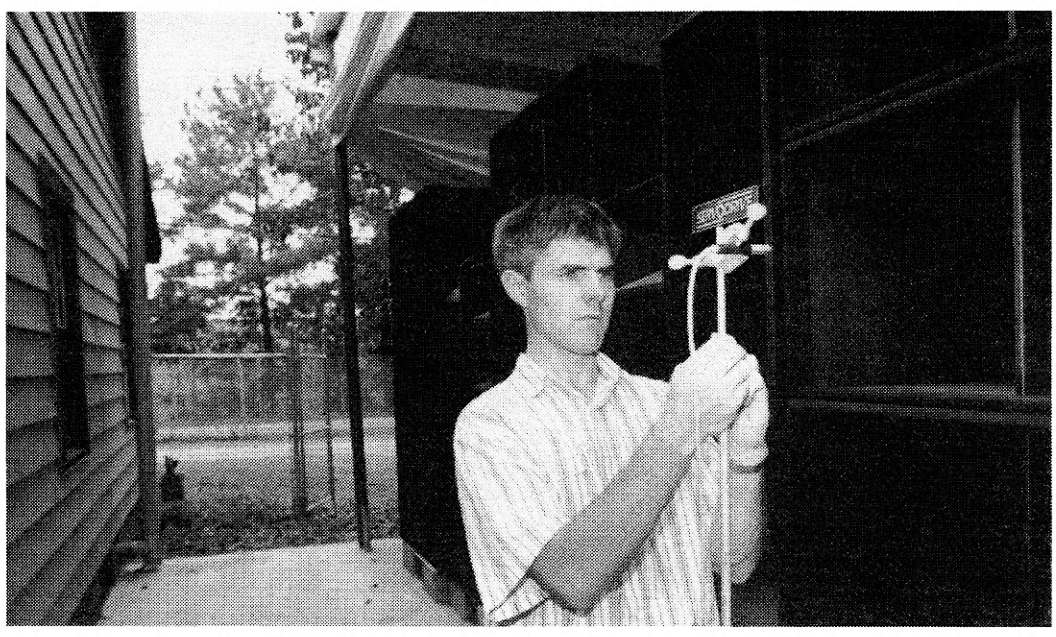

Research engineer Clarke Stevens sets up a microphone to measure noise emitted from the large speaker system during sonic boom experiments. (Photo by Gary Meek)

Giant stereo 'boom box' will benefit research

By Lea McLees, RCO

A tiny beige house with four rooms and green trim sits quietly by a gravel road, nestled among delicate dogwood trees—and flanked on one side by an 8'x20'x15' black stereo speaker system.

The scene description sounds like the setting of a rock 'n' roll dream or a surrealist short story. But it's actually the site of a GTRI study measuring the effects of sonic booms on humans and buildings. The speaker system involved in the project, which is sponsored by NASA-Langley Re-

search Center, is the first of its kind.

The 12-month study addresses an issue that must be considered if the United States is to develop supersonic high-speed civil transport (HSCT) vehicles, says Krish Ahuja, head of the Aerospace Laboratory's Acoustics Branch and professor in the School of Aerospace Engineering.

"Currently no accepted way exists to assess human responses to sonic booms people experience while indoors," Dr. Ahuja explains. "Human reaction to outdoor sonic booms is more predictable. There is some indication that people find sonic booms relatively more objectionable when they are indoors, because of the associated vibrations of objects and buildings."

Sonic booms are powerful, unexpected sounds resembling the noise of an explosion. They occur when an airplane's speed exceeds the speed of sound. Air particles in front and in back of the plane are compressed into shock waves, causing sudden air pressure changes—and thus, the booms we hear. Much sonic boom research was done in the late 1960s and early 1970s, about the time the supersonic Concorde airliner was under development.

GTRI study is unique

But the GTRI sonic boom research differs from past studies. Previously, researchers studying low-frequency sonic booms positioned boom-emitting speakers in a room or building with subjects, despite the fact that most sonic booms do not occur within a closed space. In the present study, the effects of sonic booms of various shapes emitted outside a house will be determined on human subjects seated both outside and inside the structure.

The black wooden speaker for the GTRI experiment sits on a concrete pad covered by a metal roof and shrouded in plastic when not in use, to protect it from the weather. The speaker took two years for an outside company to produce and is undergoing final refinements at Georgia Tech. Researchers plan to use noise in the 3 to 4,000 Hertz frequency range.

"You wouldn't hear much at the very low frequencies, but you would feel it," Ahuja says. In addition, secondary noise from vibrations and rattle effects of the sonic boom will produce some form of extra annoyance to subjects seated inside the house.

During the research trials, a computer broadcasts truck, helicopter, aircraft and sonic boom noises through the speaker in random order while subjects inside and outside the house pass time reading or engaging in other activities. After each experiment, the subjects answer questions that will show which types of noise they found most unsettling. The responses will be statistically analyzed to see how bothered people were by the variety of sounds.

None of the noise levels in the experiment will exceed U.S. Occupational Safety and Health Administration standards, says Ahuja, who also has involved a psychoacoustician in the project. About 150 people of all ages with perfect hearing are being chosen for the study, and they will participate for two to three one-hour trials. Their hearing will be tested before and after each session.

Researchers will measure the vibrations the house is subjected to, using an accelerometer. Because sonic booms are the result of sudden air pressure changes, they also will monitor these fluctuations inside and outside the house as sonic booms are broadcast.

Other uses for the speaker

Dr. Ahuja foresees additional research applications for the giant speaker. It might be used to broadcast sound into the sea or the sky so scientists could study how sound travels under water, as well as how turbulence in the sky affects sound propagation.

The speaker might have other applications in sound detection and ranging, temperature profiles of the atmosphere, radio-acoustics sensing, sonic fatigue studies of aircraft, and additional psycho-acoustic studies.

Ahuja also plans to use these speakers to study how low-frequency sound travels from outside an aircraft cabin to its interior, along with innovative methods of controlling cabin noise.

The sonic boom effects research has received GTRI funding in addition to its NASA sponsorship. Assisting Dr. Ahuja are RE I Clarke Stevens and undergraduate students Alex Fleming and Brad Nye. ❑

A better indoor environment

By John Toon, RCO

New research in the Environmental Science and Technology Laboratory (ESTL) suggests that the quality of air inside office buildings can be significantly improved without producing higher energy bills.

The improvement results from increased amounts of fresh air and an energy recovery system that uses a molecular sieve— a unique material able to separate compounds according to their molecular size. Microscopic pores in the material permit the system to reclaim energy from building exhaust air without bringing pollutants back into the building. The recovered energy allows building ventilation systems to bring in more fresh air—and dilute pollutants—without raising energy costs.

ESTL scientists recently confirmed that energy recovery systems using the molecular sieve material do not transfer pollutants. At the same time, they also found that new standards requiring more fresh air in buildings can significantly improve indoor air quality.

Concern about indoor air quality has grown in recent years because of increased recognition that indoor pollutants can cause a variety of health problems known as the "sick building syndrome."

Bringing in fresh air

To help improve indoor air quality, new standards recommended by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)—and recently adopted as part of some building codes—require four times as much outdoor air as older standards. Ventilation systems of new and renovated office buildings must now provide 20 cubic feet of outside air per minute per person.

A recent study of air quality inside a new Atlanta office building, the Eleven Hundred Peachtree Street Building, demonstrated the effectiveness of the new ASHRAE standard, reports ESTL's Charlene Bayer. Increasing the amount of fresh air to meet the (ASHRAE 62-1989) standard reduced levels of volatile organic compounds in the building's air by 40%, while carbon dioxide declined by 33% and formaldehyde by 24%.

"In areas where the outdoor air is of good quality, bringing more outdoor air into a building helps to remove and dilute indoor air pollutants," Dr. Bayer says. "In almost all cases, you will have lower levels of indoor pollutants."

High levels of carbon dioxide can make building occupants lethargic, she explains. Boosting the fresh air supply reduced carbon dioxide levels in the building studied from nearly 1,100 parts per million (ppm)—a level higher than the recommended 1,000 ppm—to about 700 ppm.

Volatile organic compounds and formaldehyde are irritants that may cause allergic reactions in sensitive persons. The compounds are released by office equipment, furnishings such as pressed-wood products, paints and other finishes, and by cleaning products.

But increasing the supply of fresh air can raise energy consumption because the outside air must be heated, cooled and dehumidified before it can be brought into the building. To overcome these energy penalties, engineers have developed recovery systems designed to capture energy from exhaust air leaving the building. This energy then can be used to pre-condition incoming fresh air, significantly reducing energy consumption.

The most efficient of these systems, known as total energy recovery systems (TERS), use rotating 'wheels' that transfer energy as they alternately pass through streams of exhaust and incoming fresh air. Since the cost associated with humidifying and dehumidifying a space is significant, these systems recover both temperature and moisture, making them far more effective than systems recovering only temperature.

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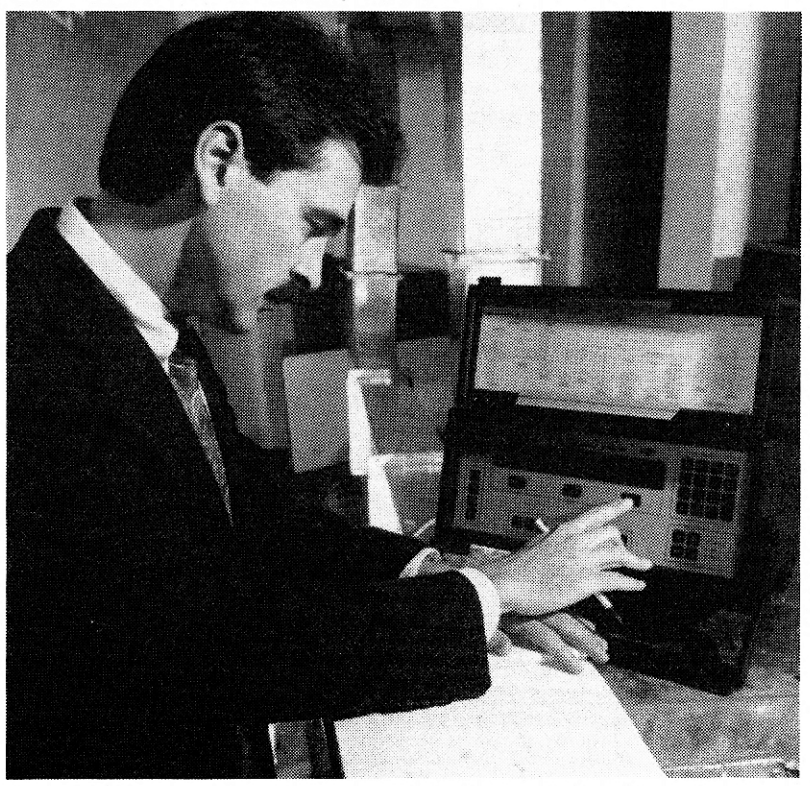
— Charlene Bayer



Research engineer Chris Downing measures air quality in a laboratory-scale total energy recovery system (TERS). (Photo by Gary Meek)

Avoiding pollutant transfer

In operation, however, some wheels also can transfer pollutants from the exhaust air into the fresh air supply, potentially negating the benefits of the increased ventilation.

To help solve the problem of pollutant transfer, SEMCO Manufacturing of Columbia, Missouri, developed and patented a total energy recovery system that uses an aluminum

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Profile & Insight

The Russians are interested in selling everything from classes for astronauts to rocket launches of payloads into space.

Russian technology for sale

By Lea McLees, RCO

Technology is for sale in one of the republics of the former Soviet Union—and two GTRI representatives have had a firsthand look at what is available.

Principal research engineers George Ewell, of the Threat Systems Development Laboratory, and Larry Corey, of the Microwave and Antenna Technology Development Laboratory, spent last November 8-25 in Moscow hearing presentations by Russian scientists, researchers and engineers on technologies available for export. The Russians are interested in selling everything from classes for astronauts to rocket launches of payloads into space, according to Ewell and Corey.

However, the GTRI representatives agreed that most of the knowledge and wares the Russians are offering are very basic. "They showed us laboratory-type technology," Corey said. "It will take a long time to develop some of the technologies they displayed, but there are areas that might be of interest to people at Tech."

Ewell and Corey were part of a group of 11 United States representatives invited to the presentations. The visit was arranged by OTI/NTI, Inc., a joint venture between U.S. and Russian companies. The two GTRI representatives' objectives were to evaluate technologies for joint ventures and determine the availability of electronic subsystems and components for GTRI programs, Ewell said.

Russia is interested in selling its technology primarily to make money. Difficult economic times are testing that country and other former Soviet states as they move from a centrally controlled government and economy toward independent rule and free-market operations.

"They are going to trade shows and offering to sell some of their most modern weapons systems," Ewell said. "In a time of decreased military procurements, they need income to keep their technological abilities in place.

"They produce a lot more electronic systems than we do," he added. "Their military establishment is much larger, particularly in areas of air defense."

Among the items the former Soviets produce in large quantities are phase shifters and microwave tubes—equipment for which the United States has never achieved large-scale, economical production, according to Ewell. These and other components of radar and communications systems, possibly produced less expensively in Russia than in the United States, might be used in satellite communications, maritime surveillance, border control activities, and drug interdiction, Ewell and Corey said.

The Russians proposed launching payloads into space using modified SS18-IBS missiles that formerly carried nuclear weapons. They also are interested in offering other countries the training they provide their cosmonauts and aerospace engineers.

Another joint venture opportunity might work in the opposite direction—United States representatives presenting short courses on management of technology to the Russians, Corey said. "The people there do not have much understanding of how to do business, of supply and demand, and how to price things," he explained. "They need to learn how to communicate in a business environment. It's just a matter of how to pay for the courses. They don't have the currency to do that."

Ewell and Corey are discussing the Russian and U.S. training proposals with Dan Papp, director and professor in the school of international affairs, and with Continuing Education representatives.

Georgia Tech could realize at least two advantages to having representatives at the technology presentations, Ewell believes. "This gives us access to areas in which we may not have any technology, or which may be more advanced there," he said. "Some of the technologies that may not be central to what they perceive as their future business activities are nevertheless very advanced."

The trip coincided with the final days of the Soviet Union. The Russian people Ewell met seemed apprehensive about the changes taking place in their country and were very uncertain, he said.

Corey returned to the United States with great appreciation for the U.S. political system. "You can't appreciate our political system until you see one with no flexibility in it and no means of meeting the needs of the public but through central planning," he said. "In the United States our system adapts quickly to the needs that exist. There was no adapting in the Soviet system at all."

But he recalled one experience that contrasted with the turmoil and uncertainty in the country—a ride on the Moscow subway system. The stations are decorated with murals, statues, stained glass and mosaics, the system is clean efficient and fast—and the cost of a ticket is equivalent to about 1/6 to 1/3 cent, Corey said.

Corey and Ewell will host two Russian radar specialists at GTRI the first week in March. They will give public presentations on radar systems and the upheaval in their country on Wednesday, March 4, at 1 p.m. in the Manufacturing Research Center auditorium. For further information about the prospective visit or the technologies displayed, call Ewell at 894-3532 or Corey at 528-7156. ❑

Joint venture opportunities

Following is a list of some of the technologies presented to Ewell, Corey and others in Moscow:

- laser-aerosol technologies
- pollution monitoring
- diamond coating technologies
- fiber optics
- space launch capabilities
- thermal protection materials
- semiconductor technologies
- computer-based psychoanalysis and behavior modification
- high-resolution acoustic microscopes
- laser techniques
- image processing
- E-beam technologies
- satellite applications for laser power transmission

Indoor Air

From page 3

medium coated with a three-angstrom molecular sieve dessicant material. Pore openings in the sieve allow only molecules smaller than three angstroms in diameter—an opening 5,000 times smaller than the diameter of a human hair—to pass into the fresh air supply, explains ESTL's Chris Downing. Water molecules (2.8 angstroms in diameter) can enter and exit the sieve, but because of their larger size, pollutants are excluded.

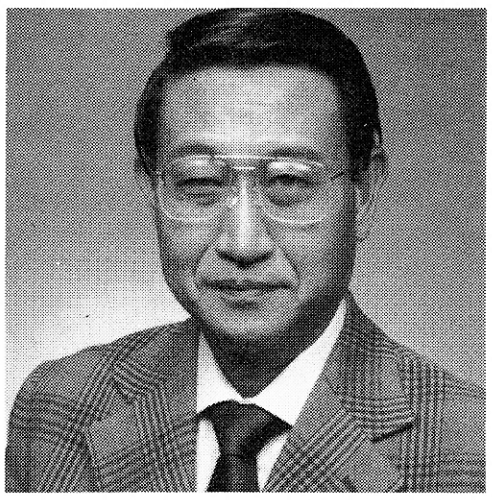
Downing and other Georgia Tech scientists tested the wheel by introducing high levels of pollutants on the exhaust air side of a laboratory-scale TERS system. Tests with carbon dioxide, formaldehyde, volatile organic compounds, ozone and sulfur dioxide showed that the wheel did not transfer measurable amounts of those pollutants to the incoming air.

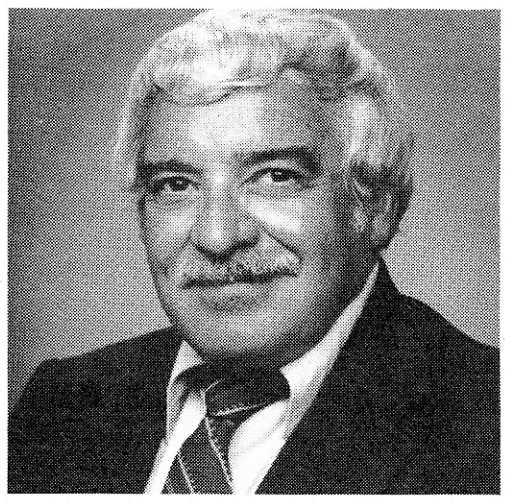
"This means you can increase the amount of fresh air ventilation to a building without significantly increasing the amount of energy used," says Downing. "If you tried to bring in enough fresh air to meet the standards without the energy recovery system, it would be very costly to maintain comfortable conditions."

Because recovering total energy allows builders to install a smaller heating and air conditioning system, the SEMCO recovery system normally does not add to the initial capital costs of a building. And because it is typically 75% to 90% efficient at recovering energy, operating costs should not show a significant increase, either, according to Downing.

Like many innovations, however, total energy recovery systems have been slow to gain acceptance among builders. But Downing believes the new ventilation standards will accelerate the use of such systems as the best way to improve indoor air quality without raising costs.

This GTRI research was sponsored by SEMCO Manufacturing Inc., Rosser Fabrap International (building engineer), and Carter & Associates (building owner). Results were published in the *Proceedings of the ASHRAE Indoor Air Quality '91 Conference* last September and presented at a conference, "Measuring, Understanding and Predicting Exposures in the 21st Century," held in Atlanta last November. ❑





New IEEE Fellows Johnson J.H. Wang (left) and Charles E. Ryan, Jr. (right).

GTRI researchers named IEEE Fellows

Two principal research engineers in the Microwave and Antenna Technology Development Laboratory at GTRI have been elected Fellows of the Institute of Electrical and Electronics Engineers (IEEE). They are Dr. Johnson J.H. Wang and Dr. Charles E. ("Chuck") Ryan.

Johnson Wang

Dr. Wang's citation reads, "For contributions to generalized moment methods for computer solution of electromagnetic problems." Since joining GTRI in 1975, he has been conducting research in the area of antennas, microwave and electromagnetic theory, focusing on the computation of a variety of three-dimensional electromagnetic problems using digital computers by the generalized method of moments. He is the author of a book, *Generalized Moment Methods in Electromagnetics—Formulation and Computer Solution of Integral Equations*, published by John Wiley & Sons in 1991.

His most significant achievement is the unification and consolidation of an ever-increasing number of seemingly new and unrelated computer-based solution techniques for electromagnetic problems within a succinct and elegant framework that he calls the "generalized method of moments." Dr. Wang's integration of this fragmented discipline has become important to the solution of both theoretical and practical engineering problems, and is expected to have a significant and far-reaching impact on the advance of science and technology.

Dr. Wang is co-inventor of a patented metal-post corner reflector for maximum same-sense CP return and has patents pending on five kinds of antennas, another type of reflector, and a dual conductor for antenna and microwave applications. He and Victor Tripp recently reported a major breakthrough in microstrip antenna technology: widening of frequency bandwidth from the conventional 10% or less to 600%. He also invented horn antennas coated with magnetic materials that achieve extremely low sidelobes and symmetrical beam widths comparable to those of corrugated horns. His contributions to electromagnetic theory and analysis include the development of a uniform and consistent theory for electric dyadic Green's functions in the source region.

He is the author or coauthor of 22 journal articles, 49 symposium papers and other presentations, and 27 major technical reports.

Charles Ryan

Dr. Ryan's citation reads, "For contributions to the geometric theory of diffraction and electromagnetic scattering analysis." His original formulation of the method of equivalent currents (MEC) in his Ph.D. dissertation resulted in a significant contribution to the theory and practice of the geometric theory of diffraction (GTD). This method has been widely used in many computer algorithms for the analysis of antennas and electromagnetic scattering. His later development of the concept of electric field edge waves provided a simple representation of the effects of edge wave scattering in the electric field plane (E-plane) for flat-plate targets aligned parallel to the E-plane. He made further contributions to electromagnetic scattering analysis by developing the plane wave spectrum scattering technique. This technique, which is computationally efficient, allows accurate analysis of the effects of near-field obstacles on directive antenna patterns.

The MEC has been applied to the analysis of antennas mounted on missiles and electronic warfare antenna performance on the F-4, F-16 and A-10 aircraft. Both the MEC and edge wave developments have significance in the analysis of the radar cross section (RCS) and RCS reduction of low observable platforms. The plane wave scattering technique has been applied to analyze the performance of both search and tracking radar antennas on U.S. Navy surface combatant ships. This method also led to further developments in ship topside electromagnetic analysis which have been applied to the siting analysis of radar antennas for several classes of ships.

Another of Dr. Ryan's contributions was co-development of the technique of near-field planar measurements of bistatic and forward scattering. He also participated in developing the modulated scattering technique (MST), which has resulted in an order of magnitude reduction in the time required for near-field measurements.

Dr. Ryan is co-inventor of a patented lens polarization control; he and Dr. Wang have a patent pending on a broadband modulated retrodirective reflector. He is the author or coauthor of 20 journal articles, three book chapters, 35 symposium papers and other presentations, and 74 technical reports.

Both Dr. Ryan and Dr. Wang received their doctorates in electrical engineering from The Ohio State University. Dr. Ryan has been at GTRI since 1971, Dr. Wang since 1975. Both also are adjunct professors of electrical engineering at Georgia Tech.

Dr. Ryan retired from Georgia Tech in December 1991 and is currently acting as a consultant for the U.S. Navy.

The Fellow grade is the highest rank of the IEEE and is awarded by the Board of Directors to nominees selected by fellow committees of the individual technical societies and the IEEE. Approximately 240 Fellows are elected each year. ❑

Surplus property finds good homes

By Martha Ann Stegar, RCO

The Electromagnetic Environmental Effects Lab (EEEL) had a problem: a roomful of old equipment, all at least 10 years old, that was taking up precious shelf space. It was all somewhat obsolete, and the lab had newer equipment to replace it.

Rather than just declare these items surplus and ship them down to the State warehouse for disposition, EEEL personnel had an idea: Why not make a descriptive list of the outdated equipment and send it out on PROFS to administrators, lab directors, service group managers, and others who might have a use for it?

Senior research engineer Jimmy Woody and his coworkers physically inventoried their equipment to determine what was no longer needed and produced a surplus property list from their internal database. Woody searched Research Property Management's database for the lab's equipment list, and they manually compared the two for accuracy and completeness. Then Woody uploaded his database list to PROFS with a note that EEEL had available 65 items that it would transfer to other interested units at Georgia Tech, sending it to 70 administrators. The items ran the gamut from black-and-white television sets to oscilloscopes to radio-frequency signal generators.

He sent the note out on Friday, February 14. The calls began bright and early Monday morning, and by Wednesday all the equipment was gone. "I've just been overwhelmed with the response," Woody says.

When a piece of Georgia Tech property is surplused, it goes to the State warehouse for surplus property. Any other unit of State government may go there and select useful items for free, except for an administrative charge. The catch, says Woody, is that "we have had instances where one group in our building has surplused and gotten rid of items that another group in the same building could have used. A little internal advertising saves time, trouble and money."

Research Property Management (RPM) head Harry Ross says transfer of property is simple. No dollars are involved. A form is executed changing accountability for the property from one party to another.

He has been advocating for several years that the RPM database be modified to automate the listing of surplus property. Researchers already can search the RPM inventory to find equipment that they can borrow, and Ross hopes to add the surplus advertising capability in the near future.

Meanwhile, why not take the initiative like EEEL's Jimmy Woody and advertise on your own? Everybody wins—and saves money. ❑

"We have had instances where one group in our building has surplused and gotten rid of items that another group in the same building could have used. A little internal advertising saves time, trouble and money."

—Jimmy Woody

Queries & Quotes

"The primary charter of the Management and Project Support (MAPS) group is to support the GTRI project director, whom we consider to be the heart of the organization."

— Carolyn Mahaffey

Information, Please!

More facts about patents

By Ann Campbell, Library

*(**Editor's Note:** This is the conclusion of a discussion of patents begun in last month's GTRI CONNECTOR.)*

U.S. and foreign patents

Most countries use a different standard than the U.S. when there are competing applicants for a patent. They use the "first to file" rule where the patent is awarded to the earliest applicant. The U.S. awards the patent by the "first to invent" standard. A properly kept and witnessed lab notebook helps to establish the date of the invention. Frequently, the first applicant to file is not the first to invent.

The U.S. and more than 90 other countries abide by the Paris Convention for the Protection of Industrial Property. The Convention requires member countries to treat foreigners the same as their own nationals in granting patent rights. The Convention permits patent applicants who have filed an application in one member country to use that original filing date as the priority date in other member countries *provided the application is made in the member countries within 12 months of the date of initial patent application.*

Most western European countries, Japan and Australia are "fast publishing." Eighteen months after the filing date (or priority date if the Paris Convention is used), the *unexamined* application will be published. In "slow publishing" countries like the U.S., nothing is published on the invention until the patent is examined and granted.

Third-world countries tend to have short patent terms, sometimes only a few years. They are interested in getting products on the market quickly and cheaply. Industrialized countries grant longer terms, often 20 years from application date, to allow companies to recover research investments.

Access to U.S. patents

The U.S. Patent and Trademark Office maintains a library in Arlington, Virginia, with a Search Room where patents issued since 1836 are organized according to the Office's classification scheme of more than 400 classes and 120,000 subclasses. Patents are numbered sequentially as granted. The *Official Gazette of the United States Patent and Trademark Office*, published weekly since January 1872, contains a claim and selected figure of each patent granted that day.

The U.S. Patent and Trademark Office distributes microfilm reels of U.S. patents to 72 depository libraries in the U.S. Georgia Tech's Library, the only depository in Georgia, maintains complete files.

Patent searches

Searches to support a patent application can be performed at a depository library, but are time consuming. The classification scheme for patents is based on how mechanisms operate. It is possible to find a butter churn, cement mixer, and a washing machine in the same class because these machines "agitate" or "stir" something. Keyword searching also is difficult. Sometimes the word we apply to a device did not exist at the time the item was invented. The first zipper was described as a "clasp locker" for shoes and boots.

The Library has access to databases for U.S. and foreign patents. U.S. patent classification information can be searched back to 1790, keyword searches back to 1950. Foreign patents can be searched back to 1963. Database searches can locate a patent number if the inventor's name or other significant information is known or as subject searches preliminary to a full patent search by a patent agent or attorney.

The Library provides copies of U.S. patents from its microfilm collection. Copies of foreign patents are ordered off site. Call the Library at 894-4511 for patent copies or searches.

Trade secrets and patents

A trade secret is proprietary information used in a trade or business. It works best if the information cannot be easily duplicated by others or discovered by "reverse engineering." Commercial benefits from a trade secret can be exploited globally and continue as long as the trade secret remains secret. Once public, all rights have been lost.

Some trade secrets continue to reap benefits long after a patent would have expired. The best-known example is the formula for Coca-Cola. An older trade secret, since 1623, is the Zildjiam family's metallurgical process for making better cymbals than anybody else. Still older is the formula for Chartreuse liqueur, a secret guarded by the Carthusian monks for over 400 years.

In the U.S., trade secret protection is based on common law and relies on the right to keep ideas secret, confidentiality and contractual agreements. A nondisclosure agreement should cover all who have access to the secret. Departing employees or suppliers have a continuing nondisclosure obligation.

Patent applications in the U.S. Patent and Trademark Office are maintained in secret. If you do not receive a patent and have not made your invention publicly known, you can still use the trade secret to protect your invention.

If you are thinking of patenting

If you are employed or a student at Georgia Tech, contact Barry Rosenberg in the Office of Technology Licensing at 894-6287. Office staff will assess whether a patent or an alternative intellectual property protection, such as trade secret and licensing, is appropriate. They also will work with you to seek commercialization of the technology.

There are support groups for inventors in the Atlanta area. One is Inventors Clubs of America, Inc. Contact Alexander Marinaccio at 938-5089 for more information. Another is Inventor Associates of Georgia, Inc. Call Hal Stribling at 427-8024 for information on meeting dates and location. ❑

Focus on Quality

MAPS—serving the project director

By Carolyn Mahaffey and Charlotte Batson

The primary charter of the Management and Project Support (MAPS) group is to support the GTRI project director, whom we consider to be the heart of the organization. In our first 18 months of operation, we have performed thousands of services for project personnel throughout GTRI. These services include:

- Re-budgeting projects to reflect planned expenditures
- Tracking encumbrances
- Assisting with sponsor-required financial reports
- Assisting with determining project cost-to-complete
- Handling overrun transfers
- Preparing proposal budgets for submission through OCA and tracking each proposal through the system to final disposition
- Assisting with problems relating to overdue deliverables and monitoring and reporting on their status
- Assisting with time sheet revisions and maintaining copies of time sheets
- Interacting as needed to resolve specific problems involving other service groups
- Maintaining and communicating the Project Management Costs (PMC) and Applied Project Level Costs (APLC) status and rates for each lab
- Setting up, amending and zeroing subbudgets

During the recent strategic planning process, we met with several of our customers to determine our successes and challenges and to identify some future objectives for our group. We set some ambitious goals for ourselves in the coming year, and will be surveying project directors on an informal basis to be sure we are working in a direction that is helpful to them.

Some of the future plans are:

- To ensure accuracy and uniformity of proposal budgets and provide better software support
- To assist with commonly required contractual financial reporting
- To participate in project director training courses to provide information about our services
- To identify and measure customer satisfaction and set numerical parameters to assess improvement
- To assist with tracking schedules and costs for mid-size projects not requiring cost/schedule status reporting (C/SSR)

The MAPS group serves many masters. In addition to our work for project personnel, we assist OOD and lab managers in determining personal services projections, backlog and other management information; prepare materials for monthly or quarterly lab reviews; and provide assistance in managing overhead budgets and other financial resources.

As a part of our participation in the GTRI-wide strategic planning process, the MAPS

group developed the following mission statement:

The mission of the MAPS group is to support the GTRI project directors and other project personnel, laboratory directors, and all other levels of GTRI management with assistance in budgeting and otherwise managing financial resources. MAPS provides expertise in obtaining and interpreting all types of information, whether it be contractual, administrative or financial in nature, and in training individuals on how to access and use data themselves. It also functions as an interface whenever needed between project personnel and the other GTRI support units and OCA and, when possible, works to prevent problems before they occur. MAPS will raise its future efforts to a higher level of problem-solving to improve the systems and methods of supporting contract research as our tools become more standardized, integrated, automated and sophisticated.

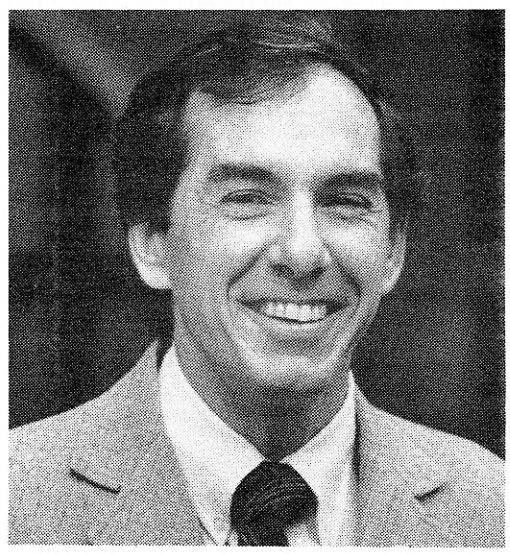
While performing our services, we are continuing to improve and standardize tools and processes among the six MAPS sites. It is our goal to create an atmosphere of accessibility for our customers and to maintain a positive, service-oriented attitude. However, we can be only as helpful as our customers will allow us. Any positive feedback or constructive criticism is welcomed, since it will permit us to provide our users with better service.

For further information or to offer suggestions, please contact your local MAPS personnel or the MAPS group manager, Carolyn Mahaffey (PROFS CMAHAFFE, telephone 894-4428, FAX 853-0061, or mail to 208 CRB). ❑

GTRI in the news

Here are highlights of GTRI national news coverage in October and November:

- GTRI experts on factory ergonomics were quoted extensively in an article in *Industry Week* (circulation 288,000). *Manufacturing Systems* (115,000) and *Manufacturing Engineering* (130,000) also reported on their research.
- *Engineering Horizons* (25,000) published an article by Vic Tripp and Johnson Wang on their microstrip antenna research.
- The development of a sensing device to measure sewing needle wear was reported in *Business Week* (975,000), *Computerworld* (135,000), and *The Chicago Tribune* (1,131,226). GTRI researchers are assisting the School of Textile & Fiber Engineering in this research.
- Participation by GTRI researchers in a space shuttle experiment was noted in a wire service story published in *The New York Times* (1,209,225), the *Newark Star-Ledger* (485,000), and other newspapers with a combined circulation of nearly 2 million.
- *The Atlanta Journal-Constitution* (682,000) reported on Jim Beletic's use of speckle imaging techniques to detect dust storms on Mars. ❑



Robert A. Cassanova

Cassanova named Aerospace Lab director

Robert A. Cassanova was appointed director of the Aerospace Laboratory in December, following an extensive national search. He had served as interim director of the lab since the GTRI reorganization.

The selection was made by a search committee chaired by Trent Farill and composed of both GTRI and academic faculty.

Dr. Cassanova has been on the GTRI staff since 1978, beginning as associate division chief in the Technology and Development Lab, then serving as director of the Energy Research Lab prior to its incorporation into the new Energy and Materials Sciences Lab in 1980. He was associate director of EMSL and chief of its Thermal Sciences Division from 1980 to 1985. He headed GTRI's Aerospace Program Office until the Aerospace Lab was created in 1990.

Dr. Cassanova was a research engineer in Georgia Tech's School of Aerospace Engineering for 10 years, during which time he received his doctorate in aerospace engineering. He has 34 major publications to his credit. He is a senior member of the American Institute of Aeronautics and Astronautics, a member of the Association for Unmanned Aerial Vehicles, and was president of the Georgia Tech chapter of Sigma Xi in 1985-86.

STGC requests proposals

The Senior Technology Guidance Council (STGC) invites all GTRI research faculty to submit proposals for the FY 1993 funding cycle, which begins in July. Proposals must be received by Devon Crowe, 229 Baker (0800), by March 16.

The STGC, working with selected Georgia Tech expert participants, will rank the top 20 proposals and submit the list to the GTRI Director's Office for funding at the level available during FY 1993.

The Internal Research Program funds individuals to perform on projects. No one may be principal investigator on more than two proposals or participate in more than three proposals.

It is expected that projects funded under this program will be innovative or provide a competitive advantage for obtaining external funding. They should be under two years in duration and cost less than $200,000.

The proposals also will be considered for their potential to further STGC goals. These goals are as follows:

- Maintain the technological leadership of existing successful programs.
- Set the standard for quality research through examples.
- Improve the quality and innovation of GTRI research.
- Identify and support new technical areas with anticipated external support.
- Improve GTRI's reputation through publications.
- Create interdisciplinary research programs.
- Demonstrate the feasibility of ideas with commercial potential.
- Promote the development of junior professionals.

This is the seventh solicitation for proposals since the program began in 1988 and is the only request for proposals planned for FY 1993. Individual researchers are invited to contact any STGC member for advice on proposal issues. Current members are Devon Crowe (chairman), Krish Ahuja, Charlene Bayer, Larry Corey, Harold Engler, John Handley, Josh Nessmith. Tom Starr, Laura Turbini, Carl Verber, and Paul Wine.❑

GTRI to publish journal

The Senior Technology Guidance Council (STGC) is sponsoring an annual *GTRI Technical Journal* that will feature approximately 10 technical papers representative of the diversity of internally and externally sponsored research at GTRI.

The inaugural issue is in the last pre-publication stages and should be printed sometime in March. Peer review committees selected 10 papers from among several dozen that were submitted. Appendices provide listings of journal, conference and symposium publications, as well as patents issued.

STGC member Josh Nessmith is spearheading the development of the new technical journal. "Today, a growing volume of GTRI's research is multidisciplinary in nature," he says. "Consequently, a need has developed to provide a resource that keeps the research community up to date on the accomplishments of GTRI's professional staff and the potential that exists for further multidisciplinary collaborations."

The journal will be distributed to GTRI professional staff, Georgia Tech general faculty and administrators, and to a selected external mailing list in the scientific R&D community. ❑

Georgia Tech
RESEARCH INSTITUTE

Focus on Folks

STGC issues a request for proposals and announces a technical journal for GTRI.

Focus on Folks

Professional Activities

Electronic Support Measures Lab

Mike Willis presented a paper on "Precision Voltage Regulation Using Three Terminal Regulator Integrated Circuits" at the Analog Design Conference and Exhibit in Santa Clara (CA) in October.

Larry Holland gave a presentation on "Electronic Warfare in Desert Storm" to the Bartow County Rotary Club January 30.

Byron Coker, Richard Pracht, and **Cindy Wierschem** received their MSEE degrees in December.

The following ESML staffers were committee chairmen at the ITEA Annual Symposium held in Atlanta last November: **Bill Youngblood**, Logistics; **Larry Stroud,** Facilities; and **Adrienne Harrington**, Registration.

Computer Science & Information Technology Lab

Charlotte Jacobs-Blecha had a paper, coauthored by **William Riall** of EDL, published in the *International Journal of Clothing Science and Technology*, Vol. 3, No. 4, 1991. The title was "The Feasibility of the Marker Making Process."

Economic Development Lab

Harris Johnson was elected regional vice president of Professional Engineers in Government of the National Society of Professional Engineers. He will represent the interests of government engineers from nine southeastern states, Puerto Rico, and the Canal Zone on the Government Engineers Executive Committee. He also will serve on the NSPE task force studying the need for required ongoing professional development for continued license to practice.

The Southeastern Trade Adjustment Assistance Center has been refunded for $1.1 million by the U.S. Department of Commerce, according to **Charles Estes**. Since 1978, SETAAC has assisted scores of southeastern manufacturing firms hurt by competition with imported products.

The Industrial Extension Service and its 12 regional offices were cited in a recent publication, *Put Up or Give Way*, by John Sidor, executive director of the Council of State Community Development Agencies.

Environmental Science & Technology Lab

Paul Schlumper is now a registered Professional Engineer. He recently gave a half-day seminar on current safety and health issues to the Valdosta chapter of the Society of Human Resource Specialists.

David Jacobs addressed an international symposium sponsored by EPA, OSHA, and NIEHS on December 10, speaking on adult lead poisoning. In mid-January, he spoke before the Georgia Association of Realtors on lead-based paint hazards in residential properties.

Materials Science & Technology Lab

Kathryn Logan attended the 16th Annual Conference on Composites and Advanced Ceramics January 7-10 at Cocoa Beach (FL). She participated as chair of the poster session on Processing/Structure/Property Relationships, as secretary of the Engineering Ceramics Division (conference organizers) of the American Ceramic Society, as chair of the Museum Committee that will implement a traveling show of advanced ceramic products for use at conferences and schools, and as a member of the planning committee for next year's annual Composites meeting.

Physical Sciences Lab

A paper on "Optimizing n+ Ohmic Contacts on GaAs for HEMTs," by **Mike Harris** and **Jeff Farley**, has been accepted for presentation at the Spring Meeting of the Materials Research Society, April 27-May 1 in San Francisco.

The November 28, 1991, issue of the *Journal of Physical Chemistry* featured a paper by **Mike Nicovich, Cor van Dijk, Kevin Kreutter**, and **Paul Wine** on "Kinetics of the Reactions of Alkyl Radicals with HBr and DBr."

Paul Wine is organizing the XXth Informal Conference on Photochemistry, which will be held at the Colony Square Hotel in Atlanta April 26-May 1. About 200 of the world's leading physical and atmospheric chemists, will attend the conference, including two recent winners of the Nobel prize in chemistry.

Wine also presented an invited seminar on "Studies of the Thermochemistry and Reaction Kinetics of Gas Phase Free Radicals" January 23 to the Georgia Tech School of Chemistry and another on "Laboratory Studies of Atmospheric Sulfur Chemistry" February 13 to the Auburn University Department of Chemistry. ❑

Personnel News

Advanced Technology Lab

Charlotte Irvine has been promoted to senior administrative secretary.

Scott Gleason has resigned.

Electronic Support Measures Lab

Ellen Barrett has gone on maternity leave and is expected back in early May.

Physical Sciences Lab

Stan Halpern was promoted from mechanical technician III to research equipment specialist effective November 1.

Radar & Instrumentation Development Lab

Jim Kurtz has been appointed head of the Systems Branch.

New student employees are GRAs **Michelle Linihan, David Meyers**, and **Wayne Pickell**, and co-ops **Craig Lacava** and **Steve Richie**.

Ed Hefter and **Roy Myers** have resigned. **Jack Harary** has resigned his full-time position but remains hourly. ❑

Personal Notes

Cradle Roll

William and **Deb Salmond** (EDL) have a baby girl, Amy Elizabeth, born January 30.

Mel (RSA) and **Christy** (formerly of MAL) **Belcher** welcomed a new son, Christopher William, January 7.

Linda and **Tim Floyd** (CAL) had a baby boy, Christopher Scott, February 7.

Joy and **Grover Richardson** (TSDL) welcomed a daughter, Lorelei Brigid, February 1.

Helen Hunton (MAPS) has a new granddaughter, Jesse Lauren, born February 16.

Also arriving February 16 were twin boys for Kevin and **Anita MacDonald** (COML); their names are Matthew and Patrick.

Two baby boys were added to the CSITL roster December 10: Carlin and **Beth Bennett** welcomed Taylor, and Drew and **Lisa Sills** welcomed Austin.

Belated announcement: Carol and **Mason Gross** (PSL) are proud parents of Sarah Elizabeth, born September 5.

Sick Bay

David Blount (ATL) has been on extended sick leave and is recuperating at home. He would welcome cards.

Our Sympathy...

To **Claudia Huff** (ESTL), whose father died at Christmas, to **Bill Leverett** (TSDL), whose mother died January 17, and to Kathy and **Tracy Wallace** (RIDL) on the loss of her mother. ❑

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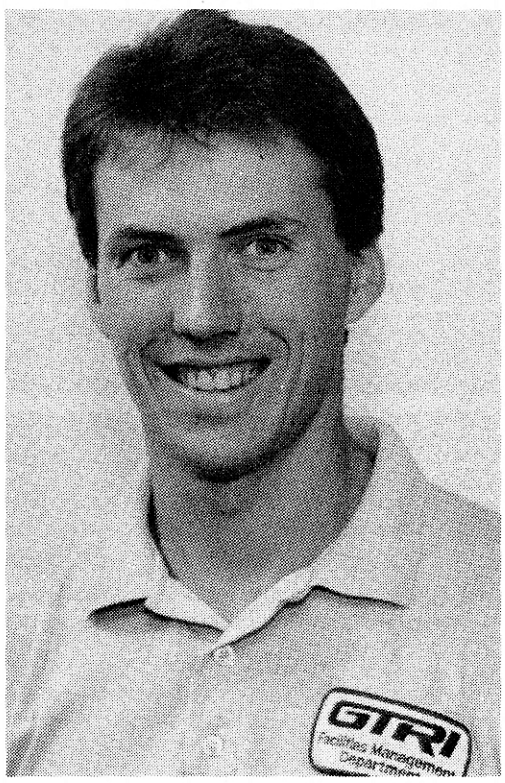

The GTRI Connector is published for Keith Hughes, maintenance worker II in Facilities Management, and all the other people in GTRI. (Photo by Joe Schwartz)

ESML fields sports teams

The Electronic Support Measures Lab has several intramural sports teams.

The Sixty-niners are in the basketball B-league. They have played two games so far, both of which had to be stopped before game's end as the Sixty-niners were 35 points ahead! They should no doubt make it to the playoffs as in years past. Players are Walter Addison, Rob Raboud, Kim Cole, Dan Mack, and Russell Leath, all of ESML; Rob Kossler, Lou Fertig, and Fred McKenn of CMDL; and Ben Slocumb of CAL.

ESML also has two B-league wallyball teams. (Wallyball is volleyball played on a racquetball court.) The No-names, consisting of Wendy Hanigofsky and Tom Autry of ESML, Andy Slack of CAL, and Michele Brown of MAPS, are 2 and 1 with one game left. The Wild Weasels, made up of ESML's Lee Evans, Steve Millar, Matt Bradley, and Mark Foreman, are 1 and 0 with three games left. ❑