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Research Horizons

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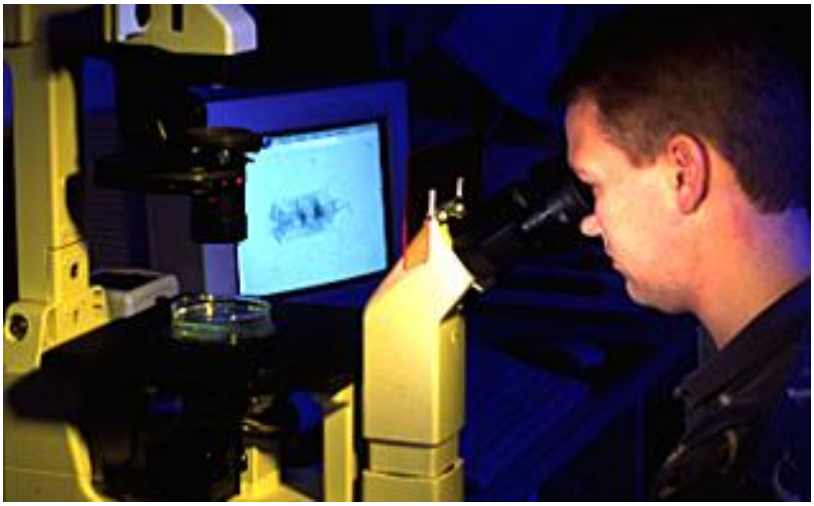
Lea McLees



Graduate student Gary Cecchine examines a rotifer.
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The "Lifeblood" of Research

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Last updated: May 30, 1997

Research Horizons
Georgia Institute of Technology

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The "Lifeblood" of Research

By Lea McLees

Photography by Stanley Leary

ONE DAY YOUR HOME COMPUTER may have a roomy 50-gigabyte -- or larger -- optical drive made possible by special materials, and you'll store everything from favorite songs and recipes to billing records on it.

Water pollution testing will take into account the subtle ecological differences between the rushing, splashing rivers of Colorado and the still, silent lakes of Florida. The embedded computer controlling your auto's anti-lock brake system will be accurately simulated on a computer for higher quality and produced faster, at less expense.

And you may very well have a Georgia Institute of Technology graduate student such as Eden Hunt, Gary Cecchine or James DeBardelaben to thank for such advances.

Ph.D. student Berdenia Walker is creating a new type of partitioning algorithm for prototyping computer hardward designs.

Hunt, Cecchine and DeBardelaben are among approximately 3,401 graduate students pursuing master's and doctoral degrees at Georgia Tech. Their research is not just winning them diplomas -- it holds the potential to improve quality of life for all of us.

"Graduate students are the lifeblood of research at universities," says Dr. Jean-Lou Chameau, vice provost for research. "Obviously, faculty members are the key in initiating ideas and finding resources. But a large amount of work comes from the students. They are very important to Georgia Tech as researchers, but also as individuals who will represent the Tech name in the future."

A Worthwhile Investment

Graduate research is a win-win endeavor

Students who perform research as part of their training absorb more than in-depth knowledge of a subject area, says Dr. Nan Marie Jokerst, associate professor in the School of Electrical and Computer Engineering.

"By doing research, students develop creative processes and creativity," she says. "In class, there's only one solution to a problem. Often, the questions posed in research have no such strict bounds. You have to evaluate tradeoffs, and you have to know what else you need to learn to solve the problem."

Ph.D. student Bob McGinty displays a speck of copper, prepared for microscopic analysis of its structure, as well as a large copper piece, used for compression tests.

Chameau agrees. In addition, graduate students practice teamwork and communication in their research experiences. And students are not the only beneficiaries of their work, he notes.

"Through interaction with graduate students, industry can identify the best and the brightest and have access to human resources, including our faculty," he says. "It is also a good way for industry to be aware of the latest developments in technology."

The long-term focus of the university research environment compliments the short-term research industry conducts, many researchers note. And interaction with government and industry sponsors helps students learn what industry needs from them, as well, says Dr. Mark Richards, a principal research engineer in the Georgia Tech Research Institute's (GTRI) Sensors and Electromagnetic Applications Laboratory.

"People really do learn more when they solve real problems with real deadlines for real sponsors," he says. "At GTRI they are exposed to all the business aspects of research."

Graduate students also find that real research -- like real life -- doesn't always work out the way one expects or hopes that it will, notes Dr. David Roessner, associate professor in the School of Public Policy.

"You run into unexpected problems, and you find the world is not as neat as you thought it was," he says. "That kind of experience, in real time, is extremely valuable."

Chameau foresees continued opportunities for graduate students.

"There is often a perception that the market is bad for Ph.D. graduates," he notes. "Although that may be true in some cases, clearly the record at Georgia Tech shows that our graduates, both M.S. and Ph.D.s, find jobs, and very good ones. For some schools here, the more graduates they produce, the more graduates are hired, including Ph.D.s. Our students get good jobs in academia, industry and research organizations."

And graduate students often bring to those jobs a view that extends beyond their areas of expertise, Jokerst says.

"The most important thing we can do as educators is to treat students not just as students of technology or engineering information, but as individuals being prepared to join a large community that serves the interests of the United States," she says. "Paying attention to the intangibles, as well as the tangibles, will produce not only excellent students, but excellent leaders."

Read on to meet some current and former Georgia Tech graduate students -- and learn about the directions in which they'll be leading tomorrow's world.

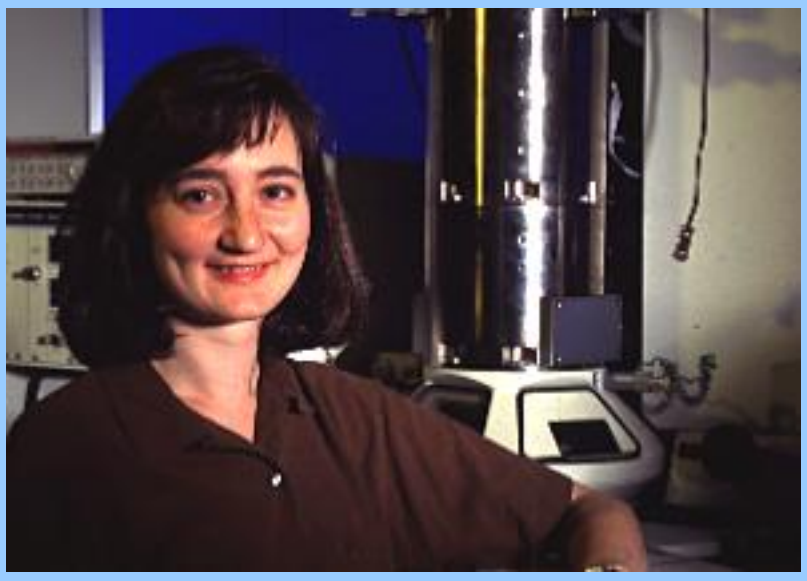
Making New Materials

Hunt: Research in non-linear materials

Optical fibers hold vast potential for transmitting large amounts of data -- but for now, their data capacity is limited by the electronic components with which they are interfaced.

Ph.D. student Eden Hunt [Adviser: Dr. Janet Hampikian] is developing non-linear materials that may lead to all-optical systems in the future: insulating materials with metallic particles embedded in them.

"Dielectric materials containing nano-sized particles have interesting non-linear optical properties for use in waveguide technology, for example," she says. "The proper combination of matrix, particle materials and size may prove to result in the properties necessary to make an optical switch."



"Any great leap in [materials] performance or cost is going to have to come from further material research," says Ph.D. student Eden Hunt.

Hunt implanted yttrium into alumina, resulting in the formation of aluminum particles. Her dissertation will address why that is happening, and how the process might be controlled to form materials with specific properties.

"Any great leap in [materials] performance or cost is going to have to come from further materials research," Hunt says. "It is very important to keep the research practical."

Hunt's research has been sponsored by several sources -- the Engineering Foundation, Georgia Tech's Molecular Design Institute, the Shared Research Equipment Program through Oak Ridge Associated Universities (ORAU) and the U.S. Department of Energy, and the Southeastern University Research Association. Hunt also won the Microscopy Society of America Presidential Student Award for an abstract she prepared for that group's annual meeting in August 1996.

"In a class, the professor generally knows the 'right' answer; in research, you must find an answer of your own," she concludes, "and be able to defend it."

Rotifers, Stress and Pollution Tests

Cecchine: Research on aquatic organisms

Rotifers and other tiny aquatic organisms are commonly used in freshwater pollution tests. The amount of food they eat, their rates of reproduction and other functions are monitored for effects of pollutants.

Gary Cecchine measures algae for use in toxicity testing with rotifers.

But these tests don't take into account the effects of predation, starvation and other stressors on rotifers' ability to withstand pollution, notes School of Biology Ph.D. student Gary Cecchine [Adviser: Dr. Terry Snell]. Cecchine is examining the combined effects of different types of stress on these tiny, multicellular herbivores -- each about 1/10th of a millimeter in size -- and how these affect the results of pollution testing. Though small, rotifers are a critical part of many aquatic environments.

"It's a rough world out there," Cecchine says. "If an animal is under starvation stress, it doesn't have much energy to allocate to dealing with pollution stress -- and pollution stress affects its ability to take in more food.

"That dynamic leads to false conclusions of environmental safety, because traditional toxicity testing reveals only the effects of pollution stress in the absence of natural stressors," Cecchine says. "Since natural stress exacerbates pollution stress, we underestimate the total effect of adding pollution to an environment when we use only traditional tests in the absence of combined natural stressors."

Cecchine's work is funded by an NSF Environmental Sensors Research Assistant Grant and the U.S. Environmental Protection Agency, Region 4. His goal is to develop freshwater pollution testing that is more realistic, and specific to different ecosystems. He wants to use his biology, aquatic toxicology and public policy training, along with 41/2 years as a medical service officer in the U.S. Army, to help industry deal with environmental protection.

"To make effective environmental policy, it takes cooperation of the government, citizens groups and industry," Cecchine says. "Academia provides the information and the

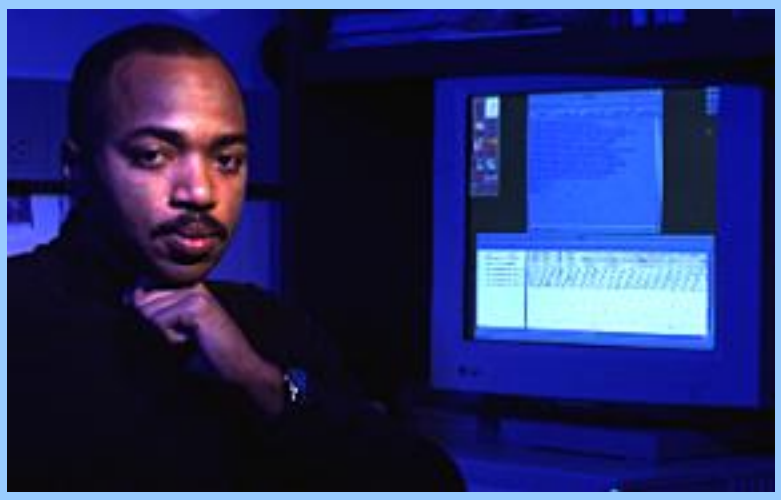
models."

Getting the Word Out

DeBardelaben: Research in signal processors

Ph.D. student James DeBardelaben [Adviser: Vijay Madisetti] is not only performing research -- he is planning ways to share his findings with industry and university colleagues.

DeBardelaben's work, along with that of other graduate students in Madisetti's Rapid Prototyping of Application Specific Signal Processors (RASSP) Laboratory at the Center for Signal and Image Processing (CSIP), is being incorporated into courses to be taught in industry and academia. It also will be used in a 1997 book on system-level design, co-authored with Madisetti.



Ph.D. student James DeBardelaben is helping develop hardware simulation models, or "virtual prototypes," used to model digital signal processors.

"Technology transfer forges a partnership between academia and industry. Our research helps companies develop new technologies, while they provide us with additional scientific input and resources," DeBardelaben says of his extra efforts.

DeBardelaben is helping develop hardware simulation models or "virtual prototypes" for modeling digital signal processors (DSPs). The processors control everything from engines and anti-lock brakes in automobiles to radar systems, video conferencing and video data encoding. The virtual prototypes allow engineers to test software before building the hardware it would run on, thus catching design errors quickly and cheaply.

DeBardelaben's optimization framework, funded as part of the Defense Advanced Research Project Agency's (DARPA) RASSP effort, combines lifecycle costs and profits with the predicted effects of a product's schedule to generate cost-effective architectures meeting the hardware/software system's design requirements.

"Our quantitative modeling approach partitions the system-level algorithm specification between hardware and software, while determining the processor type, the number of processor boards, and the amount of memory needed. From there, virtual prototypes of the architectural candidates are used to verify that the system actually meets performance constraints in addition to cost and schedule constraints," he explains.

DeBardelaben and fellow graduate students working with Madisetti also are getting lots of experience working as a team via the Internet with representatives of Lockheed Martin, Sanders, Motorola, Hughes Aircraft, SCRA, the University of Virginia, the Massachusetts Institute of Technology, the University of Cincinnati and the University of California/ Berkeley.

Mastering the Web

Farrell: Entangled in Web art

If you've seen or read about a Web site called **Art Crimes: The Writing on the Wall**, then you know a little something about the talents of Tech graduate Susan Farrell [Adviser: Dr. Kenneth Knoespel].

Art Crimes was one of the first Internet art galleries -- it also was Farrell's final project for her 1995 master's in information design and technology. The collaborative project -- developed with University of Southern California student Brett Webb -- features graffiti art and continues attracting worldwide attention. Art Crimes was highlighted in Newsweek on Oct. 21, 1994, and continues to create requests for at least an interview a week, Farrell says. "We are still collecting graffiti art, and have more than 2,000 images from 80 cities around the world," she adds. "Hundreds of people are now participating in this on-line gallery."

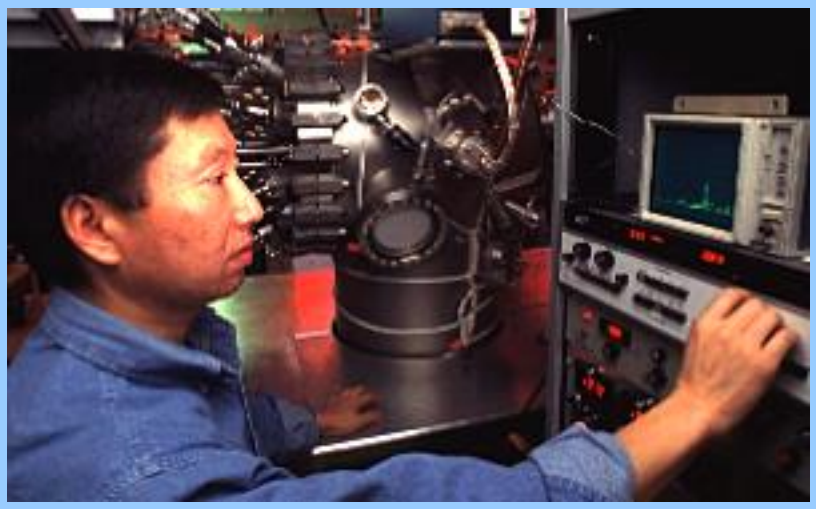
The skills, experience, instruction and access to cutting edge technology Farrell received at Georgia Tech helped her get where she is today -- Silicon Graphics Inc. in Mountain View, Calif. Farrell designs user interfaces in SGI's Worldwide Customer Service division.

"The fastest growing job categories out there are in high-tech industries," says Farrell, who studied in the School of Literature, Communication and Culture and worked in a GTRI lab. "You must have computer skills -- the only way to get those is to sit in front of a high-end workstation and bang on the keyboard. Most people can't afford to do that as individuals. The tools and access I had at Georgia Tech made it possible for me to learn new things on my own."

The Dividends of Research

Tong: Reinvestment in student prowess

Tech plows knowledge back into the institution by hiring some of its graduate students. One such former student is Dr. Wusheng Tong [Adviser: Dr. Chris Summers], who earned a Ph.D. in physics in 1996 and a master's in electrical and computer engineering in 1992.



Former graduate student Dr. Wusheng Tong develops thin-film phosphors for the next generation of electro-luminescent displays through the Phosphor Technology Center of Excellence.

He works for GTRI as a research scientist in the Advanced Materials Technology Division of the Electro-Optics, Environment and Materials Laboratory, expanding on contract-funded research he did there as a student.

Wusheng develops thin-film phosphors for the next generation of electro-luminescent displays through the Phosphor Technology Center of Excellence (PTCOE), a DARPA-funded, university-led consortium. With Summers' direction, Wusheng's thesis research resulted in the invention of technologies to grow materials for a novel low voltage electro-luminescent device which reduced operating voltage from 200 V to 24 V. Lower voltage means less power consumption; it also allows direct integration of the display and the driver circuitry on one wafer -- a great advantage for head-mounted displays.

He also developed a delta-doping technique with more than four times higher luminescent efficiency than conventional homogeneously manganese-doped, thin-film zinc sulfide.

Currently, Wusheng is working with zinc sulfur manganese, which glows yellowish-red, and strontium sulfide doped with cerium, which produces blue.

"We are trying to develop a full-color, flat-panel display for use on monitors or head-mounted devices," he says. "These displays will have broad applications in the military, as well as in the civilian market. They could be used in armed vehicles because they can

withstand tough conditions, such as high and low temperatures, and because they offer a wide viewing angle. But these displays also can be used for many civilian applications -- in cars and airplane cockpits, and as machine vision aids in advanced manufacturing technology.

"We have many chances to present our work, and to initiate new technological developments," Wusheng says of his graduate student experience at Georgia Tech. "When a graduate student takes a job, that person often has to be trained for a couple of years. But with my experience here, I was able to go to Planar America on a summer exchange program conducted by PTCOE and work with the new project right away."

Did You Design What You Planned?

Walker: Streamlining the prototype process

After a designer develops an idea for computer hardware, a real prototype is desirable for testing. Prototyping saves time and money by pointing out potential problems earlier in the design process. Ph.D. student Berdenia Walker [Adviser: Dr. Henry Owen] is trying to make that process more efficient by creating a new type of partitioning algorithm.

"Partitioning is one phase of the design cycle," says Walker, who is studying electrical and computer engineering. "Partitioning breaks the design down into pieces, such that a prototype can be created using a hardware emulator.

"Most partitioning algorithms don't take the architecture of the emulator into account, so sometimes you can partition and your results won't map on the emulator due to interconnect constraints, for example," she continues. "If it doesn't map, you can't get a prototype."

Walker's algorithm, in contrast, does take the architecture of the emulator into account.

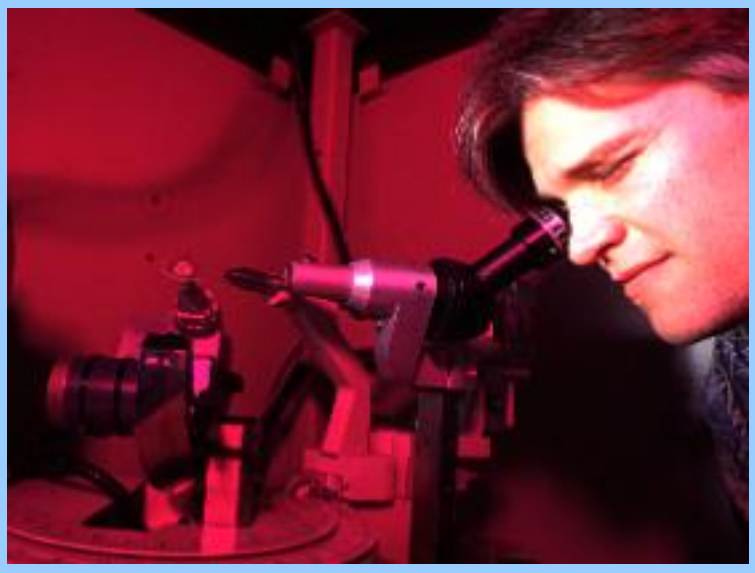
"Research helps you be creative, and you need that if you are going into industry or academia," Walker says. "You learn to develop new technologies, new tools and new methods using new ideas -- and you can't be afraid to try different things. This is useful in the real world, no matter where you work."

Coatings Applied at Less Expense

Hunt: Translating research into business

Some Tech graduate students turn their research into businesses -- that's what 1993 graduate Dr. Andrew Hunt (no relation to Eden Hunt), CEO of MicroCoating Technologies, did.

While studying for a Ph.D. in materials science and engineering, Hunt developed a method of applying solid thin film coatings from vapor in open air. Such coatings traditionally are applied in vapor form inside reaction chambers.



Former Tech graduate student Andrew Hunt (shown here using an X-ray diffractometer) turned his Ph.D. research into a business: MicroCoating Technologies.

"We save money because you don't have to use chambers or vacuum pumps, and we make the materials easier to work with," Hunt says.

The technology is useful in applying electronic, optical, catalytic, corrosion- and wear-resistant coatings. The American Ceramic Society named the technology one of the top five to watch in the coatings/films area before the year 2000.

The work has been covered by CNN, Business Week, Advanced Materials and Processes, Advanced Coatings and Surface Technology, and was published in Applied Physics Letters.

Hunt continues his lab work while running MicroCoating Technologies, in part because he believes that continued research is vital to the future of this country.

"It causes the United States to maintain its technological lead, " he maintains, "and technological advantage is very important."

Employee Perceptions

Gilson: Re-examining management strategies

Participation is one of the most popular management tools used today -- but not much is known about its multifaceted effects on employee perceptions of fairness.

For her Ph.D. research, Lucy Gilson is exploring the role of employee involvement and participation in perceptions of workplace fairness.

That will change, however, as management Ph.D. student Lucy Gilson [Advisers: Dr. Terry Blum and Dr. Christina Shalley] pursues organizational behavior and human resources research on fairness and justice issues in the workplace. Her research addresses the role of employee involvement and participation in workplace fairness.

"Much participation research states that if employees are involved, they will see a decision as more fair," Gilson explains. "But now, employees are viewed as either participative or mute. I'm saying that participation is multi-dimensional, and there are different levels and types of participation.

"For example, some people are forced to participate and some participate informally, based on their relationships with their managers. How employees participate should impact how they perceive the decision-making process and the outcome resulting from the decisions. In sum, an employee's relationship with his/her manager and organization can be altered or impacted by both participation and fairness issues."

Gilson brings to her research 10 years of experience in marketing and business development in the United States and England. Other issues she's studied with Blum, professor and director of the DuPree Center for Entrepreneurship, and Shalley, associate professor of organizational behavior, are creativity in organizations, and the importance of the work environment in ensuring that employees can reach their creative potentials on the job.

"Management research is valuable in today's rapidly changing environment," Gilson says. "Academic research helps us better understand and explain what is going on in organizations."

Modeling Metals

McGinty: Metallic strengths and weaknesses

What can't a metal withstand? That's what Bob McGinty [Adviser: Dr. David McDowell] and several other mechanical engineering graduate students are exploring.

McGinty, who is pursuing a Ph.D. in mechanical engineering, mathematically models the behavior of metals -- what kind of and how much stress is required to deform them in specific ways. The U.S. Army- sponsored work has civilian applications, as well, in the automotive, airline and aluminum can manufacturing industries.

McGinty spent 12 years in research and development at Michelin in Greenville, S.C., before returning to his master's degree alma mater for his doctorate.

"[At Michelin], I had started by studying the thermal aspects of a situation, but found all the answers in its mechanical aspects," he says. "In that way I discovered the world of material mechanics, and loved it."

McGinty advises patience for those who wonder if research pays off.

"A good example is airplane development," he says. "Based on research that was begun decades ago on fatigue and fracture, airline corporations are now able to develop much safer airplanes."

A National Reputation

Favorite: Research in nuclear reactors

The research of Tech's graduate students captures the attention of professional organizations, in addition to that of sponsors and advisers. Jeff Favorite's [Adviser: Dr. Weston Stacey] nuclear engineering research won the 1995 Mark Mills Award, the highest honor the American Nuclear Society presents to any student.

Favorite won for a published paper that eventually led to his current Ph.D. research sponsored by NSF. He is deriving equations that predict the power distribution in a nuclear reactor, even under potential accident conditions. The predictions are used in designing nuclear reactors, and they are important for nuclear reactor safety.

"These predictions are being made very well now," Favorite says. "My equations reduce the expense -- the computer resources -- associated with a given level of accuracy.

"Cutting-edge concepts only come from research and experience, and those don't pay off in U.S. dollars at the moment of discovery -- it's an investment," he adds. "Graduate students are affordable, and it's an education for us. It's an investment and a service, and it'll all pay off."

Products To Market Quickly

Du: Research in computer process control

The time it requires to launch a new electronic circuit board assembly line, or change an existing one, can affect how rapidly a product comes to market. Hua Du [Adviser: Dr. Chen Zhou], a Ph.D. student in the School of Industrial Engineering, is examining computer process control in electronic circuit board assembly.

"The current research is to develop models and frameworks for reusable, interoperable and saleable process control applications," she says. "The research will lead to a "plug-and-play" paradigm in board assembly integration. Potential benefits include savings on time and effort for new system launch and existing change."

This research, sponsored by Siemens and FASTech Integration via the Center for Board Assembly Research, could reduce tenfold the time needed to launch a new board assembly system, Du notes. "This will result in quicker and better response to customers' demands for electronic products," she adds.

The Future of Transportation

Burnside: Exploring the next phase

Transportation is changing, and Tech graduate Jack Burnside [Adviser: Dr. John Leonard] is ready, thanks to his research experience.

"Transportation has been in a building phase," explains Burnside, who recently completed a master of science degree in the School of Civil Engineering. "Today, management of existing infrastructure is becoming the primary concern."

Burnside collected data on transportation information kiosk use around Atlanta and how that affected the public transportation planning. The research was conducted for Georgia Tech's Transportation Research and Education Center, which oversaw evaluation of a system of traveler advisory kiosks installed in Georgia just before the 1996 Summer Olympic Games. The project included Georgia Tech, Concord Associates of Knoxville, Tenn., and Clark Atlanta University.

While a master's student, Burnside collected data on transportation information use.

"I enjoyed it because you can see people using [the kiosks] and watch their reactions -- what you're working on is out there, being used," Burnside says.

He also performed background research on the environmental effects of electric- vs. fossil fuel-powered vehicles for the Northrop Grumman Automotive Systems Department and GTRI. This work expanded on Burnside's five years of environmental planning for the Georgia Department of Transportation.

"You have to think several years ahead about the needs of your field, and prepare to address them," he says.

Research Means Better Teaching

Norris: Translating lessons into practice

As a mechanical engineering Ph.D. student in the early 1990s, Dr. Pam Norris [Adviser: Dr. William Wepfer] studied heat transfer in diesel engine cylinder heads for Cummins Engine Co. Inc.

Today, she is an assistant professor at the University of Virginia and has performed more than $1 million in research over the past two years. Norris' current projects include an environmental air sampler for biological warfare detection; development of aerogel thin film dielectrics; and microscale energy transport, with sponsorship from Pacific Sierra Research, IBM and NSF.

"My research experiences at Georgia Tech allowed me to interact often with the company supporting my research, and I learned how to deal with the customer," Norris says.

"I had a unique project, in that I was able to see it from its inception to completion, and then I even had the opportunity to visit the company and see the impact my research had on the product."

She also met world renowned scientist Chang-Lin Tien, Chancellor of the University of California/Berkeley, when he visited Georgia Tech as the 1992 Woodruff Distinguished Lecturer. That contact helped her get a visiting researcher/lecturer position at Berkeley, and a chance to work in Tien's lab.

"I would never have had the opportunity to work with a world-class scientist such as Tien, had Georgia Tech not provided the opportunity for me to interact with him," she says.

Involving graduate students in research ensures that research programs continue to meet the world's needs, Norris maintains.

"When investments are made in graduate student research, a new, fresh and unbiased set of minds is sent to work on problems that may be solved in unconventional ways," she says. "New graduate students look at things from a whole different perspective, and their views aren't already shaped by what 'can't possibly work.' "

Research involvement also ensures good future teachers, Norris reminds us.

"Teachers remain fresh, stimulated and abreast of their fields by actively participating in research activities," she says. "The best way to captivate my undergraduate students is to relate

the concepts I am teaching in class to the projects currently in progress in my lab. Graduate student research helps prepare the next generation of teachers and researchers in a way no other experience could possibly afford."

- **For additional articles** in this issue featuring the work of current or former Georgia Tech graduate students, see the **aging research article** and the profile of **Dr. Marilyn Smith**.

Send questions and comments regarding these pages to Webmaster@gtri.gatech.edu

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Research Horizons
Georgia Institute of Technology

Lasers and Materials: How Do They Interact?

By John Toon

A NEW RESEARCH LABORATORY launched recently at the Georgia Institute of Technology will use the latest in laser analytical techniques to study how photons interact with materials of all types, including the human body.

The Laser Dynamics Laboratory, supported in part by funds from the National Science Foundation (NSF), will provide a shared resource for researchers, encourage collaboration across disciplines and facilitate the use of laser spectroscopic techniques in new areas of study, says director Dr. Mostafa El-Sayed.

Equipment in the Georgia Tech Laser Dynamics Laboratory can study phenomena that occur in as few as 100 femtoseconds -- the time required for

"We are establishing collaborative programs in many research areas in which lasers interface with materials," he explains. "We

know about photons and what they will do. We want to extend that knowledge into other applications that are helpful to us and to other researchers. This combination of expertise from different areas can lead to many new developments."

light to travel the width of a human hair. (200-dpi JPEG version - 140k)

Part of Georgia Tech's School of Chemistry and Biochemistry, the Laser Dynamics Laboratory operates a series of laser systems and related analytical equipment configured for use in spectroscopic techniques. The equipment can study phenomena that take place in as short a time scale as 100 femtoseconds -- the amount of time required for light to travel the width of a human hair.

Such analytical techniques can be used to investigate a wide range of phenomena, including the dynamics of molecular dissociation, energy relaxation and transformation; molecular mechanisms of the primary processes of photosynthesis; and electronic and energy transport in various materials ranging from nanoparticles to disordered solids to photobiological systems.

El-Sayed says the facility would be of interest to researchers studying the detailed structural changes in molecules or materials following linear or non-linear laser excitation in the 100 femtosecond to millisecond time domain. The laser-induced changes can be followed by observing the optical absorption, fluorescence, Raman or infrared spectra of the transients.

At Georgia Tech, the new facility could boost existing research into the properties of optical, electro-optical and non-linear optical materials -- key technologies in developing new generations of fast optical switches, new memory devices, and techniques useful in interfacing high-bandwidth optical systems to computers.

"This adds to Georgia Tech a facility that can measure the properties of materials using lasers, which is one of the most important capabilities today," El-Sayed explains. "As we get deeper and deeper into studying materials and their application to the field of communications, this will become more important."

But while study of inorganic materials may provide the laboratory's primary near-term benefit, El-Sayed believes laser spectroscopic techniques also offer great long-term potential in the diagnosis of human disease processes. There, unique "signatures" of cancerous tissue or disease organisms could provide physicians with immediate diagnosis without the need for time-consuming laboratory clinical analytical techniques.

Opportunities for Collaboration

El-Sayed expects the new research laboratory, built with NSF and Georgia Tech support, will encourage collaboration and help researchers make efficient use of the costly laser equipment, which is already used extensively in his own research program. This availability also could encourage research into new areas where these analytical techniques are helpful to understanding complex issues.

"At a time when national resources are limited, a facility like this will help stretch the ability [of] researchers to get their work done and allow them to study these phenomena without having to invest in their own laser equipment," he explains.

Systems and techniques available at the laboratory include transient optical absorption spectroscopy, time- resolved Raman Spectroscopy, time-resolved IR spectroscopy (TRIR), time-resolved Fourier Transform Infrared (TRFTIR) spectroscopy, fluorescence spectroscopy and time-correlated single photon counting.

Available equipment includes:

✔ A Clark-MRX Amplified Ti:sapphire system that pumps two Quantronix TOPAS-POP, producing two femtosecond pulses each with a wavelength that can be changed independently from the UV to the infrared range.

✔ An Antares/Satori coherent picosecond system and a SpectraPhysics MOPO 730 nanosecond laser that can provide wavelengths in the UV to the infrared range.

✔ A flash photolysis system combining laser pumping and Xenon flash or CW lamps for time-resolved spectral measurements in the nanosecond to millisecond time scales.

✔ A Bruker time-resolved FTIR system is available to measure changes in IR spectra in the nanosecond to millisecond time range.

The laboratory was formally inaugurated with a symposium and open house in late November 1996. El-Sayed holds the Julius Brown Chair in chemistry and is editor-in-chief of the Journal of Physical Chemistry, a publication of the American Chemical Society.

Further information is available from Dr. Mostafa El-Sayed, School of Chemistry and Biochemistry, Georgia Institute of Technology, Atlanta, GA 30332-0400. (Telephone: 404/ 894-0292) (E-mail: mostafa.el-sayed@chemistry.gatech.edu)

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Research Horizons
Georgia Institute of Technology

PSYCHOLOGY

Age Brings "Capabilities, Not Limitations"

By Amanda Crowell

COMPUTER TECHNOLOGY that is second nature for those under 20 can be confusing and intimidating for some older adults.

Problems increase when everything from software to World Wide Web pages to computerized library databases is targeted at young adults or children. Too often, product designers either don't understand the needs and limitations of older users or they simply ignore them, say some researchers who study aging.

Yet technology can do much to simplify and improve the lives of older adults, who will make up an increasing percentage of the U.S. population in coming years.

"We have a lot of opportunities because of the aging of the American population," says Dr. Arthur D. Fisk, a Georgia Tech psychology professor. "I'm interested in solving important, fundamental

Studies show older adults are less likely to use automatic teller machines (ATM), but that many

problems of cognition and aging, and skill acquisition and aging. It's also important to determine, from a practical perspective, what aspects of system design, product design, training and the activities of daily living we really need to worry about from an age-related perspective."

would if banks offered training such as that offered via this simulator. (200-dpi JPEG version - 120k)

Growing Population of Elderly

The country's retirement population, defined as those 65 and older, is currently the largest in history and growing. By 2030, this group is expected to make up 22 percent of the U.S. population -- a predicted 66 million people. The fastest growing subgroup is women over 85.

Some people may worry about the problems posed by an aging population, but Fisk says aging should not be viewed only in terms of deterioration.

"Older individuals do quite well in this world," he notes. "Look at the age of chief executive officers in this country. Look at the age of our very good scientists. Age brings with it an awful lot of capabilities, not limitations."

Fisk conducts much of his work in this area under the Center for Applied Cognitive Research on Aging, a consortium of researchers from Georgia Tech, the University of Georgia (UGA) and the University of Michigan.

It is one of six national Edward R. Roybal Centers for Research on Applied Gerontology, established in 1993 by the National Institute on Aging (see related article, below). Roybal is a retired, longtime member of the U.S. House of Representatives from California who championed aging research.

The centers promote social and behavioral research that can be used to improve the lives of older people and their families. Each has a different theme, such as work performance, social integration, exercise compliance and ways to make nursing home residents more independent.

"The mission of the centers, I think, is a very nice use of taxpayers' dollars," Fisk says. "We must advance science but we must also produce products that the general public can look at and say, 'I can see how that will benefit someone.'"

Although the centers don't repeat each other's work, they overlap enough to establish a body of knowledge, says Dr. Denise C. Park, director of the Center for Applied Cognitive Research on Aging and a University of Michigan psychology professor.

Dr. Jared Jobe, Roybal Centers coordinator for the National Institute on Aging, adds that, "It's important to emphasize that the centers are multi-disciplinary, and they're investigating a wide variety of different things."

Age-Related Studies

In Georgia and Michigan, the focus is on daily activities like driving, taking medications and using computer technology.

Researchers at Georgia Tech and UGA, for example, are studying age-related differences in automatic teller machine (ATM) usage. A 1993 survey of 1,562 adults in Memphis and Atlanta showed that adults 18 to 34 use ATMs far more than those 65 and older -- 86 percent to 33 percent.

Non-users 61 to 81 gave several reasons for avoiding ATMs, including not feeling safe using them, not needing them and not knowing how to use them. Yet nearly 63 percent said they'd use ATMs if someone showed them how.

"When we first started this project, we went to the banks and we asked, 'What kind of training do you give to people when they get an ATM card?' " says Dr. Wendy Rogers, an associate professor of psychology at UGA. "They said, 'Training? What training? It's so easy to use.'"

But studies with older adults who had never used ATMs or received training showed they made correct transactions only 20 percent of the time, says Rogers, who received her master's degree and doctorate from Georgia Tech and is Fisk's wife as well as his research partner.

Researchers now are working to pinpoint which training methods work best, especially for older adults, with the hope that bank officials and ATM designers will use this information to improve service.

Other center projects include:

✔ Georgia Tech researchers are studying how aging affects driving skills. Research suggests that cognitive, decision-making abilities remain strong in older adults, particularly in familiar settings, but that response times are generally slower.

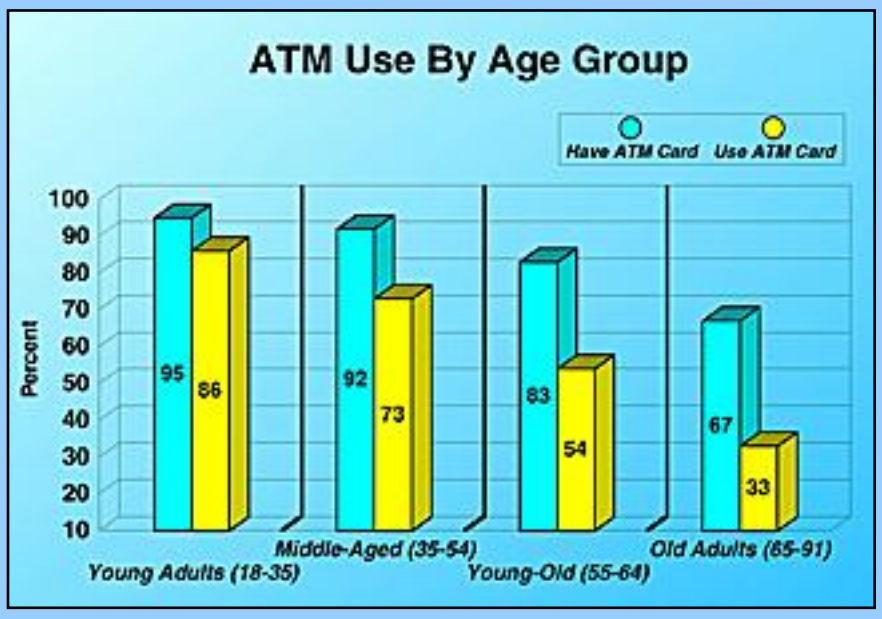
✔ University of Michigan researchers are monitoring medical adherence among older adults. Surprisingly, they're finding that older adults are better at taking medications than

are middle-aged adults, especially those who report having extremely busy lives. "The 60- to 75-year-olds take their medication correctly for three reasons," says Park, who conducts this research in the University of Michigan's Institute of Gerontology. "They easily have adequate cognitive function to figure out what to do with their medications, they feel vulnerable to health problems and are motivated to take their medications correctly, and they aren't so busy -- since many are retired -- and can remember to take the medication on time."

✔ Researchers at Georgia Tech, UGA and University of Michigan are studying computer usage by older adults, to improve access, training and design.

Research shows that older adults want to learn to use computers, but most software isn't designed to address their needs. Ongoing projects by Dr. Roger W. Morrell at the University of Michigan include creating an interactive computer disc to teach basic computer skills and setting up an electronic community bulletin board system called ELDERCOM.

Georgia Tech researchers are testing new software to help older adults overcome decreased fine motor control that makes it difficult for them to use a computer mouse or joystick. They're also working with UGA researchers to solve problems older adults have with computerized library databases and to encourage older adults to use the Internet.



(high-quality JPEG version - 120k)

"Internet access can provide older adults, especially those who are homebound, with social interaction, entertainment, information, goods and services," says Sherry Mead, a Georgia Tech doctoral student.

Students like Mead who work in the aging center gain valuable experience in both basic and applied science, Fisk says. Georgia Tech doctoral student Richard Sit agrees.

"I believe that our lab conducts some of the best applied research in the country," says Sit, who worked last summer as a usability specialist for the Microsoft Corp. "Industry is interested in our applied research on a number of real-world systems because we have the

time, funding and personnel to perform in-depth research."

This work also is part of Georgia Tech's wider expertise in cognitive aging research, says Dr. Anderson Smith, former director of the School of Psychology. Other psychology faculty members working in this area include Dr. Neff Walker, who also works in the aging center, Dr. Timothy A. Salthouse, Dr. Christopher Hertzog, Dr. Fredda Blanchard-Fields and Dr. Jeffrey Toth.

"I think Tech probably has the best group of cognitive psychologists studying aging in the country," says Smith, who is now a professor of psychology and associate dean of the College of Sciences. "It is critically important research."

Studies with A Future Orientation

Although some people may think studying how older people learn technology is unimportant -- since younger generations will be increasing comfortable with it -- Fisk disagrees.

"The implication is that young people today are going to have no problem with technology in the future," says Fisk, who also serves as president of the national Human Factors and Ergonomics Society. "Technology is advancing at a very, very rapid rate. We have to design technology appropriately from a human perspective, so that humans can interact properly, efficiently and safely with it."

Researchers also should work to tap into the vast experience and wisdom older adults offer, instead of viewing aging only in terms of decline, Park says.

"I think these applied centers are not just about compensation for aging but about growth with aging, such as learning how to use computer technology," she says. "Also, I think it's very important to understand that the character and meaning of technology is going to change very rapidly as the baby boomers age.

"We're about to have an aging population for whom computers have always been a part of their lives," Park adds. "We're still thinking about how to train elderly people to use computers, but it's also important to understand how to adapt technology to the sensory and cognitive capabilities of elderly people who are already technically capable."

Further information is available from Dr. Arthur D. Fisk, School of Psychology, Georgia Institute of Technology, Atlanta, GA 30332-0170; or Dr. Wendy Rogers, Department of Psychology, University of Georgia, Athens, GA 30602. (Telephone: 404/894-6066, Fisk; 706/542-3115, Rogers) (E-mail: arthur.fisk@psych.gatech.edu; wrogers@uga.cc.uga.edu)

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Research Horizons
Georgia Institute of Technology

RESEARCH PERSONALITY

Flying High

By Lea McLees

IF YOU OBSERVED the wings of the airplane you last flew in, you probably noticed that they moved slightly during your stay in the sky. That movement, although important, hasn't always been taken into account in the study of fluid -- such as air -- flowing over objects -- such as airplane wings.

But Dr. Marilyn Smith of the Georgia Tech Research Institute (GTRI) is trying to change that. She, her colleagues and sponsors at the Air Force's Wright Laboratory Aeromechanics and Aeroelasticity Divisions are integrating computational fluid dynamics (CFD) applications with the structural equations of motion. They apply these combined sets of equations to form the basis of aeroelasticity -- the movement of a plane's structure during flight, using realistic air forces.

A code that incorporates the structural and aerodynamic equations of motion and computational fluid dynamics provides the most accurate picture to date of how air behaves around the body of a plane, says Dr. Marilyn Smith.

By solving these equations on

powerful computers, Smith is
making important progress in methodologies that are enhancing aircraft design, and making airplanes and helicopters less susceptible to damage from fatigue.

"We've had calls from all over the country wanting to access the methods and the research that we've done, so I think it may be making an impact," says Smith, a senior research engineer.

Enhancing Computational Fluid Dynamics Studies

Smith's work is centered in the CFD world of predicting drag and visualizing flow. A relatively new tool, CFD is based on differential equations that, when manipulated on a computer, can help researchers predict fluid flow behavior.

Smith is integrating CFD applications with the structural equations of motion. She applies this combination of equations to the study of aeroelasticity.

"Most CFD codes today only consider a rigid body," says Smith, who works in GTRI's Aerospace and Transportation Laboratory. "But that's not what really happens in flight in an aircraft. In flight, if you're sitting near the wings and you look out the window, you'll see the wings move. The structural equations of motion address that phenomenon, along with the air loads generated by the flight speed. So, by incorporating the structural and aerodynamic equations of motion and CFD in the same computer code, you can get the coupling and the interaction between structure and fluid flow -- and that's what really happens in flight."

The combination provides the most accurate picture to date of where air flows smoothly over a plane's body and where it whips into turbulent whirlpools, or vortices, that vibrate or buffet parts of the vehicle. These vibrations fatigue parts and may cause them to wear out more quickly than they would otherwise, Smith says.

"By performing computational aeroelasticity at such a high level, we can predict changes in performance that result from design modifications or fatigue," she explains. "We can simulate a situation numerically, see what's happening in the flow field, and design better parts."

Her biggest contribution has been making the study of aeroelasticity, using any given CFD computer code, easy.

"Different CFD codes work well for different applications, different aircraft components or flight regimes," Smith explains. "Right now we're concentrating on static aeroelasticity, which will give us a good idea of the performance changes and the overall flow field

changes. Dynamic aeroelasticity, which is the prediction of flutter points -- the points at which the structure begins to be become dynamically unstable -- is probably two to three years away."

Smith collaborates with several Georgia Tech colleagues: Dr. Dewey Hodges, professor of structural dynamics in Tech's School of Aerospace Engineering; Dr. Carlos Selznik, a post-doctoral aerospace student in structures; Dr. Lakshmi Sankar, professor of fluid dynamics in the School of Aerospace Engineering; and Dr. Olivier Bauchau, professor of structures in the School of Aerospace Engineering.

These researchers make Georgia Tech one of five institutions in the United States that combines high-level aerodynamics and structures research. The other locations are NASA's Langley Research Center in Virginia, Ames Research Center in California, the Air Forces' Wright Laboratory, the Lockheed-Martin Engineering Services Co. and Skunk Works.

"There are other people working in aeroelasticity all over the country, but not to the complexity that we are working on it in aircraft or in aerodynamics," Smith says.

Computers have only recently become fast enough to do the work Smith and her colleagues perform. They develop codes in C and FORTRAN and test them using a Cray supercomputer.

"We can tell the impact of the structure motion by comparing the pressures on the vehicle with the rigid vehicle results," Smith explains. "The pressure are integrated into loads which are the forcing functions for the structural equations of motion. We also look at the flowfields surrounding the aircraft, particularly for vortex movement. These data are examined by both conventional plots and by color contouring graphics."

The Effects of FlowStudies

As she has incorporated structural dynamics knowledge with Euler/Navier-Stokes equations of fluid motion around aerodynamic vehicles, Smith has learned some interesting things.

"It's interesting to see how the flow field changes," she says. "Obviously things move -- vortices will change their directions and strengths, for example. You get differences in performance of the aircraft, or of the component you're looking at."

The implications of her findings are important.

"We've been called upon to help fix problems in aircraft," Smith says. "The classic case is

the F-15 vertical tail buffet problem. By incorporating aeroelasticity into our CFD analyses early, we can predict more accurately where these flow field phenomena will appear on the body. If we know where the vortex or unsteady flow is going, we can either design devices to turn the unsteady flow away from that component, to prevent the damage -- or we can beef up the structure enough that it will not move with the unsteady flow around it.

"If we can simulate a situation numerically and see what's actually happening in the flow field, we can design a better part," she explains. "It won't be a hit or miss process anymore."

The biggest challenge for Smith so far? Maintaining the integrity of the numerical solution she's using when linking motion to a flexible surface. In addition, nodes -- the points on the plane at which she tests the equations -- have to be placed correctly, especially when running tests for a moving vehicle. When a vehicle isn't still, vortices move and change directions.

"If you don't have the nodes in the right places, if they're not smoothly distributed, or if there are not enough in a certain area where you have a lot of flow fields, then you won't get as accurate of an answer as you would if they were," Smith explains.

An Industry Beginning

Smith has enjoyed a lifelong fascination with flight. She grew up watching Apollo missions on television and planning to explore space. The space program hit a lull during her high school years -- but during a college co-op job at NASA Langley Research Center, airplanes piqued her flight fascination.

"I like the mathematics of it and the physics of it," she says. "I like the ability to see what's going on around the aircraft."

Smith worked as an associate scientist at Lockheed Aeronautical Systems Co. in Georgia, and as a senior flight test engineer at Lockheed-Georgia Co., and as a member of the technical staff at McDonnell-Douglas Helicopter Co. in Arizona. She joined GTRI in 1990.

"I've had a wide range of practical engineering experience -- all the way from flight testing to design and wind tunnel testing," she says. "I have a practical outlook on things."

While working full-time in industry she earned master's and doctoral degrees in aerospace engineering from Georgia Tech. Smith was the sixth woman to graduate with a Ph.D. in aerospace engineering from the school.

Her master's degree required two years to complete. Her Ph.D. required nine years from starting classes to defending her dissertation. During those nine years she moved across the country twice, changed jobs twice, and had a daughter.

Smith is a senior member of the American Institute of Aeronautics and Astronautics, an associate member of the AIAA Fluid Dynamics Technical Committee, and a member of the American Helicopter Society. She was a recipient of the 1982 Best Woman Engineering Student and Best Cooperative Student awards from Atlanta's chapter of the Society of Women Engineers.

She occasionally teaches high-speed aerodynamics, hypersonics or transonic aerodynamics at her alma mater, encouraging students to develop a broad foundation of knowledge -- even if they are enamored of one particular facet of aerospace engineering.

"They learn that as design people, for example, they will use numerical simulation and they need to know the theory behind it...and that the structures people need to understand aerodynamics, and how it impacts on structures," she says. "And I try to introduce a balance of good, practical engineering applications in every topic that I teach. There's no greater satisfaction than to be able to teach a course in aerodynamics to the younger generation and be able to introduce practical aspects -- so that a new generation of engineers sees the worth of it while they're still in school."

Future Research

Smith wants to use the integrated codes she and her colleagues have worked on to design new aircraft. She's also interested in incorporating an additional discipline, acoustics, into her current work.

"I'd like to determine how these vibrations and motions affect the sound environment," she says. "Sound plays a very big role in determining vulnerability and survivability aspects of military aircraft."

Sound also is important in the commercial sector. Bad acoustic signatures from an airplane can cause noise problems for those living near airports.

"It's not only important to design aircraft and aircraft parts that are less susceptible to damage from fatigue -- we can use the results from the codes we hope to develop to make their takeoffs and landings more palatable to the ears of the people on the ground," Smith says.

Further information is available from Dr. Marilyn Smith, Aerospace and

Transportation Laboratory, Georgia Tech Research Institute, Georgia Institute of Technology, Atlanta, GA 30332-0840. (Telephone: 770/528-7804) (E-mail: marilyn.smith@gtri.gat ech.edu)

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Research Horizons
Georgia Institute of Technology

Solar Satisfaction

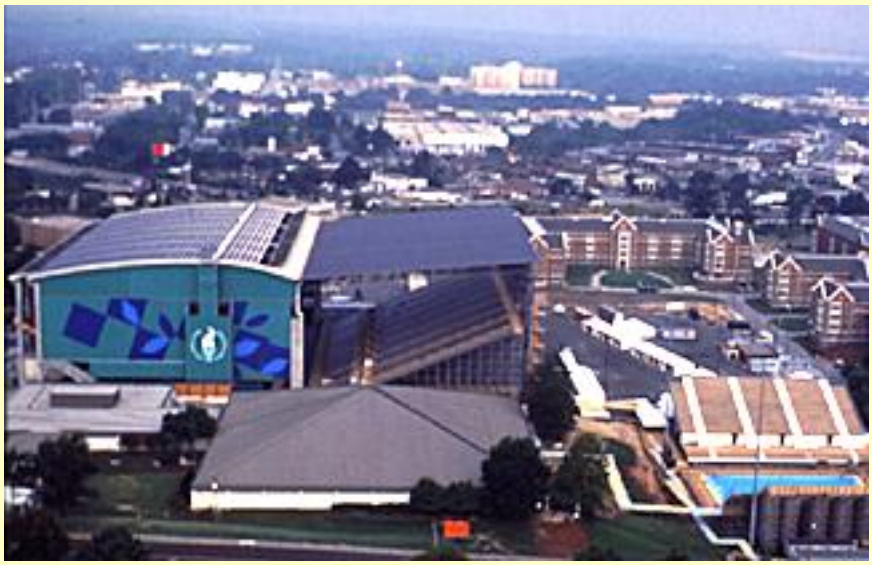
System's energy performance near peak efficiency

The solar-powered energy system atop the Georgia Tech Aquatic Center is performing close to its peak efficiency but has produced less energy than expected.

Installed in July 1996, the photovoltaic system is the largest rooftop system connected to a utility grid in the country. It supplements the Aquatic Center's main electrical system and serves as a research model.

From July 1996 through January 1997, the system produced 162 megawatt hours of energy, enough to power 16 average Georgia homes for one year. Researchers had predicted 409 megawatt hours per year, enough to power about 40 homes.

photo by Stanley Leary



The photovoltaic system is on the roof of the green-and-blue-trimmed Georgia Tech Aquatic Center. (200-dpi JPEG version - 130k)

"The system has performed pretty much up to expectations," says Mike Ropp, a doctoral student in the School of Electrical and Computer Engineering (ECE). "We have quantified that by looking at the system's efficiency instead of just the output because, obviously, the

output is dependent on the input."

Researchers attribute the lower energy production to several factors, including fuses blown in July when lightning struck the Aquatic Center roof, a water main break in October 1996 that flooded the electrical control room, and experiments that required partial shutdowns in December 1996 and January 1997.

Also, sunlight levels were lower than expected and extremely high temperatures in August decreased the system's efficiency.

The photovoltaics system was one of several Georgia Tech projects showcased during the 1996 Summer Olympic Games and Paralympic Games when the Aquatic Center was the site of swimming and diving events.

It was designed by Dr. Ajeet Rohatgi and Dr. Miroslav M. Begovic of ECE and Richard Long of Georgia Tech's Office of Facilities. The project was initiated under Georgia Tech's University Center of Excellence for Photovoltaic Research and Education (UCEP). Sponsors include Georgia Power Co., the U.S. Department of Energy and Georgia Tech.

Look for an in-depth report on photovoltaics research in the Spring RESEARCH HORIZONS.

Further information is available from Dr. Ajeet Rohatgi or Michael Ropp, School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA 30332-0250. (Telephone: 404/894-7692) (E-mail: ajeet.rohatgi@ee.gatech.edu; mr52@prism.gatech.edu)

Detecting the Diabolical

Tech researchers evaluating new technique for detecting deadly concealed land mines

Georgia Tech is one of five universities whose researchers will evaluate new electronic surveillance measures against a hidden and deadly menace: the concealed land mines currently endangering the populations of more than 60 nations.

With U.S. Army sponsorship, researchers at Duke University,

Caltech, Georgia Tech, Ohio State University and Stanford University will explore innovations in mine detection ranging from a microelectronic, chemical-sniffing "nose" and through-the-air ultrasound to ground-shaking seismic waves and unique mathematical and computational aids. Industry partners providing some technical support include EG&G, Hughes Aircraft Co. and Northrop Grumman Corp.

The collaborators plan 12 different research projects to better detect buried -- and often diabolically clever -- military booby traps that often kill or maim innocent noncombatants.

The projects will fall under three research areas:

- Chemical-sensing processes that mimic smell
- Radar, magnetic, infrared and sound sensors
- Sensor-information processing.

Georgia Tech researchers led by Dr. Waymond Scott, an associate professor in the School of Electrical and Computer Engineering, will investigate a new technique for detecting land mines.

"We are proposing a technique that uses both acoustics and electromagnetic waves in a synergistic manner to detect the mines," says Scott. "The synergism has the potential to detect mines that would be impossible to detect otherwise."

Scott plans to use acoustic waves to vibrate the earth and any hidden mines.

"The acoustic properties of the earth and the mine are quite different; therefore, the vibrations of the mine and of the earth near the mine will be quite different from vibrations of the earth farther away from the mine," he says. "We will use a specially designed electromagnetic radar to measure the differences in the vibrations and identify the location of the mine."

According to a Department of Defense research report, estimates of the number of uncleared mines worldwide range from 85

million (by the U.S. Department of State) to 105 million (by the United Nations) spread over 62 nations.

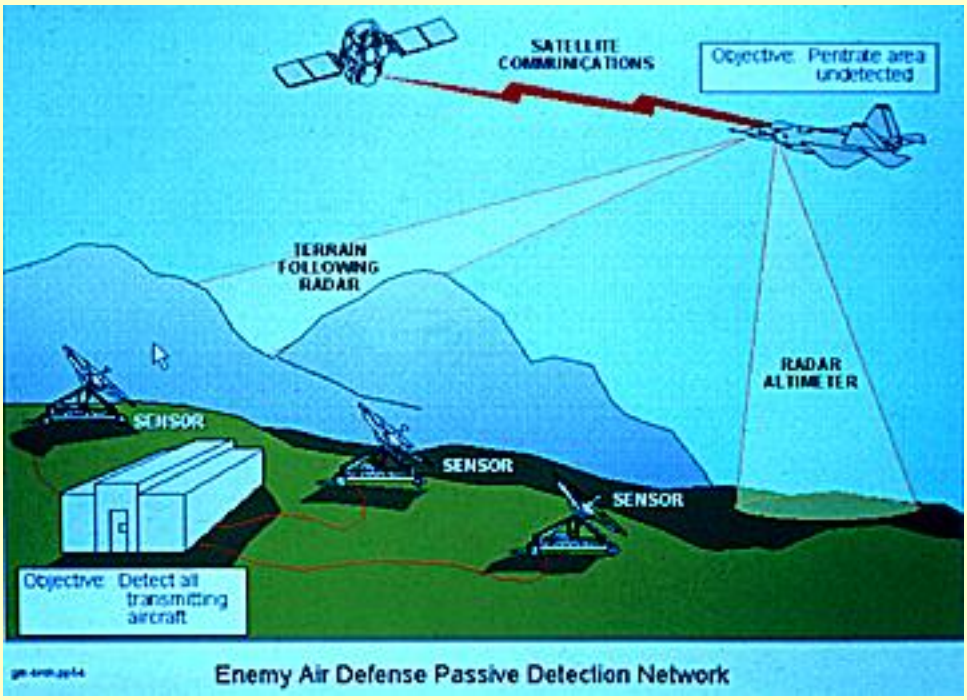
Between 500,000 and 1 million new mines are believed to be deployed each year. And between 10,000 and 100,000 people are said to be killed or maimed by them annually.

Further information is available from Dr. Waymond Scott, School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA 30332-0250. (Telephone: 404/894-3048) (E-mail: waymond.scott@ee.gatech.edu)

Electronic Protection and Attack Research

GTRI's R&D capabilities address most DoD electronic protection and attack areas

graphic courtesy Judy Wiesman



Research at GTRI supports development of advanced radar and

communication systems that have low vulnerability to enemy air defense passive detection networks. (200-dpi JPEG version - 325k)

The Georgia Tech Research Institute (GTRI) offers research and development capabilities in most technical areas typically encompassed by the Department of Defense thrust in electronic protection and attack.

These areas include electronic countermeasures (ECM) and electronic counter-countermeasures, as well as associated capabilities in radar, communications and antennas.

GTRI is involved in all aspects of the life cycle of equipment -- from research and development in the early stages of development, to systems integration, test and evaluation, logistics reliability and maintainability.

An appropriate blend of hardware, software and analytical expertise is applied to the challenges of electronic protection and attack.

Further information and a brochure are available from Jim Cofer, Advanced Programs Office, Georgia Tech Research Institute, Georgia Institute of Technology, Atlanta, GA 30332-0801. (Telephone: 404/894-3346) (Fax: 404/894-5274) (E-mail: jim.cofer@gtri.gatech.edu)

Transportation Institute Funded

New Tech center explores and coordinates transportation research in Georgia

The Georgia Department of Transportation (GDOT) has provided start-up funding to Georgia Tech for a new multi-disciplinary center on campus. The center, which will be called the Georgia Transportation Institute (GTI), will conduct research, development, education and technology transfer

pertaining to all forms of transportation in the State of Georgia. The role of the GTI will be to coordinate and enhance the involvement of Georgia Tech and other state universities doing research in transportation.

"Transportation-related research has been a strategic area at Georgia Tech for several years," says Jean-Lou Chameau, vice provost for research and dean of graduate studies. "We have seen a significant increase in those activities, including the successful demonstration of the Atlanta Short Haul Transportation System during the Olympics. Another example is a multi-year, multi-million dollar project sponsored by the U.S. Environmental Protection Agency (EPA) to develop a new model for estimating automobile pollutant emissions. The Georgia Transportation Institute will help us foster and enhance those activities, and serve the state better in an area critical to its economy and future."

"Our goal is to bring together the people doing transportation research in the state," says Bob Cassanova, director of GTRI's Aerospace and Transportation Laboratory (AERO). "The GTI makes it possible for our sponsors to tap into all of the resources that Georgia Tech has to offer, as well as the expertise of researchers from other universities in the state."

The GTI was the suggestion of GDOT Commissioner Wayne Shackleford, who believed that the state needed to consolidate its transportation resources.

"We felt that the Institute would be a good way to expand transportation research in Georgia by having one organization that could oversee research for the entire state," says Lamar Caylor, chief of the Research and Development Branch for GDOT. "Other states, like Texas and Virginia, have had similar organizations for a long time. The GTI will make Georgia more competitive in the area of transportation research."

Further information is available from Dr. Bob Cassanova, Aerospace and Transportation Laboratory, Georgia Institute of Technology, Georgia Tech Research Institute, Atlanta, GA 30332-0860. (Telephone: 770/528-7826) (E-mail:bob. cassanova@ gtri.gatech.edu)

"Electronic House Calls"

New prototype interactive system may make home health care more accessible

The prototype for an electronic house call system that could make health care as accessible as cable television has been developed and tested by Georgia Tech, the Medical College of Georgia, the U.S. Army and a private cable company.

The prototype has been tested in the homes of 25 patients of MCG Hospital and Clinics and Eisenhower Army Medical Center at Fort Gordon. It also is being tested at Westlake Manor, a 100-bed nursing home in Augusta, with links to a physician's office and home.

photo courtesy Medical College of Georgia

A patient has her temperature taken via computer on a prototype system developed by Georgia Tech and partner researchers. (200-dpi JPEG version - 130k)

The electronic house call's target audience is what developers call "frequent flyers" -- people whose chronic health problems require constant attention that can lead to frequent doctor visits and hospital stays.

Jones Intercable Inc., a Denver-based company that services the Augusta area, provided the cable service -- which not only brings a signal into the home, but also gets one back out -- at no cost to test patients. Development and initial testing of the electronic house call system was funded primarily by grants from the Department of the Army and the Georgia Research Alliance.

Researchers fashioned the prototype from existing computer hardware, with additions such as a multi- function patient monitor -- like one used in intensive care units -- into

which blood pressure cuffs, stethoscopes and other medical devices are plugged. The patient's computer also is fitted with a videoconferencing camera that can be remotely controlled by the nurse.

Tech's Biomedical Interactive Technology Center also developed a touch-screen monitor, says senior research engineer Michael F. Burrow. For example, a patient touches a telephone icon on the screen to make the initial connection with the nurse practitioner.

The computer system uses a commercially available videoconferencing program that enables the nurse and patient to see each other and talk throughout the examination. The electronic house call prototype also accepts data from a variety of medical devices, such as those registering blood pressure and blood oxygen levels. The nurse can listen to heart and lungs and perform an electrocardiogram.

The system provides audio instructions and images on the screen to assist the patient during an exam and "gives instructions on how to use the instruments," Burrow says.

"For the most part, patient feedback has been positive," Burrow continues. "The patients like the idea of being monitored at their homes and interacting with the nurse frequently."

Developers at Tech and MCG want to fine-tune the electronic house call into a more standardized, commercially viable piece of equipment, and they are seeking a company willing to do that.

As is, the prototype costs about $15,000 for each unit. But Burrow thinks it could realisically cost less. "I'd like to see a system that would cost less than $10,000," he says.

Further information is available from Michael Burrow, Biomedical Interactive Technology Center, Georgia Institute of Technology, Atlanta, GA 30332-0823. (Telephone: 404/894-7034) (E-mail: michael.burrow@bitc.gatech.edu)

Researchers Honored

- Dr. **David Ku**, professor in the School of Mechanical Engineering, is the recipient of the 1996 Gustus L. Larson Memorial Award presented by the American Society of Mechanical Engineers.

- Dr. **David Roessner**, professor in the School of Public Policy, was named a 1996 Fellow of the American Association for the Advancement of Science.

- **Michael Phillips**, South Carolina state coordinator for the Georgia Tech/Clark Atlanta University- sponsored Electronic Commerce Resource Center, was awarded the 1996 SOLE Field Award by the International Society of Logistics. The award recognizes outstanding contributions to electronic logistics commerce and logistics in general.

- Dr. **Richard Salant**, professor in the School of Mechanical Engineering, received the 1996 Worthington Medal from the American Society of Mechanical Engineers. The award recognized his achievements in the design of controllable seals.

- Two faculty members were named Fellows of the Institute of Electrical and Electronics Engineers in December 1996. Dr. **Robert Trebits**, director of the Sensors and Electromagnetic Applications Lab of the Georgia Tech Research Institute (GTRI), was recognized for his work in millimeter wave reflectivity. Dr. **Michael Tuley**, a principal research engineer in GTRI's Signatures Technology Laboratory, was recognized for his nationally known work on radar cross section reduction.

- Dr. **Ward Winer**, chair of the School of Mechanical Engineering and Regents' Professor, received the Donald Marlow Award from the American Society for Engineering Education. It recognized his creative, distinguished leadership in engineering education.

-- Articles by Toni Baker, Monte Basgall, Amanda Crowell, Joey Goddard, Lea McLees, Rick Robinson, Victor Rogers, John Toon

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