Georgia Tech Research Institute

Annual Report - 75th Anniversary Edition

THE GTRI MISSION:

EXECUTE a synergistic model of research, innovation and education, and
APPLY this to solve the significant problems of a complex world.

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www.gtri.gatech.edu

PROBLEM SOLVING.

The pioneering Georgia legislators and regents who launched the State Engineering Experiment Station – known today as the Georgia Tech Research Institute (GTRI) – would no doubt be pleased if they could see today what they started 75 years ago. While they might not recognize today's GTRI, the organization's fundamental purpose would be very familiar: real-world research that solves the toughest problems facing government and industry.

For GTRI, the 75th anniversary year was like no other. From record-setting research awards to aggressive hiring of world-class scientists and engineers, GTRI grew not only in size and prestige – but also in impact.

In many organizations, this kind of success would provide a well-deserved opportunity to rest on its accomplishments – but not at GTRI. While our people are proud of what they have achieved, their greatest satisfaction comes from regularly seeing the positive impact their work has on the world in which we live.

Every day, our problem-solving research touches a broad range of industrial companies and government organizations. It's a legacy that began 75 years ago and will continue as long as there is a need for innovative solutions to difficult problems.

Welcome to GTRI.
Problem. Solved.

GTRI Research Focus Areas

Q&A

with Stephen E. Cross, executive vice president for research at the Georgia Institute of Technology

Stephen E. Cross has been director of GTRI since 2003, and was recently named Georgia Tech's first executive vice president for research. In this new position, he will lead Georgia Tech's $500 million-per-year research program — which includes GTRI.

1934 – The State Engineering Experiment Station (EES) opens in Georgia Tech's Old Shop Building, with a little more than $5,000 in state funding and 13 part-time faculty researchers.

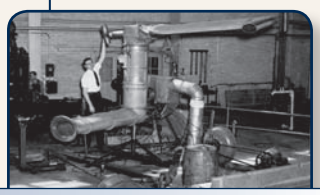
1939 – EES – a.k.a. "the research station" – moves into the Research Building, its first purpose-built home base.

1943 – An EES researcher discovers that certain radio frequencies heat food, but is too busy with wartime projects to develop the phenomenon further. EES misses out on inventing the microwave oven.

1919

1940

1919 – The Georgia General Assembly authorizes a state engineering experiment station, but leaves it unfunded.



1934-1940 – Georgia Tech's expertise in rotorcraft research begins with EES's work on the autogyro, a short-winged aircraft that predated the helicopter.

1940 – Federal funding linked to World War II begins bringing in more projects, including work in wind-tunnel testing and communications technology.

GTRI 75 YEARS

Since September 2003, Stephen E. Cross has served as director of the Georgia Tech Research Institute (GTRI) and a vice president of the Georgia Institute of Technology. On March 19, 2010, he was chosen to become Georgia Tech's first executive vice president for research, a position that will play a broader leadership role in directing the Institute's research program – including GTRI. In this interview, he discusses GTRI, Georgia Tech and his new role.

GTRI has changed dramatically in the past 75 years, going from a few people working in the basement of one building to nearly 1,500 employees in multiple locations today. How would you describe GTRI's current growth status?

We're definitely in a growth period. Our research awards have risen about 63 percent in the past three years to more than $200 million in fiscal 2009. We've scaled up our research staff so that we're able to do all this work. Growth has also occurred in the breadth of the technical work we do and in the impact of that work – as described in this annual report. Perhaps the most exciting aspect of growth has been the new people we have been able to attract to careers at GTRI.

Of the 120 people we've hired in the past year or so, all of them are Georgia Tech quality. They're just phenomenal people. We may be one of the few organizations in the world to really benefit from the global financial crisis, because in the past year especially there have been a lot of really talented, skilled people who have been looking for work. We might not have had that opportunity if the economy had been stronger.

Ultimately, what I see is growth in the ways in which we contribute to the overall economic vitality of the state while enhancing our national stature.

Will this growth continue?

We believe it will, but we don't want to sacrifice technical quality for the sake of growth. We're addressing this as a strategic issue, trying to figure out how large we should be ideally. We do know that we don't want to grow too large. We've seen some of our competitors become rather sluggish and not as innovative because they grew too large too fast.

We're probably going to grow by another 100 to 150 people this year, bringing us up to about 800 research faculty positions. But if we grow beyond that we're going to be seriously space-constrained.

What are the most important things GTRI must do to keep moving forward?

The two things that I think are most critical are (1) a willingness to take prudent risk and (2) a strong focus on interdisciplinary collaboration.

We need to be an organization that does not fear the unknown. We need to always embrace the opportunity to do new things. To accomplish that, we need to be willing to take calculated and prudent risks. We should never use the simple existence of risk as a reason for not trying something new or challenging.

New ideas and insights emerge at the intersection of fields. Some of the things we're looking at now – in cyber operations and social/cultural modeling and sensor fusion – couldn't be done without taking an interdisciplinary perspective. So the more interdisciplinary collaboration we can get, the better.

1947 – The research station installs one of the first U.S. electron microscopes; the $13,000 device goes to work on basic kaolin research.

1946 – The name "Georgia Tech Research Institute" is given to a non-profit corporation created to handle EES contract and patent issues.

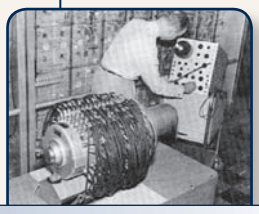
1949 – EES research income passes the $1 million mark.

1950

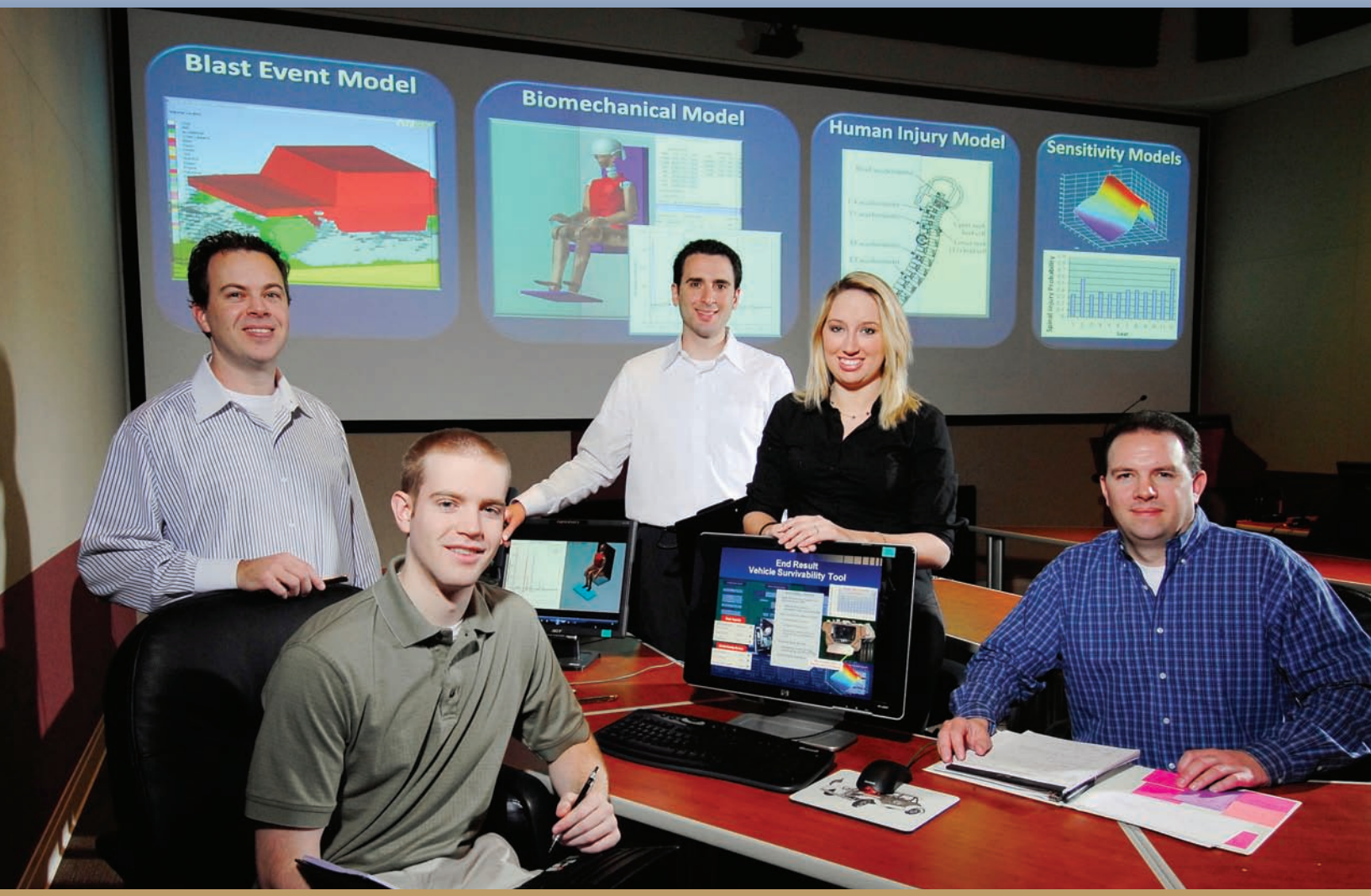
1950 – The Korean conflict increases federal funding, leading to pioneering work at EES in millimeter waves – an area of GTRI expertise today.

1952 – EES personnel help found Scientific Atlanta, later renowned for its satellite Earth stations and cable TV equipment.

1959 – As interest in nuclear technology soars, EES opens the Radioisotopes and Bioengineering Laboratory.



1955 – Georgia Tech opens the Rich Electronic Computer Center, housing a 38-foot-by-20-foot UNIVAC 1101 with 48 kilobytes of memory.



GTRI researchers are developing integrated techniques for predicting how powerful acceleration forces forces caused by roadside bombs affect personnel inside vehicles. Shown (l-r) are researchers Kevin Massey, Jonathan Morgan, Tommer Ender, Kimberly Uzzell, and Carl Blunt.

1966 – Richard C. Johnson develops the compact range, an antenna-measurement technology that remains important today.

1970 – EES's high-temperature ceramic expertise leads to a fused-silica technique for forming complex shapes such as missile radomes.

1973 – The Agricultural Technology Research Program is established to support Georgia's economically important poultry industry.

1960

1968 – Veteran radar researcher Maurice Long becomes director; his tenure will emphasize EES's continuing independence within Georgia Tech.

1969 – EES begins work on protecting pacemakers from microwaves – a research field that continues today at GTRI's Medical Device Test Center.

1970

1971 – New contracts and grants at EES total a record $5.2 million.

1976 – Donald J. Grace, a colleague of Georgia Tech President Joseph M. Pettit when both were at Stanford University, becomes EES director.

GTRI 75 YEARS

What kind of GTRI do you envision 25 years down the road?

We were the first research site at Georgia Tech, and today we're the largest research center here. But I hope that, by continued collaboration with our colleagues in the Georgia Tech colleges, new kinds of research centers will evolve that will benefit all of Georgia Tech.

I believe we can create a new development model that will rival Silicon Valley, based on market-centric industries that emerge in thematic areas at Georgia Tech – in energy or biotechnology or future media or systems engineering.

For example, our current emphasis on future media could work out very successfully during the next 25 years. I can see whole new industries developing out of that, creating corporations that would hopefully locate near the Georgia Tech campus in Atlanta, or in Savannah, or in other parts of the state.

Research in autonomous vehicles is taking place all across campus, including in GTRI. Georgia could become one of the leading centers for autonomous vehicles; we could test them here, build them here and teach people how to maintain them here.

So I can see such industries forming around thematic areas that come out of Georgia Tech. That kind of industrial growth could benefit the economic development of Georgia and of the whole Southeast.

What do you consider your most significant accomplishment as director of GTRI?

My real accomplishment has been what I call the upside-down organization chart. I tried to make it clear when I arrived here that my job is to support the people of GTRI – the people who do the real work.

My thought was that you wouldn't have much of a research institute if it wasn't for the researchers. So when I drew the organization chart, I placed myself at the bottom in support of management functions that, in turn, support the researchers and our sponsors. I'm very proud of what our researchers and staff have accomplished as a result of thinking about the organization in this way.

What do you think is GTRI's greatest single strength?

The people of GTRI are truly special. They're all focused on solving problems, and they do solve them.

We have put in place a plan to preserve what is a key cultural attribute of GTRI, and that is the freedom that research faculty have to try out new ideas and to pursue their aspirations – as long as they're guided by the overall strategy of where we're trying to go in sensors, information technology, systems engineering, materials and our other areas of expertise. Within those parameters, researchers can carve out their own careers as pre-eminent experts or pursue opportunities in other key areas such as program management.

Another dimension of this strength in human capital is students. We now employ more than 350 students, about twice the number we had five years ago. Students bring fresh ideas, enthusiasm and a yearning to succeed – which helps reinvigorate the rest of us. Not surprisingly, some of our top faculty and staff are Georgia Tech graduates.

We will continue to support a strategy that emphasizes career development and opportunity for everyone at GTRI. We haven't yet made all the improvements

1977 – Solar energy research heats up at EES with construction of a 325-kW, 500-mirror Solar Thermal Test Facility, the second largest in the U.S.

1980s – GTRI/EES work on millimeter-wave radar culminates in development of what was at the time the world's highest-frequency microwave radar, operating at 225 GHz.

1985 – Coinciding with Georgia Tech's 100th birthday, GTRI moves into a new home, the $12.5 million, six-story Centennial Research Building.

1978 – EES acquires its Cobb County research complex – and soon adds a state-of-the-art electromagnetic-radiation measurement range.

1979 – The Huntsville Research Laboratory begins operations, giving EES a presence at Redstone Arsenal that continues to this day.

1980

1984 – EES celebrates its 50th Anniversary by, among other things, changing its name to the Georgia Tech Research Institute (GTRI).

1987 – GTRI unveils its first Light Detection And Ranging (LIDAR) system.

we would like to make. But judging by the growth in our research awards, we're moving in the right direction.

How are GTRI's international research efforts going, especially those in Ireland?

We have learned a lot since we started working in Ireland in 2006. Perhaps the greatest lesson is that to be successful, the initiative needs to involve all of Georgia Tech: GTRI and faculty in the academic colleges. We have also been in discussion with two major research universities in Ireland about working together in ways that will create additional opportunities for GT Ireland and open doors for new academic collaboration. While we have secured a stable base of industry-focused research involving such areas as wireless sensing and digital media applications, we have also seen new opportunities to acquire European Union funding to further support our research and technology maturation plans.

In your new role as executive vice president for research, you will play a broader leadership role for Georgia Tech's entire $500 million-per-year research effort. What will that mean for GTRI's stakeholders?

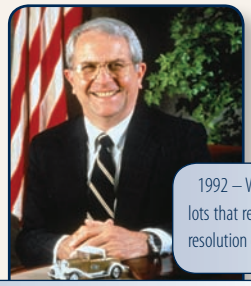
Our stakeholders have benefitted from GTRI's ability to "reach back" into Georgia Tech's academic colleges and research centers to ensure that the best possible technical expertise is applied to solving problems. That will be a continued tangible benefit of having an executive vice president overseeing the entire research program. Another benefit will be developing research strategies in specific theme areas in which Georgia Tech seeks to provide global leadership to benefit many stakeholders.

This new position will provide opportunities for all of Georgia Tech. GTRI will bring its problem-solving culture and systems view to partner with our academic college colleagues to address important societal issues. One such exciting opportunity began to emerge at the end of 2009 in an area of health information systems. Though the specifics haven't yet been put into place, we would expect that GTRI would develop a next-generation systems architecture and implement it through a test bed that would be used both by (1) Georgia Tech faculty and students in their research, and (2) by economic development specialists to accelerate adoption of the technology in partnership with major corporations. We hope to see many more such "one Georgia Tech" opportunities developed in the future.

When you consider both GTRI and the research programs based in the academic colleges, what do you think are Georgia Tech's greatest strengths?

Georgia Tech's strength has always been its people – faculty, staff and students – who embrace the culture of problem-solving, and through it, do what others would probably consider impossible. This has always been, and will continue to be, a key aspect of our culture.

We are a community of collegial hard workers who, in a very real sense, are rooted in the shops and foundries on North Avenue from Georgia Tech's earliest days. Solving problems is in our DNA, and that – in part – helps distinguish us from other great research universities. We innovate by making and testing things that work. Doing this well requires an integrated skill set that spans basic research to applied research to working directly with industry and government organizations to meet real needs.



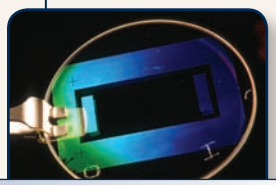
1992 – Admiral Richard H. Truly succeeds Don Grace, who retires after a record 16 years as director.

1992 – Work begins on FalconView™ software for pilots that replaces hand-drawn mission maps with high-resolution graphics on a laptop screen.

1997 – Veteran GTRI researcher Edward K. Reedy succeeds Richard Truly as director, emphasizing increased collaboration with state government and industry.

1990

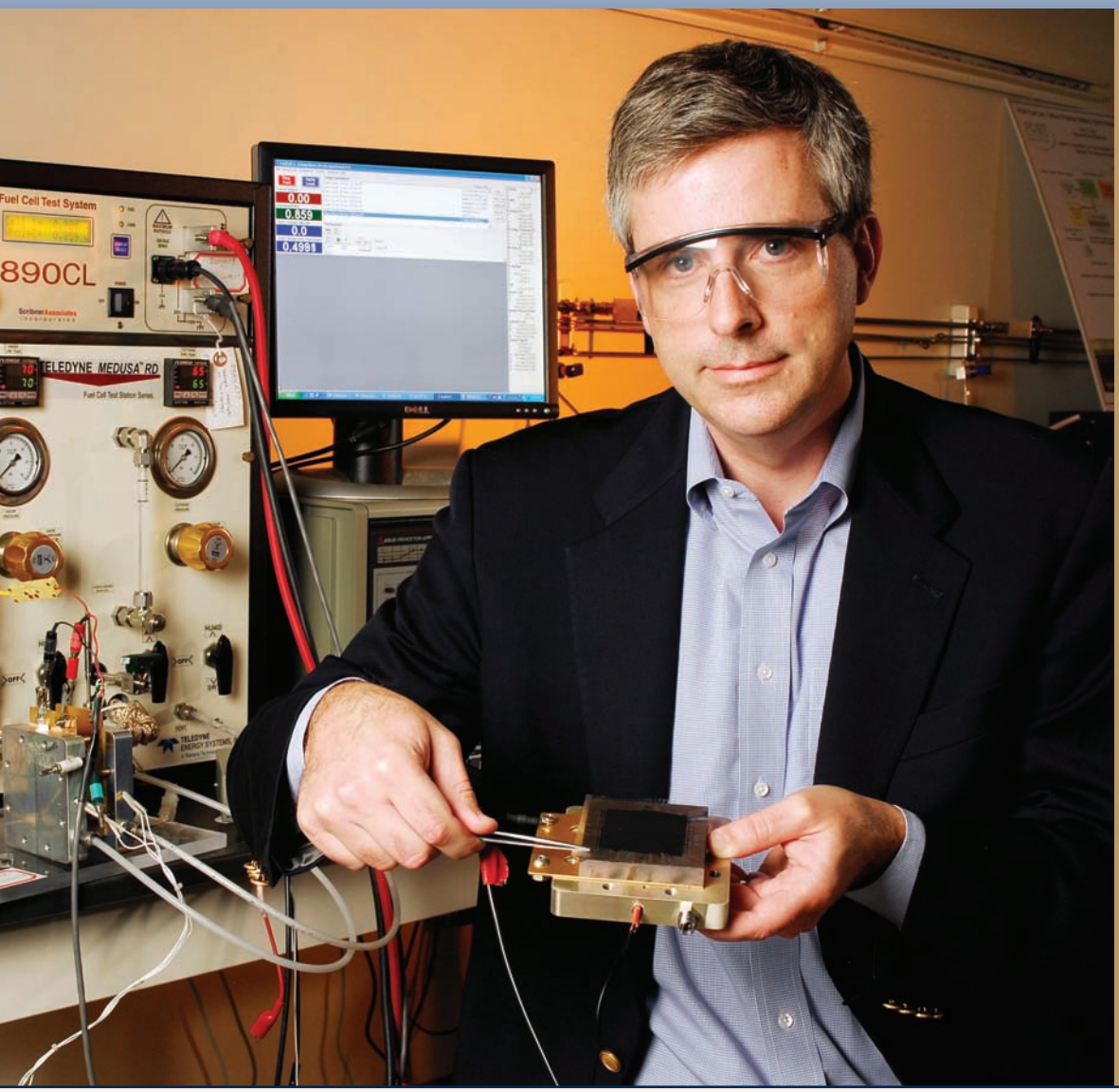
1990 – GTRI supports development of a computer-generated virtual tour of proposed Olympic venues, often called a key to Atlanta's successful bid for the 1996 Summer Olympics.



1993 – Director Richard Truly begins a diversification aimed at increasing GTRI's non-defense research in the wake of the Soviet Union's collapse and a decline in defense funding.

1998 – GTRI's Severe Storms Research Center opens to research methods for increasing the length and accuracy of tornado warnings in Georgia.

GTRI 75 YEARS



Tom Fuller, director of the Center for Innovative Fuel Cell and Battery Technologies, displays a fuel cell under development. Fuller has faculty appointments in both GTRI and Georgia Tech's School of Chemical and Biomolecular Engineering.

2000 – Research awards at GTRI pass the $100 million mark during this millennial year.

2004 – GTRI establishes the Military Sensing Information Analysis Center – SENSIAC – to support military sensing technology areas.

2006 – The first overseas GTRI office opens in Athlone, Ireland, emphasizing Internet protocol TV, radio frequency identification, biotechnology and sustainable energy.

GTRI 75 YEARS

2000

2003 – Stephen E. Cross becomes director, promising growth in both established and new research areas, and improved collaboration with Georgia Tech's academic colleges.

2005 – The Food Processing Technology Building opens, providing a state-of-the-art headquarters for GTRI's Food Processing Technology Division.

2009 – Research awards top $200 million, up 63 percent over a three-year period; GTRI now has nearly 1,500 employees, including some 700 research faculty.

2009 – The FutureMedia℠ initiative launches to help develop Georgia leadership in digital media.

2009 – The Georgia Tech Research Institute celebrates its 75th anniversary.

GTRI AT A GLANCE

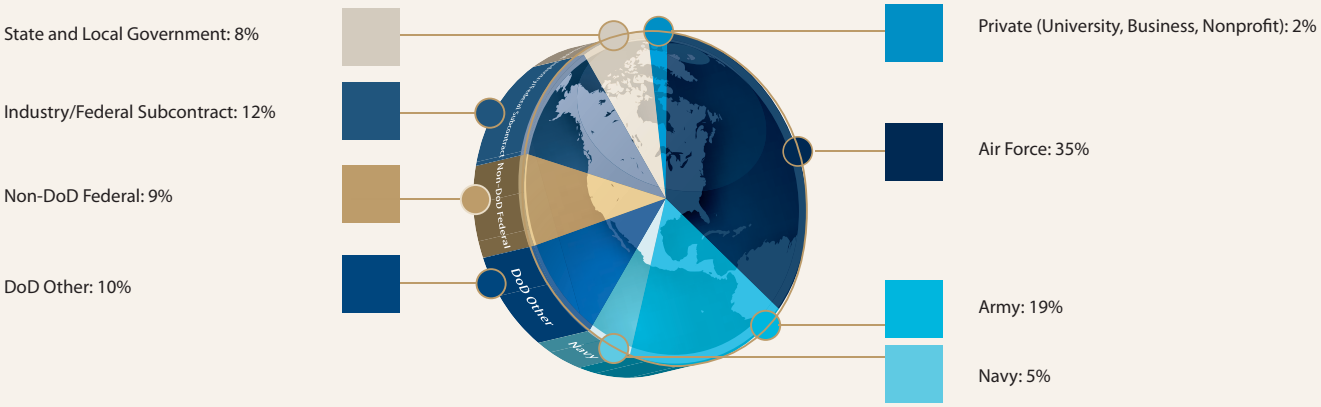
OUR LOCATIONS

Aberdeen, MD
Arlington, VA (Wash., D.C.)
Athlone, Ireland
Atlanta, GA
Fairborn, OH
Huntsville, AL
Jacksonville, FL
Orlando, FL
Panama City, FL
Quantico, VA
Rockwall, TX
San Diego, CA
Shalimar, FL
Smyrna, GA
Tucson, AZ
Warner Robins, GA

Contact information for these offices may be found on page 64.

OUR CUSTOMERS

Fiscal Year 2009



OUR NUMBERS

TOTAL GTRI EMPLOYEES

AS OF 12/31/09 **1,456**

NEW HIRES

AS OF 12/31/09 **166**

STUDENTS WORKING AT GTRI

BETWEEN 11/1/08 AND 10/31/09 **333**

TOTAL FY09 RESEARCH AWARDS

IN MILLIONS **$206**

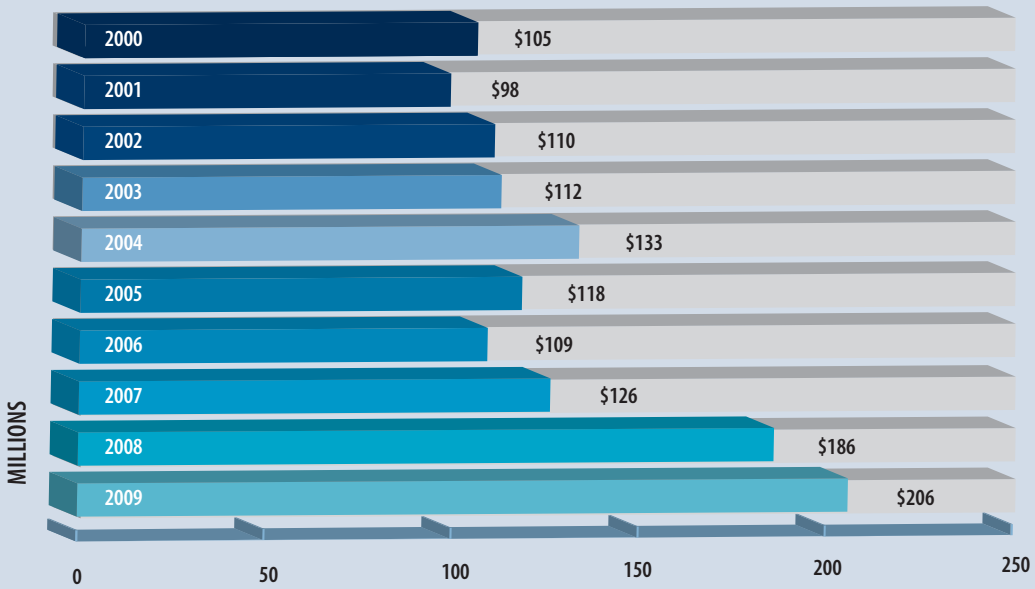
TOTAL FY09 RESEARCH VOLUME

IN MILLIONS **$172**

INDEPENDENT R&D EXPENDITURES

IN MILLIONS **$4.5**

GTRI RESEARCH AWARDS FY 2000 –2009



OUR ORGANIZATION

The Georgia Tech Research Institute is headquartered on the Georgia Tech campus in Midtown Atlanta. The toughest engineering problems of our customers are solved in seven dynamic research laboratories on and off the main campus, in an array of interdisciplinary research centers, in 13 field offices located around the nation, and at our international location in Athlone, Ireland. Complete contact information is available starting on page 64.

RESEARCH LABORATORIES OF GTRI

http://www.gtri.gatech.edu/labs

Aerospace, Transportation and Advanced Systems Laboratory (ATAS)

ATAS develops advanced technologies and systems from concept development to prototypes. Included are system simulations and test and evaluations related to threat radars, missiles, air and ground vehicles, unmanned and autonomous systems, transportation systems, power and energy systems, and food processing technologies.

Electronic Systems Laboratory (ELSYS)

ELSYS employs an end-to-end approach to developing countermeasure techniques for national defense. The laboratory provides operational embedded software and has designed hardware modifications for multiple production systems fielded on military aircraft. ELSYS human systems research supports U.S. government agency needs, industrial product usability and accessibility evaluation, and workplace safety programs.

Electro-Optical Systems Laboratory (EOSL)

EOSL conducts research and development of electro-optical systems, with expertise that spans the electromagnetic spectrum from radio frequency (RF) through ultraviolet (UV). Research includes LIDAR, infrared countermeasures modeling and simulation, RF transmit/receive modules for radar, growth and application of carbon nanotubes, multifunctional materials, RFID and optical tagging, and chem-bio sensors. EOSL is also home to the Medical Device Test Center, the Landmarc Research Center, SENSIAC and the Environmental Radiation Center.

Huntsville Research Laboratory (HRL)

HRL conducts applied research of air and missile defense and rotary-wing aviation systems that include systems modeling and simulation, systems-of-systems, and family of systems interoperability, fire control, command and control, and tactical software development and engineering.

Information Technology and Telecommunications Laboratory (ITTL)

ITTL conducts research in areas of computer science, information technology, communications, networking and technology policy to help customers master information. Research supports national security, emergency response, interoperability of interconnected systems, planning, learning and decision support, and systems engineering. The laboratory also supports commercial product realization.

Sensors and Electromagnetic Applications Laboratory (SEAL)

SEAL researchers investigate and develop radio/microwave frequency sensor systems with particular emphasis on radar systems engineering, ELINT, COMINT, MASINT, electromagnetic environmental effects, radar system performance modeling and simulation, advanced signal and array processing, sensor fusion and antenna technology.

Signature Technology Laboratory (STL)

STL develops technologies for managing and controlling multispectral signatures of objects under observation by sophisticated sensor systems. The laboratory maintains modeling and measurement capabilities for electromagnetic phenomena from quasi-static to UV wavelengths. STL is recognized for the design, development and deployment of secure enterprise information systems requiring state-of-the-art database, platform and Internet security.

FutureMedia[sm] is a new collaborative initiative chartered to create a robust, open innovation ecosystem to leverage and build upon existing world-class digital media efforts at Georgia Tech and elsewhere in Georgia. The purpose of **FutureMedia** is to develop physical and virtual places where all are invited to experiment, discover, create, commercialize, and shape the future of digital, social, mobile and multimedia. The broad-based, campus-wide initiative includes 37 Georgia Tech research laboratories from 19 centers and schools.

The **Military Sensing Information Analysis Center** (SENSIAC) serves the U.S. Department of Defense, providing information on defense-related technologies such as infrared, laser, radar, acoustic, electro-optical, aroma, and chemical sensing. SENSIAC also conducts research and educational programs, drawing upon experts from Georgia Tech and seven other universities that are part of the SENSIAC team.

The **Landmarc Research Center** is a multidisciplinary research and development center focused on mobile and wireless solutions. Landmarc has expanded its original focus of logistics and maintenance to include mobile platform computing, wireless solutions, location-based services, software and hardware usability and universal design, website and database development and management, and information display technologies.

The **Georgia Tech Quantum Institute** is a multidisciplinary effort created to explore and develop quantum information science and technology. Its mission is to combine Georgia Tech strengths in engineering and technology with the emerging field of quantum information science to advance both fundamental science and emerging quantum information technologies.

The **Test and Evaluation Research and Education Center** solves problems for the test and evaluation community. Leveraging the Georgia Tech academic environment and decades of test and evaluation experience, the center is defining the future of test and evaluation by advancing knowledge, education and training.

The **Office of Policy Analysis and Research** integrates public policy considerations into GTRI's technical research and facilitates GTRI's input into the science and technology policy debate. The office supports the Georgia General Assembly with policy analysis and subject matter expertise in a wide range of science and technology issues.

The **Severe Storms Research Center** conducts research on severe storms in Georgia. It provides the state with quick response information about weather and helps educate Georgians about severe weather.

The **Commercial Products Realization Office** helps companies from across many technical and business domains move new technology products to market. The office provides customers with a broad range of services, including advice on technology selection, product design, prototyping, production preparation, product data documentation and testing assistance.

The **Center for Innovative Fuel Cell and Battery Technologies** takes a multidisciplinary approach to fuel cell and battery research. It serves as a catalyst for developing revolutionary advances through world-class research integrated across disciplines and ranging from fundamental discovery to application-specific prototypes.

The **Environmental Safety and Occupational Health Center** oversees programs in compliance, sustainability, environmental emergency response, and occupational safety and health issues. It conducts research on environmental concerns, and helps Georgia industry and other organizations understand government regulations. It is linked to GTRI's Occupational Safety and Health consultation and education program.

Foundations for the Future supports technology-enabled learning in Georgia's K-12 schools, providing vendor-neutral technology advice, customized professional development experiences and other services that directly affect learning in the classroom. Current efforts focus on the Georgia Cybersafety Initiative, use of virtual worlds for interactive education and learning beyond the bandwidth barrier.

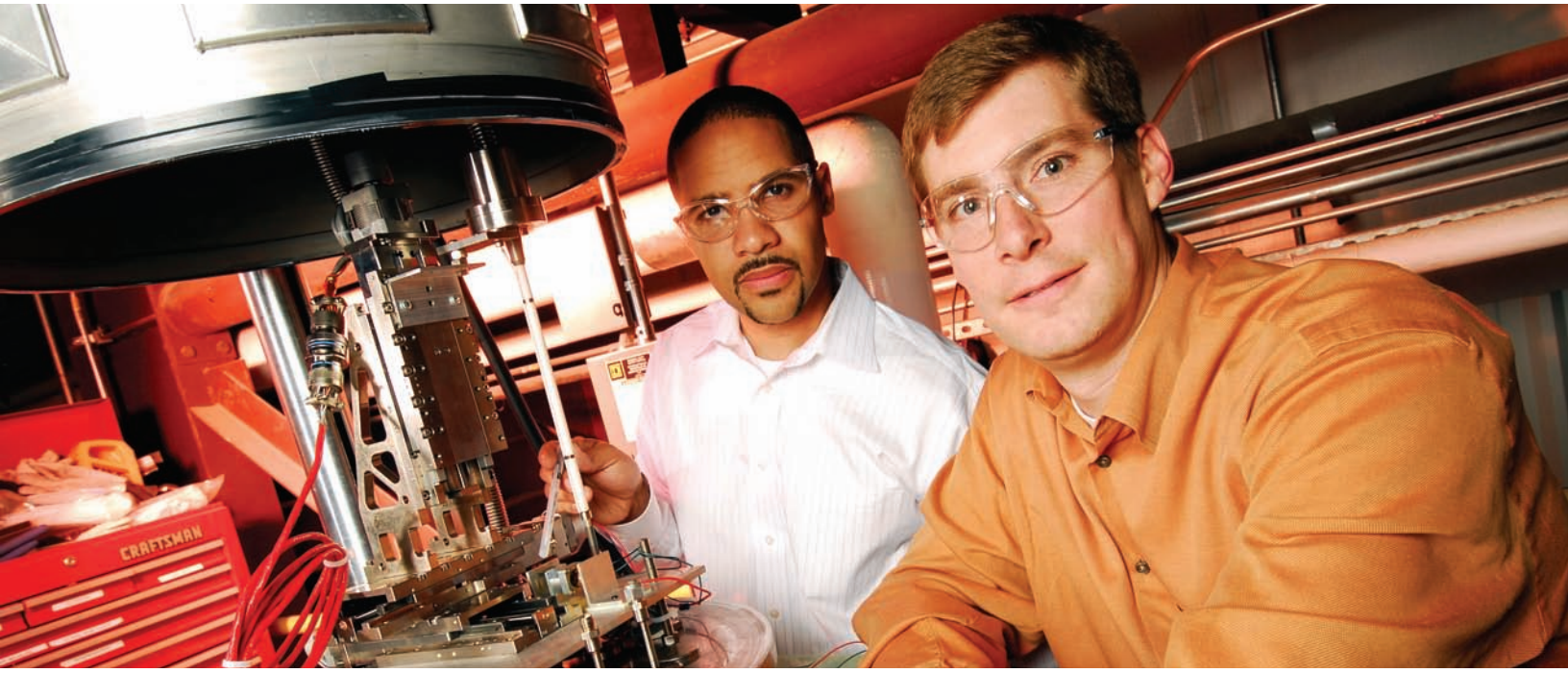
The **Center for International Development and Cooperation** develops low-cost radar and phased-array concepts through joint international research activities. It also provides an international forum for technical interchange and seeks dual-use applications for foreign radar technologies.

GTRI RESEARCH HIGHLIGHTS

Research at GTRI solves tough problems for government and industry. GTRI has a strong reputation for meeting the mission-critical research needs of the U.S. military, other federal agencies and the nation's homeland security organizations. GTRI is also known for innovation that helps industrial companies solve their problems and gain a competitive edge in world markets.

The pages in this section provide examples of how GTRI has helped solve tough research problems for a wide range of customers. Longer articles that provide additional detail on these projects are available at www.gtri.gatech.edu/ar75.

For more information about any story in this section, visit www.gtri.gatech.edu/ar75


CRAFTSMAN

Deployable Mobile Headquarters Gains Communication Upgrades

The U.S. military's Deployable Joint Command and Control system (DJC2) is a self-contained temporary headquarters facility that includes everything from computers and communications technology to climate-control equipment and containers for delivery. GTRI researchers are supporting the DJC2 program through continuing design, testing and upgrade activities.

GTRI researchers have been responsible for designing DJC2's information technology infrastructure since the initial prototype stage. Supported by the DJC2 Joint Program Office, the work has included networks, wired and wireless communications, as well as newer elements such as advanced peer-to-peer networking convergence and satellite communications.

Recent upgrades have involved a transition from the original serial communications equipment to new Ethernet systems based on Internet protocol technology. GTRI is also studying future wireless architectures, and ways to shorten deployment times. DJC2 proved its versatility during a recent deployment to Haiti in support of earthquake relief.

U.S. Army personnel use a Deployable Joint Command and Control (DJC2) forward command post. GTRI researchers have supported information technology upgrades for the DJC2.

This DJC2 was set up during an annual exercise involving military and interagency personnel. It was held at Camp Bullis, Texas.

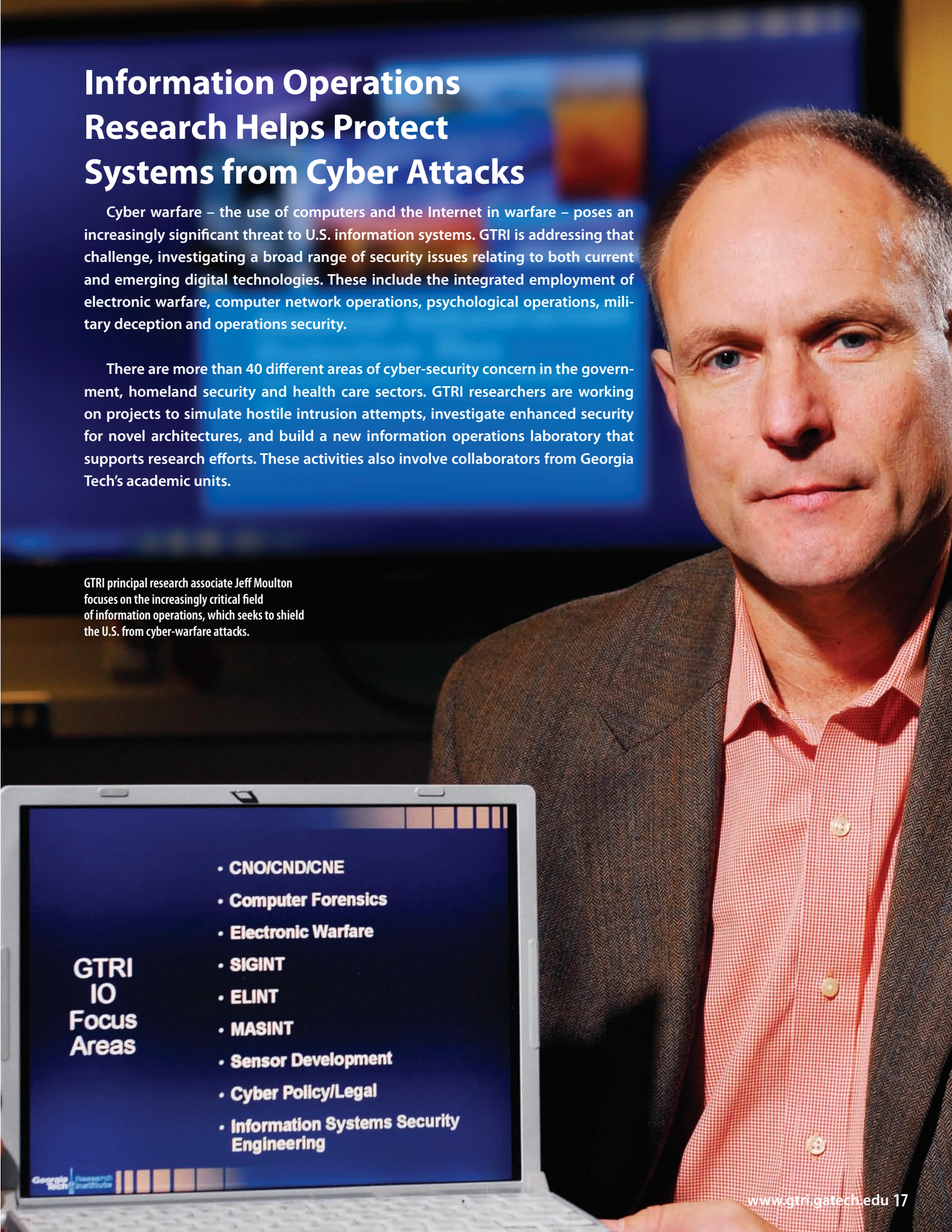
For more information about any story in this section, visit www.gtri.gatech.edu/ar75

Information Operations Research Helps Protect Systems from Cyber Attacks

Cyber warfare – the use of computers and the Internet in warfare – poses an increasingly significant threat to U.S. information systems. GTRI is addressing that challenge, investigating a broad range of security issues relating to both current and emerging digital technologies. These include the integrated employment of electronic warfare, computer network operations, psychological operations, military deception and operations security.

There are more than 40 different areas of cyber-security concern in the government, homeland security and health care sectors. GTRI researchers are working on projects to simulate hostile intrusion attempts, investigate enhanced security for novel architectures, and build a new information operations laboratory that supports research efforts. These activities also involve collaborators from Georgia Tech's academic units.

GTRI principal research associate Jeff Moulton focuses on the increasingly critical field of information operations, which seeks to shield the U.S. from cyber-warfare attacks.



Test Center Protects Medical Devices from Electromagnetic Effects

Long utilized for applications such as inventory control and package tracking, radio frequency identification (RFID) systems are now finding uses in health care environments for tracking patients, equipment and even staff members.

To help ensure that these systems don't interfere with the operation of medical devices, GTRI is collaborating with AIM Global – the international trade association representing automatic identification and mobility technology providers – and MET Laboratories, a company that provides testing and certification services for medical devices.

The first step will be to develop standardized test protocols for studying any possible interactions. At GTRI, that work is being done at the Medical Device Test Center, established 14 years ago to evaluate potential interactions between implantable medical devices and electronic article surveillance systems.

Ralph Herkert, director of GTRI's Medical Device Test Center, is developing protocols to test how RFID systems affect the function of implantable and wearable medical devices, such as this pacemaker.

Improved Electric Propulsion Could Keep Satellites in Orbit Longer

When commercial, government and military satellites are launched, they carry a finite amount of propellant. Satellites that rely on electric propulsion systems must use a portion of that limited propellant to operate a hollow cathode system that generates the ions used to provide thrust for repositioning the satellites.

GTRI researchers are working with colleagues in the Georgia Tech School of Aerospace Engineering to develop a system that would generate the ions with arrays of carbon nanotubes, eliminating the hollow cathode. Supported by the Defense Advanced Research Projects Agency (DARPA), the project would allow satellites to remain in orbit longer, be launched from smaller rockets or carry larger payloads.

Researchers from GTRI and Georgia Tech's School of Aerospace Engineering are using carbon nanotubes to improve the electric propulsion systems used in certain government, commercial and military satellites. Here, assistant professor Mitchell Walker and graduate student Logan Williams examine a Hall Effect thruster.

Competition Shows Information-Gathering Value of Social Networks

Can social networks operating across the Internet help facilitate massive information-gathering projects? A competition sponsored by the Defense Advanced Research Projects Agency (DARPA) demonstrated that the answer is affirmative.

The DARPA Network Challenge invited teams to tackle the challenge of locating 10 red weather balloons raised at previously undisclosed locations across the United States on a single day in December 2009. A GTRI-led team used a website, the popular Facebook™ service and word-of-mouth communication to enlist and coordinate a nationwide team of volunteers that located nine of the 10 balloons within nine hours.

The GTRI-led team finished second in the competition – and gained valuable information about building and using social networks. A team from MIT won first place by locating all 10 balloons.

A team led by GTRI researchers placed second in the DARPA Network Challenge in December 2009. Here, team member Betty Whitaker, a GTRI principal research engineer, poses with a red balloon in Atlanta's Centennial Olympic Park.

Members of the GTRI Network Challenge team pose with DARPA officials after the competition. Shown are (left to right), Peter Lee, director of DARPA's Transformational Convergence Technology Office; Rick Presley; Steve Cuzzort; Jessica Pater; Erica Briscoe; Regina Dugan, director of DARPA; Miles Thompson; Betty Whitaker; Ethan Trewhitt and Stephen Cross, Georgia Tech's executive vice president for research.

This map shows balloon locations submitted by visitors to the GTRI team's website on the day of the competition. Each report had to be verified.

New Radar Will Enable Remote Mapping of Ice and Snow Formations

Understanding the potential impacts of global climate change requires accurate mapping of the Earth's ice and snow formations. Until now, that mapping could only be done with bulky radar equipment operated on the surface, a slow process.

GTRI researchers are part of a team – led by colleagues in the Georgia Tech School of Electrical and Computer Engineering– that is developing a new type of low-cost, lightweight phased-array radar for mapping these ice and snow formations from the air. Using silicon germanium chips and radio frequency micro-electromechanical systems, the radar will be small and light enough to operate from aircraft – including unmanned aerial vehicles.

Researchers have already built radar sub-arrays based on flexible polymer substrates. The project is sponsored by the National Aeronautics and Space Administration (NASA).

Researchers from GTRI and Georgia Tech's School of Electrical and Computer Engineering are developing a phased-array radar for mapping ice and snow deposits. Shown is John Papapolymerou, a Georgia Tech professor.

International Patents Move 3-D Solar Cell Closer to Commercialization

Design and materials innovations are driving down the cost of photovoltaic systems, moving this source of renewable energy closer to broader use. A three-dimensional solar cell design developed by GTRI researchers in 2004 has won key international patents that will make it attractive for commercial development.

The GTRI design uses micron-scale towers that resemble the skyscrapers of major cities like New York. The towers increase the available surface area for absorbing solar energy, and modeling suggests the innovative design could boost power production by as much as 300 percent over conventional flat photovoltaic cells of the same size. That could make the design useful for powering satellites, military equipment and other devices that have limited surface areas for capturing sunlight.

GTRI senior research engineer Jud Ready holds a sample of the 3-D solar cells developed to catch as much as three times as much light as flat solar cells.

FutureMedia^{sm} Brings Together Digital Media Industry in Georgia

Like many other states, Georgia is dealing with budget challenges arising from the global economic downturn, and that has focused attention on maximizing the benefits from new industry. Georgia has the potential to become a global pioneer and leader in the future of media – but reaching that goal will require focus, determination and collaboration among universities, corporations, venture capitalists, entrepreneurs and government.

That was the message from the day-long FutureMedia conference held Oct. 15, 2009, in Atlanta. The event focused on opportunities and challenges in the already-burgeoning field of digital, social and multimedia. Hosted by GTRI on behalf of Georgia Tech, the gathering brought together some 260 people from as far away as Canada, Ireland, Scotland, South Korea and Singapore – more than half of them representing industry. Nearly 20 different Georgia Tech groups participated, as did several other universities. The event marked the formal launch for the FutureMedia initiative, which was created to facilitate collaboration among Georgia Tech programs in digital, social and mobile media. FutureMedia is a research and development effort that explores new paradigms of how content is created, distributed and consumed. www.futuremediaglobal.com

A follow-up event is being planned for October 2010.

Attendees at the first FutureMedia conference in October 2009 demonstrate the widespread use of portable electronics during a break in the sessions.

For more information about any story in this section, visit www.gtri.gatech.edu/ar75

Programmer's Handbook Helps Standardize Air Force Testing

Effective flight-testing of U.S. military aircraft and the subsystems they depend on is a complex challenge, and it's important that every test facility use standard approaches. Among the key procedures are those governing the use of digital flight-data recorders that track instrument readings and other information about a flight test.

To support these efforts toward standardization, GTRI researchers have developed a handbook that describes how digital recorders work, what the resulting information will look like, and how test officials should use and interpret it. Produced for use by the Range Commanders Council, the project was funded by the U.S. Air Force and facilitated by the Military Sensing Information Analysis Center (SENSIAC) located at Georgia Tech.

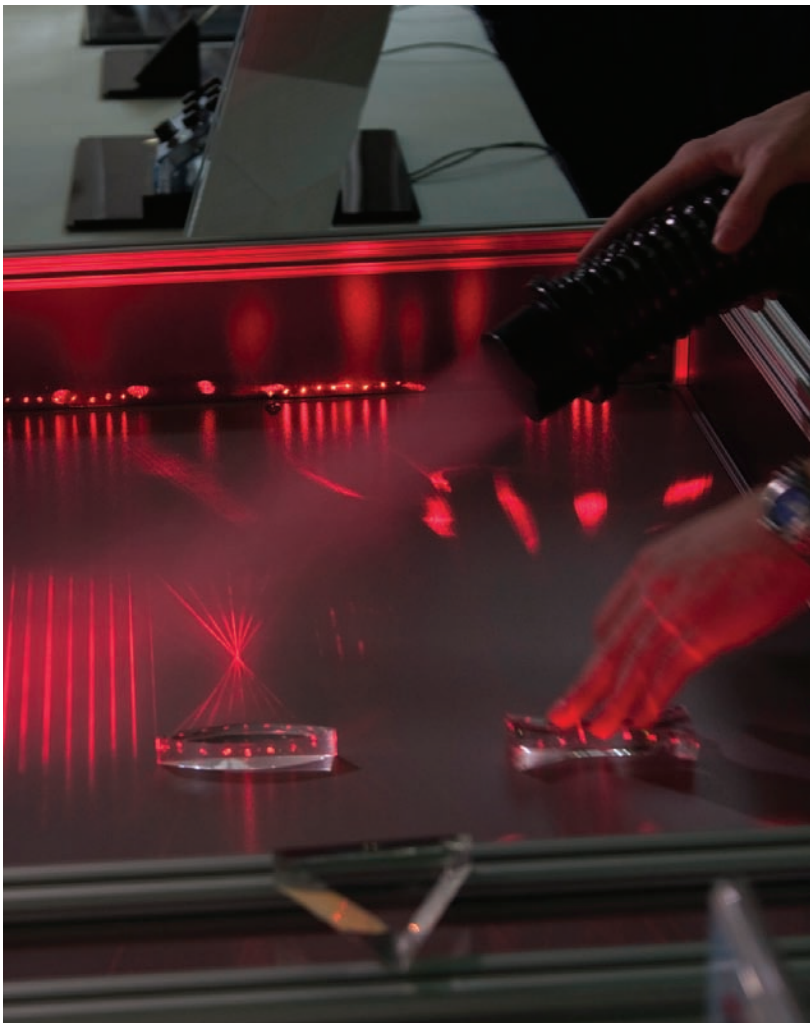
GTRI has developed a handbook to help standardize digital flight-data recording on U.S. military test ranges. The task was led by Bob Baggerman, the GTRI research engineer shown here.

LaserFest Helps Interest K-12 Students in Science and Engineering

Attracting more top students into mathematics, science and engineering disciplines is a key part of efforts aimed at improving U.S. global competitiveness. Volunteers from GTRI used the recent national meeting of the American Meteorological Society (AMS) in Atlanta to advance that goal by creating a dozen hands-on, museum-quality exhibits highlighting the 50th anniversary of the invention of the laser.

The exhibits were part of LaserFest, and were displayed at the Georgia World Congress Center during the AMS WeatherFest event. The exhibits are now being loaned out to local schools, where they will help meet the need for interactive science education activities. GTRI and its researchers donated more than $100,000 in materials and labor to produce the exhibits.

Children enjoy an exhibit demonstrating the applications of lasers. GTRI researchers developed the museum-quality exhibits and are making them available to K-12 schools.



GTRI researchers developed this demonstration showing how laser light can be bent. The project was part of LaserFest, a year-long celebration of the 50th anniversary of the invention of the laser.

For more information about any story in this section, visit www.gtri.gatech.edu/ar75

Circulation Control Technology Helps Improve Wind Turbine Efficiency

Wind turbines used for generating electricity require sophisticated blade designs and complex mechanical controls that can make the systems too costly to use in many locations. An aerodynamic technology originally developed to increase lift in aircraft wings and simplify helicopter rotors may soon help reduce the cost of manufacturing and operating these wind turbines.

In collaboration with the Georgia Tech School of Aerospace Engineering, GTRI researchers are supporting California-based PAX Streamline Inc. in applying "circulation control" technology to wind turbines. The technology will use air blown from the turbine blades to replace mechanical devices now used to control aerodynamic properties. Funded by the Advanced Research Projects Agency - Energy (ARPA-E), the project will lead to construction of a demonstration wind turbine that could also produce significantly more power than current equipment does.

Researchers from GTRI and the Georgia Tech School of Aerospace Engineering are working with California-based PAX Streamline to simplify wind turbines and lower the cost of wind energy.

New Technologies Improve Security of Cargo Shipping Containers

Shipping containers that bring cargo into the United States from around the world have long been a source of concern because they could be used to smuggle weapons, drugs and other contraband across national borders. Two security technologies recently demonstrated by GTRI researchers could reduce that threat by providing notification to authorities if the containers are opened in transit.

The two projects, GTRI's Container Security Device and the Composite Container Security System, were developed under contract to the Department of Homeland Security's (DHS) Science and Technology Directorate. They were among the projects demonstrated at the DHS Cargo Conveyance Security Technology Demonstrations held at Sandia National Laboratory in August 2009. Collaborating with GTRI on the projects are the University of Maine, California-based iControl Inc., and Georgia Tech's School of Electrical and Computer Engineering.

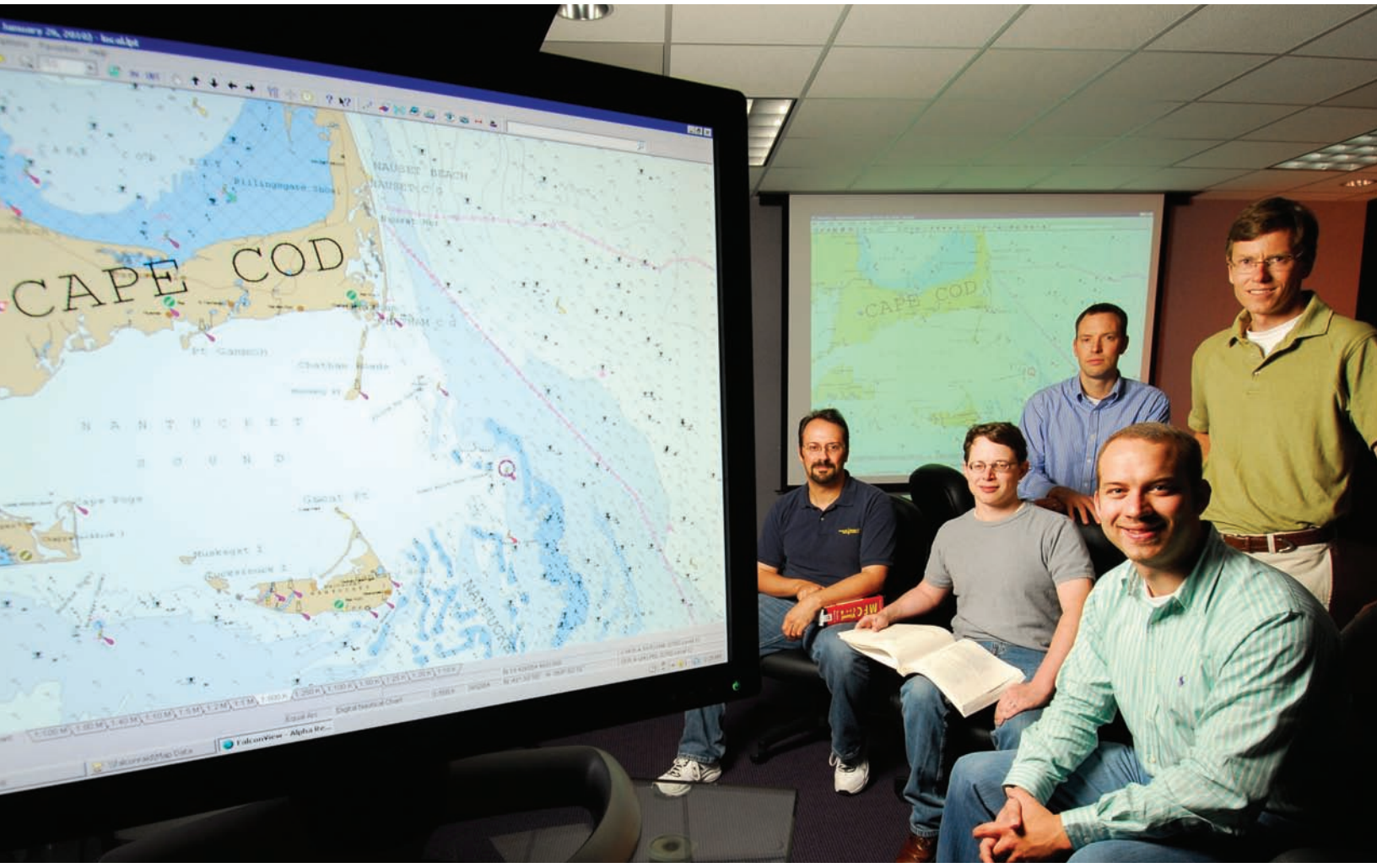
Top: Containers like these, shown at the port of Savannah, have long been a source of security concerns. GTRI is addressing the issue with devices designed to detect unauthorized opening of container doors.

Left: GTRI's Container Security Device is shown being installed on a test cargo container. The device detects unauthorized door openings.

Open Source FalconView™ Becomes Available to Industry and Government

U.S. Department of Defense agencies have used the FalconView software program since the 1990s to analyze and display geographical and other information crucial to flight mission planners. Now, the program – known for its ease of use, open architecture and interoperability – has been made available to new groups of potential users through release of an open source version.

FalconView displays topographical maps, aeronautical charts, satellite images and other maps, along with overlay tools that can be displayed on any background. The open source version is expected to be used by state and city governments, police forces, architects, environmental researchers, utility companies and others. An estimated 45,000 military personnel were using FalconView when the open source version was released.



A portion of the GTRI FalconView development team displays the new open source version of FalconView software. Shown (l-r) are Rick Presley, Carl Cox, Joel Odom, Jim Koch and Chris Bailey.

For more information about any story in this section, visit www.gtri.gatech.edu/ar75

Open Source Movement May Accelerate Military Software Development

Recent years have seen rapid growth in the use of open source software – programs that make their source code available to others so it can be changed and improved. The U.S. military is interested in open source software because it offers the potential for increased development speed and flexibility – advantages that outweigh potential security concerns.

GTRI researchers are working with the Department of Defense to maximize the open source potential by making source-code tools and applications available – and practical – for military use. Among the steps taken so far is the launch of the Military Open Source Software (Mil-OSS) community (www.mil-oss.org). Using an "unconference" format, the first Mil-OSS Working Group (WG1) gathered more than 120 persons at GTRI for discussions about key issues such as development of a secure website where users may download source code for specific software tools. The next working group is scheduled for August 2010 in Washington D.C.

The military open source initiative could allow personnel to rapidly adapt mission software to battlefield situations, without sacrificing data security. Those issues were discussed during a recent meeting organized by GTRI.

GTRI senior research engineer Mick West is developing an unmanned vehicle that can function autonomously under water, yet collaborate with other underwater and airborne unmanned vehicles.

Collaborative Unmanned Vehicles Could Revolutionize Underwater Surveillance

Unmanned aerial vehicles have gained considerable visibility because of their successes in Iraq, Afghanistan and other locations. GTRI researchers are working to extend those advantages to the underwater environment by developing systems for vehicles that could work cooperatively on a variety of subsurface missions.

Underwater unmanned vehicles face challenges unlike comparable systems designed for aerial use. For instance, communication among collaborating vehicles and controllers can be difficult. GTRI researchers are addressing that challenge by replacing existing acoustic communications with radio frequency (RF) signals. They are also developing technology that would allow multiple vehicles to work together on a common task.

Arthritis Simulation Gloves Help Companies Design Easy-to-Use Products

As the population ages, consumer goods manufacturers must adapt their products for use by customers who may not be as nimble-fingered or sharp-sighted as they once were. To help product designers and engineers meet these changing requirements, GTRI engineers have developed arthritis simulation gloves that reproduce the reduction in functional capacity experienced by persons who have arthritis.

The gloves can help a designer or product manager understand how arthritis affects a consumer's ability to grasp, pinch, turn, lift and twist objects. They can be used to evaluate a wide range of products, including medicine bottles, beverage containers, office supplies, medical devices, vehicles and cell phones. The gloves can also simulate the challenges involved in opening product packaging of various kinds.

GTRI principal research scientist Brad Fain opens a medicine bottle while wearing the arthritis simulation gloves. The gloves reproduce the reduction in functional capacity experienced by persons with arthritis.

For more information about any story in this section, visit www.gtri.gatech.edu/ar75

Improved Design and Sacrificial "Blast Wedge" Could Improve Vehicle Survivability

New design approaches are needed to help protect the occupants of future light armored patrol vehicles from improvised explosive devices. GTRI researchers have developed and tested a crew survivability concept that would build future vehicles around a protected personnel compartment and use a sacrificial "blast wedge" to absorb energy from explosions.

With support from the U.S. Office of Naval Research, GTRI designed and built a full-size test article dubbed ULTRA II to evaluate the concept. A blast test conducted at the Aberdeen Test Center showed that the concept could protect the occupants from explosions. Using a "space frame" constructed of tubular steel, the vehicle was designed for the addition of modular armor to facilitate field modification and accommodate future armor innovations.

GTRI researchers Kevin Massey, Vince Camp and Burt Jennings (left to right) pose with the ULTRA II test article as it was set up for evaluation at the Aberdeen Test Center in Maryland.

For more information about any story in this section, visit www.gtri.gatech.edu/ar75

GTRI researchers Kevin Massey (left) and Tommer Ender pose with simulations designed to help understand how powerful acceleration forces caused by roadside bombs affect personnel inside vehicles.

Injury Prediction Studies Could Assist Designers of Future Military Vehicles

Improved design and armor are helping new generations of military vehicles better protect their occupants from roadside bombs and related threats. But even when these blasts can be kept out of vehicle crew compartments, warfighters can still be injured by the powerful and unpredictable acceleration forces that occur.

GTRI researchers are integrating methods for predicting human injury that may result from such blasts. The goal is to create an end-to-end system that military procurement officials and vehicle designers could use to evaluate different crew protection concepts and make tradeoffs between survivability and other vehicle performance issues.

U.S. Army and GTRI Dedicate New Communications Lab in Atlanta

Getting communications equipment updates into the field quickly is vital for U.S. warfighters. To support that goal, GTRI is expanding its collaboration with the U.S. Army by establishing an on-site laboratory that will work closely with the Army in the field of communications electronics. As part of the U.S. Army CECOM Software Engineering Center (SEC), the Army Reprogramming Analysis Team – Support Cell Atlanta (ARAT-SC ATL) facility will develop software and other technologies for communications electronics used by soldiers in the field.

The Army Reprogramming Analysis Team is the primary distribution point for threat updates to Army aviation, ground systems and platforms. Among other services, it supports warfighters by assisting with the installation, operation and maintenance of aircraft survivability equipment, and it supports operations for the Army, Air Force, Navy and Marines. Representatives from the Army and GTRI officially opened the laboratory June 17, 2009, at a ceremony held in GTRI's Baker Building on the Georgia Tech campus.

Ned Keeler (left), director of the Software Engineering Center (CECOM), and Steve Cross, Georgia Tech's executive vice president for research, cut a ceremonial ribbon at the Atlanta laboratory.

For more information about any story in this section, visit www.gtri.gatech.edu/ar75

Michael Harris, a GTRI co-op student who served as a Yellowstone intern in summer 2009, enjoys one of the region's splendors.

Emissions Initiative Makes Yellowstone More Environmentally Friendly

Yellowstone National Park is one of the nation's most popular natural attractions, and park managers are concerned about reducing the human impact on this environmental treasure. Through a GTRI-directed program, Georgia Tech student interns are helping the park reduce its emission of greenhouse gases, working toward a goal of cutting emissions 30 percent by 2016.

Funded by the Yellowstone Park Foundation, the students are examining emissions from electricity consumption, mobile combustion from vehicles, and stationary combustion from cooking and heating. Improvements to reduce emissions may include energy-efficient windows and doors, and replacing fossil fuels with renewable energy sources such as water turbines. Plans call for six Georgia Tech students to work at Yellowstone during the summer of 2010.

Imaging System Ensures Quality in Meat Cooking

Fully cooked, ready-to-eat products continue to increase in popularity among consumers because of their convenience. However, cooking these products on the processing line requires careful control to ensure that the food items are neither overcooked nor undercooked.

To help ensure proper cooking, GTRI has built a system that measures the three-dimensional shape and surface temperature of every piece of meat placed onto conveyor belts before entering the oven. The system uses two commercially available cameras that can detect arrangement issues – such as overlapping products – that could affect proper cooking.

The system is expected to be tested at a Georgia processing plant later this year.

GTRI senior research engineer John Stewart and Georgia Tech undergraduate Chris McClanahan measure the three-dimensional shape and surface temperature of meat on a conveyer belt.

Power of Graphics Processing Units May Threaten Password Security

Graphics processing units (GPUs) developed for computer games continue to grow in power and performance. Because they are relatively inexpensive, these parallel-processing GPUs are finding applications well beyond those for which they were originally developed. Collaborating with scientists in Georgia Tech's College of Computing, GTRI researchers are evaluating concerns that some of these GPU applications may threaten existing password protection systems.

Hackers could use GPUs to mount brute-force attacks against computer password-protection mechanisms. The researchers indicate that passwords of eight or fewer characters are inadequate and can be easily broken by GPU-accelerated cracking programs. To protect against such threats, passwords of at least 12 characters should be used.

GTRI researchers Josh Davis (standing) and Richard Boyd (right) investigated the GPU threat to password security, aided by undergraduate researcher Carl Mastrangelo (front).

GTRI researchers use this laboratory test bed to assess the ability of a polymer film-coated optical sensing device they designed to detect the presence of TNT.

Polymer-Coated Optical Sensor Offers Improved Explosives Detection

Detecting explosive compounds is essential for countering terrorism, locating buried land mines and aiding environmental protection efforts. The most common explosive is TNT, and detecting trace amounts of this material in samples of air requires a very sensitive sensor.

Working with collaborators at the College of Wooster, the Georgia Tech School of Mechanical Engineering and the Georgia Tech Nanotechnology Research Center, GTRI scientists have designed and tested a new optical-sensing device capable of detecting TNT in the parts-per-trillion range. Based on unique polymer film coatings, the sensor utilizes the interference of light waves, a principle called interferometry, to determine how many particles of the explosive are in a given sample of air. The sensor was developed with funding from the National Science Foundation. The technology has been licensed to an Atlanta company for commercialization.

New Wireless Captioning System Debuts at Dallas Cowboys Stadium

Persons who are deaf or hard-of-hearing often miss important information at public events such as football games. To help them stay informed, GTRI researchers have developed a wireless captioning system that sends information such as public address system announcements and referee calls to handheld devices in real time.

The system, which is being commercialized by Atlanta-based Intelligent Access, was recently installed at the Dallas Cowboys stadium in Arlington, Texas. The Atlanta company teamed up with Houston-based Softeq Development Corp. to integrate the real-time captioning system into Softeq's handheld devices for use at the stadium. Captioning information is now broadcast throughout the facility, and guests may borrow the special devices.

The Intelligent Access system can also be used at other public facilities, including museums, theaters, classrooms and places of worship.

With the help of a wireless captioning system developed at GTRI, this handheld device allows Dallas Cowboys Stadium guests who are deaf or hard of hearing to receive real-time captions for all public address system announcements and referee calls.

For more information about any story in this section, visit www.gtri.gatech.edu/ar75

Simple Breath Test May Provide Early Detection of Breast Cancer

Early breast cancer detection can significantly improve survival rates, but current diagnostic tests often fail to detect cancer at the earliest stages. A team of researchers led by GTRI is using a portable device to search for molecules in a person's breath that may indicate the presence of breast cancer. Known as biomarkers, these volatile organic compounds originate in the lower lungs. As a patient breathes into the device, these compounds are trapped and examined by a sensor.

The team, which includes researchers from Emory University, the University of Ulm in Germany and the Department of Biomedical Engineering at Georgia Tech and Emory University, recently conducted a study analyzing more than 300 organic compounds in breath samples from 20 healthy women and 20 women who had been diagnosed with cancer. The breath analysis was able to determine whether the sample came from a cancer patient or healthy subject 78 percent of the time.

Emory University researcher Dana Allen blows into a device that traps specific compounds found in breath. The compounds are then examined to confirm the presence or absence of cancer.

Interactive High-Definition Connection Brings Research to K-12 Schools

Strengthening K-12 education in science, technology, engineering and mathematics is a top challenge for educators, especially as budgets for field trips shrink. To provide new interactive educational opportunities for its students, Georgia's Barrow County has established a novel program that brings higher-education instruction directly to K-12 students through a sophisticated high-definition teleconferencing system.

Scientists and engineers from GTRI and other Georgia Tech units are supporting the Barrow County program, which is known as Direct to Discovery. These scientists and engineers teach classes and virtually take students into their laboratories, communicating over a fast network connected to high-definition monitors and real-time audio systems in the schools.

GTRI is working with groups in Australia, Canada and Ireland to use videoconferencing for global learning collaboration via the Internet2 network. Students in Dublin, Ireland, have viewed the intricacies of a fly's eye through a scanning-electron microscope based at Georgia Tech. In addition to Georgia Tech, the project has involved the University of Georgia, Georgia State University and the University System of Georgia.

Kevin McCage of Barrow County schools (left), and Jud Ready of GTRI converse in real time with an educator in Sydney, Australia, using a high-definition videoconferencing system. The GTRI-based equipment was used to demonstrate a high-speed, high-definition connection between the Internet2 educational network in the U.S. and the Australian Academic and Research Network.

For more information about any story in this section, visit www.gtri.gatech.edu/ar75

GTRI CELEBRATES 75 YEARS OF SOLVING TOUGH PROBLEMS

The Georgia Tech Research Institute (GTRI) marked its 75th anniversary in 2009 with a yearlong series of events that ranged from research presentations to a legislative breakfast for members of the Georgia General Assembly.

For the Research Institute, there was a great deal to celebrate.

In 1934, 13 part-time researchers started out in a Georgia Tech basement with a few thousand state-appropriated dollars. By 2009, that seed had grown to nearly 1,500 employees in multiple U.S. locations – and more than $200 million in research grants and contracts from a host of federal, state and industry sponsors.

"This success story was built, year by year, by the great people of GTRI," said Stephen E. Cross, Georgia Tech's executive vice president for research. "It was fitting that their accomplishments should be on display, and that we should all have some fun, too."

75th Anniversary Legislative Breakfast

The commemorative year began with a February event that communicated GTRI's accomplishments to the government body that made it all possible: the Georgia General Assembly.

In 1919, the Assembly officially authorized a state engineering experiment station, but funding was unavailable. In 1934, state-

(continued on page 45)


GTRI
75 YEARS


Georgia Tech
Research Institute
PROBLEM. SOLVED.

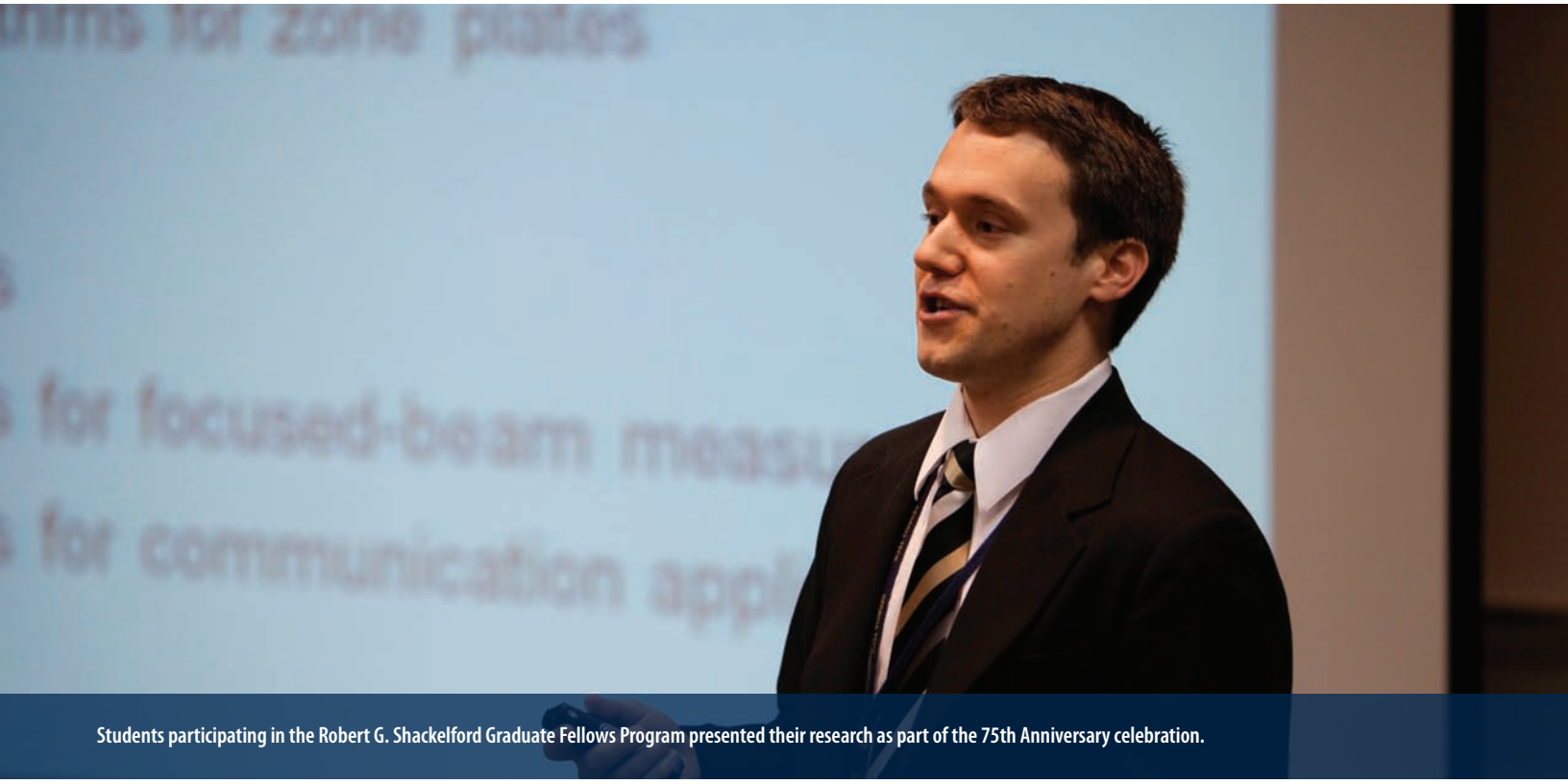
As part of the 75th Anniversary celebration, GTRI hosted a breakfast for legislators — and visited the State Capitol.

During its 75th Anniversary Legislative Breakfast, GTRI briefed legislators and other key officials on projects that have benefitted the state of Georgia.

supplied seed money finally made the State Engineering Experiment Station (the entity that became GTRI) a reality at Georgia Tech.

The Legislative Breakfast celebrated that auspicious start and the beneficial impact that the Research Institute has had on the state of Georgia. The event – held at the Historic Georgia Railroad Freight Depot in Atlanta – included a poster session detailing some of GTRI's accomplishments and a reading of commemorative resolutions passed by the General Assembly.

The Georgia House and Senate both proclaimed, among other things, that "GTRI's economic impact on Georgia has been profound…" and that the Research Institute has "provided invaluable services to state agencies to improve education and protect its citizens."



Students participating in the Robert G. Shackelford Graduate Fellows Program presented their research as part of the 75th Anniversary celebration.

First Annual Shackelford Showcase

Students participating in the Robert G. Shackelford Graduate Fellows Program presented their research to attendees of an April 17th event held at GTRI's Food Processing Technology Building. The program was the first such presentation by Shackelford Fellows; a similar annual event is planned for the future.

Shackelford Fellows are graduate students, usually at the doctoral level, who focus on internal research and development (IRAD) projects that are of special interest to GTRI. The Fellows Program is named after Robert G. Shackelford – a GTRI research scientist, lab director and associate director during his 34-year career – who encouraged the Research Institute to increase the hiring and funding of graduate students.

Student presentations at the showcase included such cutting-edge technologies as three-dimensional photovoltaics, robotic flexible endoscope control and planar ion traps for quantum information transmission.

The 75th Anniversary Technology Symposium

This large gathering at the Ferst Center for the Arts was a highlight of the commemorative year. The April 20th event, moderated by GTRI Chief Scientist Dennis Folds, offered attendees a variety of research presentations and talks, including an address by

The family of GTRI principal research engineer Robert Howard enjoyed the 75th Anniversary Employee and Family Picnic at Stone Mountain. Shown are (back row) Rachel, Brenda, Sarah, and Jonathan; and (front row) Claire, Christopher and Robert.

Georgia Tech President G.P. "Bud" Peterson.

Peterson underscored GTRI's importance to both the university and the state of Georgia.

"As universities are increasingly called upon to become drivers of innovation and high-end economic development," he said, "the importance of the role of GTRI and organizations like it will continue to grow."

Peterson added: "It's clear to me that GTRI is a wonderful resource for Georgia Tech – and is one of the principal reasons that Georgia Tech enjoys the national and international respect that it has today."

Georgia Tech Executive Vice President for Research Cross spoke of GTRI's tradition of student research involvement. He noted that student involvement has deep roots that go back to at least the 1950s, even before Georgia Tech began to offer doctoral degrees.

Among other talks, Sensors and Electromagnetic Applications Laboratory (SEAL) Director Bill Melvin offered a presentation on knowledge-based signal processing, which is related to GTRI's traditionally strong emphasis on radar.

Principal research engineer Chris Bailey gave an overview of GTRI's accomplishments in technology related to graphical information systems, including the highly successful FalconView™ flight-planning software.

Fred Wright, chief engineer at GTRI's Electronic Systems Laboratory (ELSYS), reviewed GTRI's work on airborne defensive systems, such as radio frequency countermeasures and other technologies developed to defeat enemy sensors.

Senior research engineer Jud Ready reviewed GTRI's recent materials research, which includes advances in nanomaterials.

75th Anniversary Employee and Family Picnic

This April 25th event brought more than 1,100 people to Stone Mountain Park for a day of fun, food and excitement at the noted Atlanta landmark and recreation area.

"The picnic was a way to thank current and past GTRI employees for their contributions to the organization's impact and success," Cross said. "And I think everyone had a really good time."

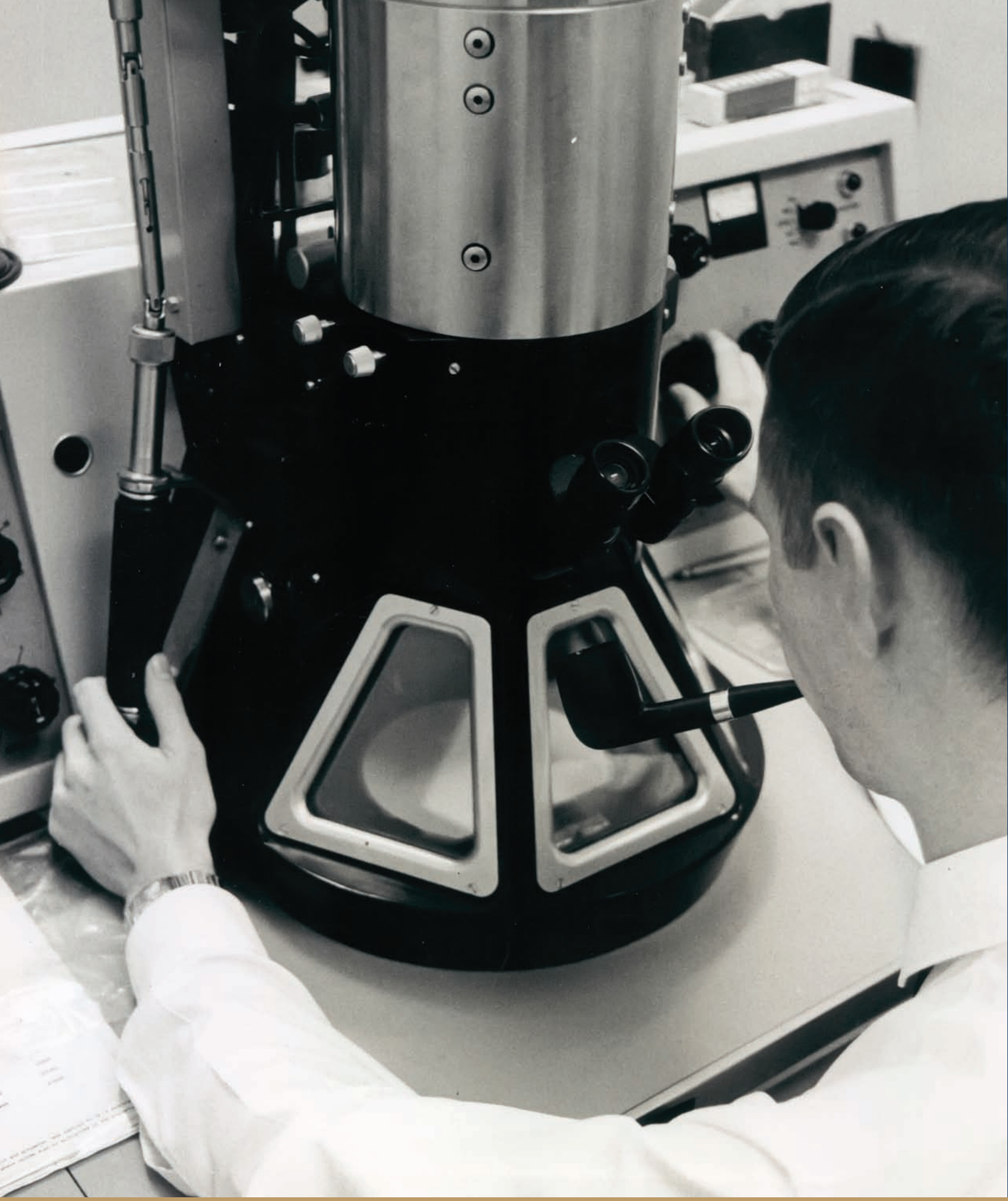
75th Anniversary Alumni Brunch and Lab Tours

This "family reunion" for GTRI retirees, former employees and former students was an opportunity for former colleagues to reconnect with GTRI and with one another. Held Oct. 16th at the

Georgia Tech President G.P. "Bud" Peterson addressed the 75th Anniversary Technology Symposium held at the Ferst Center for the Arts. Peterson underscored the importance of GTRI to Georgia Tech's mission.

GTRI Conference Center in Atlanta, the brunch was followed by a poster session showcasing current GTRI research and tours of the Information Technology and Telecommunications Laboratory located in the Conference Center building.

The event wrapped up with the premiere of the 75th anniversary video and a State of GTRI address delivered by Cross and by deputy directors Lisa Sills and Tom McDermott.



In 1947, the Engineering Experiment Station (EES) installed one of the first electron microscopes in the United States. The device was used for research on kaolin.

GTRI PAST: 75 YEARS OF APPLYING TECHNOLOGY FOR GOVERNMENT AND INDUSTRY

In 1934, the State Engineering Experiment Station (EES) at Georgia Tech started life with a budget of $5,000, 13 part-time faculty researchers and a few graduate assistants.

In fiscal year 2009, the Georgia Tech Research Institute (GTRI) – the modern name for the EES – listed research awards of more than $200 million, nearly 1,500 full-time employees including about 700 research faculty, and 350 co-op student researchers.

The progress of the Georgia Tech Research Institute over the past 75 years didn't happen in a vacuum, said Stephen E. Cross, Georgia Tech's executive vice president for research.

"Our history is tied to major changes in how government and industry regard university-based research and development," he said. "It also reflects steadfast support from Georgia government and industry – and the hard work of a lot of smart people."

Modest Beginnings

GTRI, the applied research arm of Georgia Tech, might be celebrating its 90th anniversary if things had gone a bit differently. When W. Harry Vaughan, a Georgia Tech associate professor of ceramics, was preparing a plan in 1929 for the development of an engineering experiment station, he discovered that the General Assembly had authorized – but not funded – just such an organization in 1919.

By 1934, however, funding priorities had changed. With the Great Depression wilting the state's economy, the University System of Georgia's Board of Regents appropriated $5,000 to establish a State Engineering Experiment Station. Georgia Tech was to furnish personnel and other support to the new unit, which was envisioned as an industry-oriented version of the federally funded agricultural experiment stations that were already operating in many states.

What soon became known as simply "the research station" opened for business on July 1, 1934, with Vaughan as its first director. The state even came up with an additional budget allocation, with the understanding that it would be augmented by sponsored research funds – actual contracts – as new projects came on board.

Expertise in high-temperature ceramics led the Engineering Experiment Station to develop a fused-silica technique for forming complex shapes such as missile radomes.

Legislation authorized the new Engineering Experiment Station to conduct specific research in areas that included "transportation, road building, drainage, irrigation, flood protection, aeronautics, aerodynamics, fuels, power, lighting, heating, refrigeration, ventilation, sanitation and architecture."

The research organization went on to do just about all of that – and a great deal more.

The first years at EES were modest. The research effort was housed in the basement of Georgia Tech's Old Shop Building, with much of its equipment rented from the School of Mechanical Engineering. The bulk of its first work focused on textiles and ceramics – including a facility where researchers developed the first rayon made from Georgia pine pulp.

EES contracts in the 1930s included work on the autogyro, a short-winged aircraft that predated the helicopter. It's not known what contributions the EES may actually have made to the true helicopter, which emerged by 1940.

Value of the EES research-project portfolio in 1940: $260,000.

Wartime Transformation

EES's workload jumped sharply just before and during World War II, thanks to new funding from the federal government. The research station's sponsored work expanded to include wind-tunnel testing of airfoil designs and additional helicopter research. The EES also focused on sensitive communications research including a high-selectivity, high-gain audio amplifier; a rugged portable "mini-band" amplifier; and lock-in amplifier circuits used to separate pulse signals from thermal noise.

Perhaps most important – for the organization's future – was an EES study of electromagnetic-wave propagation. That work was followed by a large Navy contract for radar research and development, which set the stage for Georgia Tech's long-time status as a leading U.S. innovator in radar and defense electronics.

Gerald Rosselot, a Georgia Tech physics professor, took over as EES director in 1941. He's often credited with facilitating the research station's entry into electronics during and after the war.

One wartime EES story indicates just how comfortable researchers were becoming with electromagnetic-wave technology. Several sources agree that one electrical-engineering professor had discovered that certain radio frequencies, transmitted inside a box, would heat food.

"The only things the EES would give him to cook were sweet potatoes and peanuts," said George M. Jeffares, who worked at the station part-time as a Georgia Tech senior. Jeffares was recruited along with other EES persotnnel to periodically "taste the sweet potatoes to see if they were done."

Wartime research priorities scotched further investigation of the phenomenon. Possible EES claims to discovery of the microwave oven became the stuff of Georgia Tech lore.

By the 1943-44 fiscal year, more than 30 projects were under way at EES, which now employed 17 full-time and nearly 100 part-time researchers. Just over half of the operating budget came from government and industry contracts, as opposed to state support. By the last year of the war, the government-industry figure had climbed to 61 percent.

Cold War Tensions

World War II's intensity gave way to Cold War tensions, and it soon became clear that federal government support for university-based research would continue. Georgia Tech President Blake Van Leer and Dean of Engineering Cherry Emerson spearheaded a 1946 move to create an independent, nonprofit corporation to handle contract and patent issues for EES.

The name for the new entity was the Georgia Tech Research Institute. Nearly four decades later, the EES would take that name for itself, and the contracting unit would become the Georgia Tech Research Corporation.

Under the new structure, growth continued nicely. By 1947, 56 full-time and 95 part-time EES researchers were performing work worth $441,000 – 87 percent from outside contracts.

On the home front, EES was collaborating with the University of Georgia's College of Agriculture to make Georgia peanut farming more profitable, including production of better harvesting and processing machinery. Experiments with an electric eye, to aid peanut-picking machinery, were a precursor to sophisticated machine-vision work for the poultry industry decades later.

In 1948, the Research Building, built in 1939 as EES's home base, was enlarged and named after a major contributor, Atlanta dentist Thomas Hinman. Soon after, EES's annual research income passed the $1 million mark.

The Korean conflict (1950-53) increased the flow of federal research dollars to universities across the country. EES's share included many sensitive projects in the areas of radar, microwave propagation, communications, missile-tracking frequency control, antenna design, underwater acoustics and microwave optics.

The research station's role in national security research had become permanent.

Millimeter Wave Pioneers

EES's wartime work had brought Georgia Tech growing recognition as a top player in radar research and development. Research-station investigators were soon delving into millimeter waves, an area of the electromagnetic spectrum that seemed to offer great opportunities. Millimeter waves – the band between 30 and 300 gigahertz – can provide effective image identification even through fog, rain and smoke.

Researchers were soon determining which millimeter-wave frequencies worked best for a given task – and in doing so they

pioneered the basic science of the millimeter-wave environment. The research that began at EES has continued at today's GTRI, bringing with it international recognition for millimeter-wave expertise.

EES engineers also developed broad expertise in the hardware – antennas, receivers and transmitters – needed for millimeter-wave applications.

Today, millimeter-wave technology is used for everything from identifying tanks and warplanes to tracking raindrops and wind patterns as part of severe-weather research and climate modeling.

Georgia Tech's important role in helping to create new Georgia companies began during this period as well. It was an auspicious start.

In 1952, several EES personnel – including Director Rosselot, Associate Director James E. Boyd and former EES researcher Glen P. Robinson, Jr. – formed Scientific Atlanta. The venture's basic business model was to commercialize some of the technology developed at Georgia Tech, especially for antennas.

Scientific Atlanta eventually became a large company, renowned for developing satellite Earth stations and cable television equipment. In 2006, it was acquired by Cisco Systems Inc., a major network-technology corporation.

Dawn of the Computer Age

In 1947, EES installed an "electro-mechanical brain" – an analog computer – the first in the Southeast. It was so large that the Research Building needed an annex to house it.

Then, in 1955, Georgia Tech opened the Rich Electronic Computer Center, with a mission of "education, service to industry and research." The Rich Center, too, was the first facility of its kind in the Southeast. Its first resident was a UNIVAC 1101, built by Remington Rand, an analog computer that measured 38 feet by 20 feet and featured rotating-drum memory equal to 48 kilobytes.

"We had to program it by counting drum revolutions and putting ones and zeros on it," recalls Fred Dyer, who joined EES as a Georgia Tech student in 1957 (and stayed on some 40 years). "There wasn't even a compiler. I said that computers would never be practical."

Yet the computer center had opened at a critical time. Analog-computer experience during the 1950s prepared Tech's engineers and scientists for the revolutionary transition from analog to digital computing that took place in the 1960s.

In and out of the computer center, the research station's work during this period was nearly as diverse as GTRI's work is today. In addition to the core defense work, EES engineers of the 1960s tackled an electro-mechanical system for organizing and aligning plastic bottles, spectrographic analysis of diesel truck components, a study of butane lighters, improvements to peanut-brittle manufacturing – even a project involving bra design for the Loveable Brassiere Co.

During the 1960s, Georgia Tech became well-known for its innovative experimental systems in atomic collisions, initiated by Earl W. McDaniel of EES. Among notable EES projects in atomic collisions was development of the first drift-tube mass spectrometer to study certain low-energy chemical reactions. Another highlight was the first experiments in the U.S. to study collisions between beams of electrons and ions.

The station kept up its Georgia connections as well. During the five-year period from 1966 to 1970, EES's industrial extension division performed 16 major feasibility studies of manufacturing opportunities in Georgia, 24 studies of industrial sites and 14 special reports on manufacturing, plant financing and other issues.

And thanks to an EES study begun in 1969 on how to shield heart-regulating pacemakers from microwave interference, the once-familiar "WARNING: Microwave Oven in Use" sign is rarely seen today. Analogous safety work continues today at GTRI's Medical Device Test Center.

Energy – Nuclear and Otherwise

After several relatively short-term directors – including Paul Calaway, James E. Boyd, Robert Stiemke and Wyatt E. Whitley – EES veteran radar researcher Maurice Long became EES director in 1968. He was one of the first directors chosen from within the EES ranks.

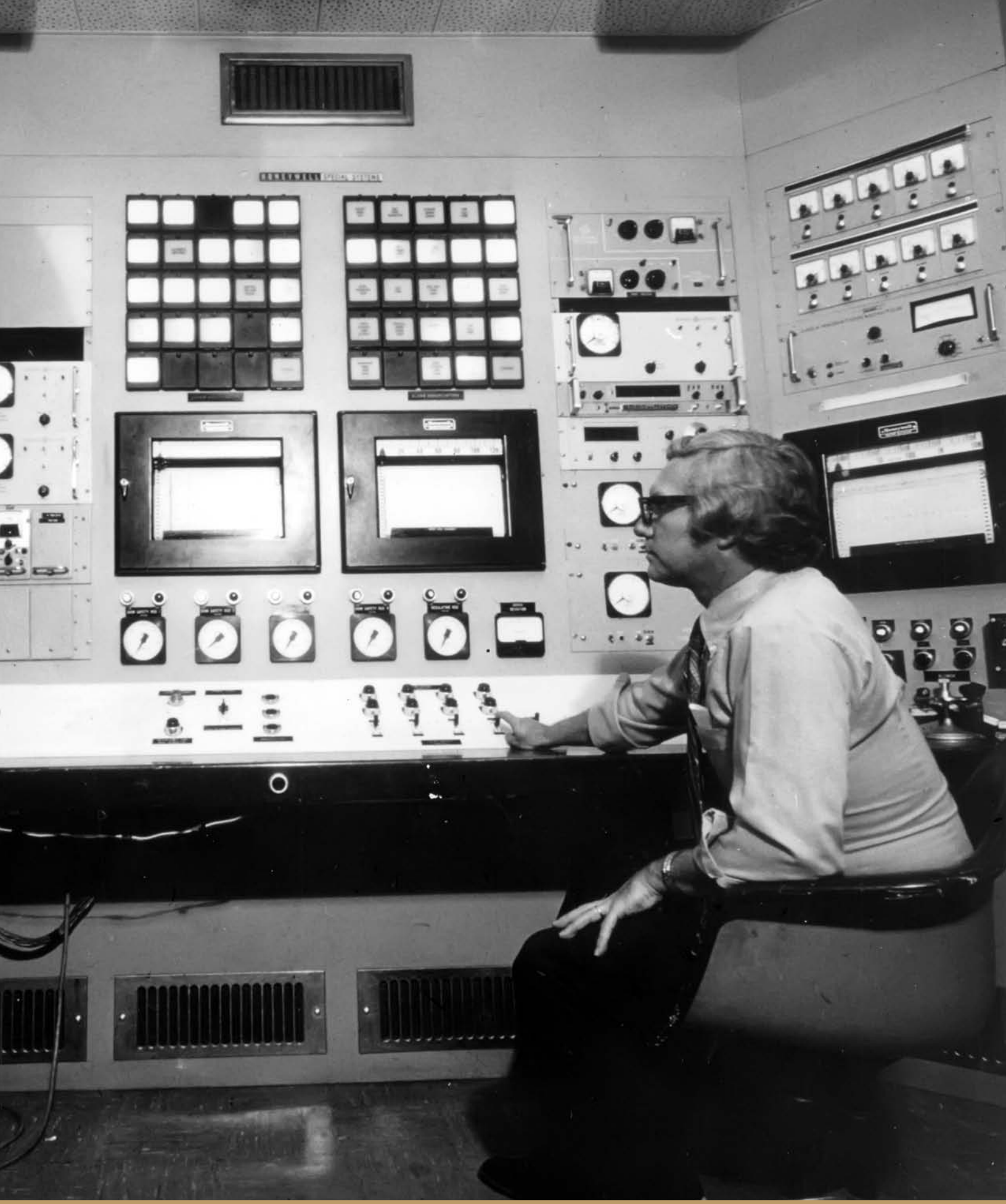
By fiscal year 1970-1971, new contracts and grants at EES totaled a record $5.2 million.

Scientific interest in nuclear technology was peaking in the 1960s. At the EES, a Radioisotopes and Bioengineering Laboratory had opened in 1959; it was utilized for both academic and research activities. Elsewhere on campus, a low-power nuclear reactor was also built. (It has since been dismantled.)

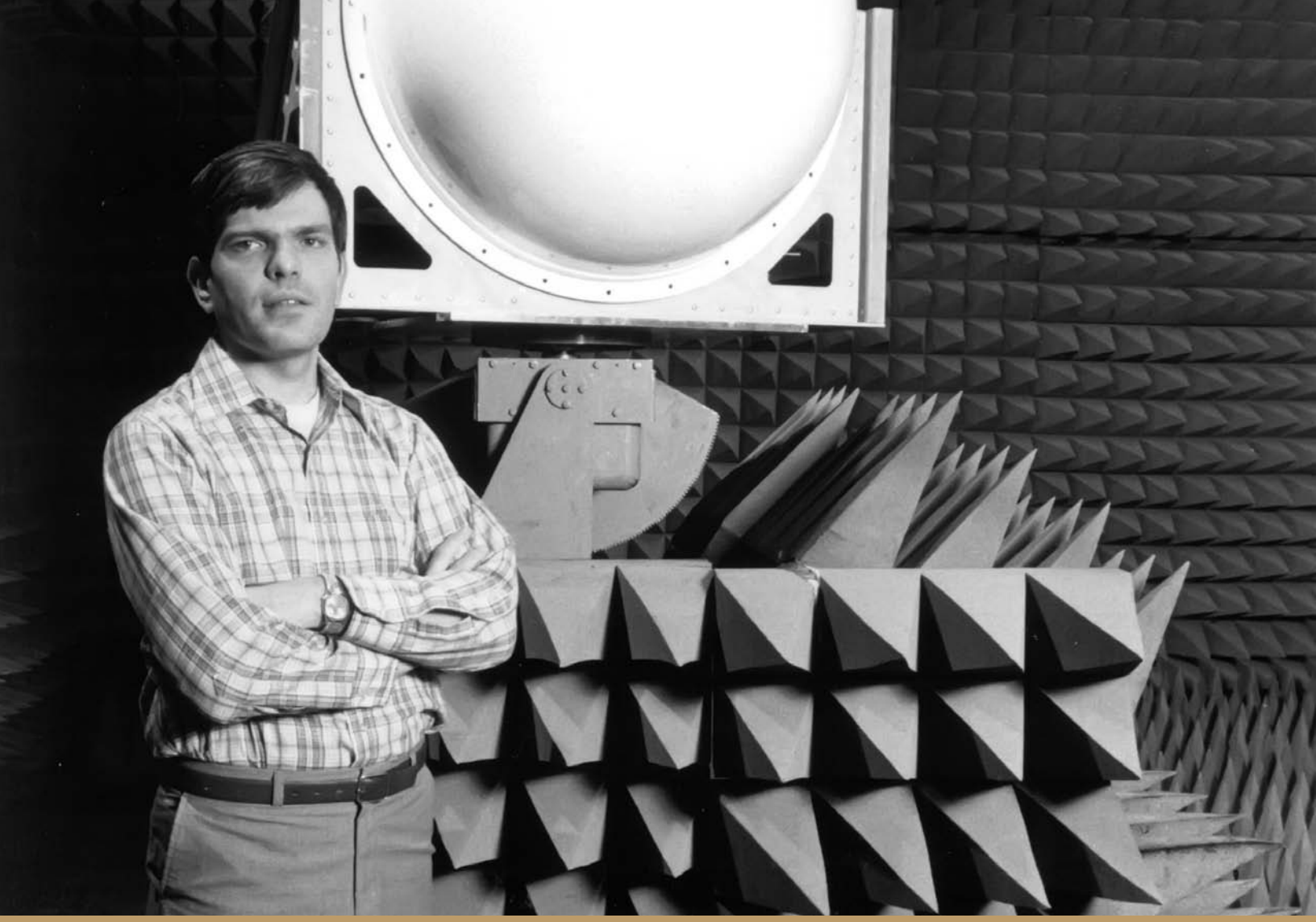
The oil embargo of 1973 made energy a national priority. EES started work on an array of alternative fuel technologies, particularly solar – an important research focus to this day. EES staff conducted a detailed proof-of-concept study of a large solar-energy power-generation plant, while a 325 kilowatt, 500-mirror Solar Thermal Test Facility – second largest of its type in the U.S. – was constructed on campus in 1977 where the Manufacturing Research Center now stands.

One National Science Foundation project examined power-system options for the Southeast. It identified potential opportunities for increasing efficiency and lowering the cost of electrical power and transmission. And EES staff created energy monitoring and conversion proposals for such energy-intensive industries as petroleum refining, meat packing, steel production, papermaking and others.

EES defense activity remained strong during the 1960s. The compact range was invented by Richard C. Johnson in 1966 to measure antenna performance. Today, building-size compact ranges are used to simulate radiation patterns of antennas as



A low-power nuclear reactor at the Neely Nuclear Research Center hosted research on radioactive materials until it was removed to make way for the Nanotechnology Research Center.



GTRI engineer Bill Cooke poses with an S-band telemetry antenna system used to collect data during MX missile testing programs in 1983. The antenna is shown being tested inside a GTRI compact range.

they would occur naturally over much longer distances in real-world applications.

In 1970, researchers discovered that by manipulating the temperature and the rate and duration of heating, they could strengthen certain ceramics via a phenomenon called sintering. These improved ceramics were used to produce radomes – structures that shield a missile's sensors – for such missile systems as the Patriot.

Among his accomplishments, Director Long successfully resisted an attempt by the university's administration to drastically change EES's status by absorbing it into Georgia Tech's academic programs. Long believed that Georgia Tech needed a separate applied research arm; his viewpoint prevailed when Georgia Tech President Arthur G. Hansen resigned in 1971 and was replaced by Joseph M. Pettit, dean of engineering at Stanford and a strong advocate of applied research.

The Grace Years

Director Long stepped down in 1976, and the choice of his replacement came straight from the top. President Pettit had worked at Stanford with a man named Donald J. Grace, whose positions there had included director of the Systems Techniques Laboratory and associate dean of engineering.

Grace's arrival at Georgia Tech was greeted with much anticipation, according to Hugh Denny, a retired principal research engineer and former director of the Electromagnetic and Environmental Division.

"There was a feeling that we were out in the woodpile someplace and nobody paid much attention to us," Denny recalled. "Because he had worked with Joe Pettit earlier out at Stanford, the sense we had with Don was that now we had somebody who at least had the ear of the president."

Under Grace, EES acquired the Cobb County research complex in 1978. The Cobb facility was expanded in the 1980s with a multi million-dollar electromagnetic radiation measurement range.

Another early Grace-era accomplishment was establishment of the Huntsville Research Laboratory. The idea for a permanent Georgia Tech presence in Huntsville was first proposed by William McCorkle, executive director of the U.S. Army's Missile Research, Development, and Engineering Center. McCorkle and his staff worked with EES's Electro-Magnetics Laboratory to make the proposal a reality, and by early 1979, six Georgia Tech research faculty and co-op students had settled into government offices at Redstone Arsenal in Huntsville, Ala.

The move "gave Tech instant accessibility to the government sponsors who were in need of expertise," said Richard Stanley, who began a 14-year career as Huntsville's director in 1984.

Inquiring minds at the EES were always delving into the latest technology. Fred Dyer recently recalled reading about something called Ethernet in 1974 and then teaming with other research-station personnel to run test cable between buildings – long before most people had even heard of the technology. By 1976, serious networking had begun at Georgia Tech on a building-by-building basis, he said, although it wasn't until the 1980s that the campus became fully networked.

New Name, New Home

In October 1984, on the occasion of its 50th anniversary, the Engineering Experiment Station officially became the Georgia Tech Research Institute.

"I had nothing against engineering experiment stations – they're all over the country – but that wasn't what we were," Grace said.

From the GTRI perspective, the 1980s were especially productive. Its core competencies fit in well with the dramatic upswing in military spending under the Reagan administration. The Strategic Defense Initiative missile-defense system, known as "Star Wars," brought Georgia Tech its largest research contract to date – $21.3 million divided between the School of Electrical Engineering and GTRI.

GTRI landed a 1986 solo contract – its largest ever at the time – with a $14.7 million job to design and build technology that would simulate a Soviet surface-to-air missile system. The huge simulator was housed in a 40-foot trailer and three 20-foot transportable shelters.

The same year, a few months past Georgia Tech's 100th birthday, GTRI's new home, the Centennial Research Building, was dedicated at 10th and Dalney streets. The $12.5 million, six-story structure provided desperately needed lab and office space for GTRI's growing research activities.

National Recognition, Active Growth

Between 1980 and 1985, electronics – including defense electronics, electronic systems, electronic techniques and components, antennas, electromagnetics and optics – comprised two-thirds of the organization's research volume. Energy accounted for 15 percent; domestic and international economic development projects 9 percent; computer technology 7 percent, and the balance involved the physical, chemical and material sciences.

Research accomplishments at Georgia Tech and GTRI were becoming noticed at a national level. The volume of Georgia Tech's engineering research placed it third among all U.S. universities, and GTRI contributed substantially to that success.

Growth was extensive throughout GTRI. The Research Institute expanded its defense work, developing new expertise in such areas as computer software technology, electronic warfare technology, multispectral sensors, electro-optic materials and applications, space power and strategic materials.

It also expanded into newer areas, including autonomous aerial vehicles, artificial intelligence and robotics, and lead paint and asbestos abatement, among many others. Sponsored programs ranged from basic neutrino experiments to the development of economically viable solar-heated chicken houses.

"What I remember most is how much it grew and how fast it grew," recalled Janice Rogers, a GTRI veteran who retired in 2006 after a 30-year career that included assisting four directors and rising to senior management. "When I worked for the Systems Engineering Lab, it was not unusual for us to hire two or three researchers a week. I think we probably doubled in size during the 10 or so years I worked in that lab."

GTRI became involved in antenna-design work for the International Space Station. GTRI also tackled other projects for the space station, such as design of an Earth-controllable robot to perform experiments onboard the station.

In 1987, GTRI unveiled its first Light Detection And Ranging (LIDAR) system – a technology that is similar to radar but uses light waves instead of radio waves. To encourage more women to consider a science career, GTRI established a LIDAR observatory at private Agnes Scott College in Atlanta.

Also in the 1980s, GTRI and Georgia Tech founded the Materials Handling Research Center for improving the movement of products through factories and distribution systems. It quickly became a successful National Science Foundation Industry/University Cooperative Research Center, with more than 20 major companies and federal agencies supporting its research.

By the late 1980s, GTRI was becoming noted for its expertise in a highly important area: retrofitting existing military aircraft with new technology. The work, which continues today, keeps existing systems operating and saves the cost of building new ones. Among GTRI's successful early projects was an upgrade of the Air Force's H-53 helicopter.

During the same period, researcher Nile Hartman devel-

This three-screen presentation system was used to make Atlanta's proposal for hosting the 1996 Summer Olympics. Shown is a simulation of the Georgia Tech campus, which housed athletes during the games.

oped an integrated optic interferometric sensor that would quickly detect even small amounts of contaminants in air, soil, groundwater and food.

GTRI was also becoming involved in electronic warfare (EW) research and development, which protects U.S. aircraft from enemy radar and missile systems. EW continues to be a major area of expertise for the Research Institute.

Integrated Defensive Avionics Software (IDAS) is a component of GTRI-developed EW technology that rapidly displays and responds to threats and gives accurate, useful information to the aircrew. IDAS incorporates the Virtual Electronic Combat Training System function, which allows aircrews to train in-flight using simulated threats.

Fusion Failure, Olympic Victory

One of GTRI's most embarrassing moments was, arguably, also one of its finest.

In the spring of 1989, a University of Utah research team announced that it had achieved cold fusion in the laboratory. A GTRI team led by James Mahaffey sought to confirm the astonishing report.

Mahaffey and team soon believed they had succeeded. Reporters flocked to hear the news, and the name of Georgia Tech echoed round the world.

It turned out that the original Utah experiment was fatally skewed due to unsuspected instrumentation errors. The Georgia Tech team, following the Utah team's flawed procedure to try to duplicate the results, had arrived at the same flawed positive conclusion.

"It turned out that what we had was a problem with the neutron detectors," which had not been designed to count very low numbers of neutrons accurately, Mahaffey recalled recently. "And I said, well, we made a big splash with a press conference to announce it, so we've got to de-announce it. At Georgia Tech, data integrity and the integrity of research were so ground into us – if we were wrong, we were going to say that we were wrong and why we were wrong."

GTRI engineer Vic Tripp is shown with a scale model astronaut used to simulate operation of a "towel bar" antenna for use inside the air lock of the International Space Station.

A few days after the first announcement, GTRI called the press back in. Standing side by side with Don Grace in front of dozens of cameras, Mahaffey reported the error.

"It was the right thing to do," Grace later recalled.

Any lingering Georgia Tech chagrin gave away to euphoria when, in September 1990, the International Olympic Committee announced that Atlanta would be the site of the 1996 Summer Olympics.

That win was the work of thousands of people. Yet it was widely acknowledged that a computer-generated virtual tour – developed by a GTRI-led team – of Atlanta's proposed Olympic venues was a key to Georgia's underdog win.

Swords and Plowshares

After a record 16 years as director of GTRI, Grace retired in late 1992 and was replaced by Richard H. Truly, a former NASA administrator, retired vice admiral, Space-Shuttle astronaut and Georgia Tech alumnus. Truly took over at a sensitive time.

"When I arrived in 1992, the Soviet Union had recently collapsed," Truly recalled. "And frankly, there was fear on the campus that GTRI would become a lot smaller because there would be much less defense work."

Changes were soon made. Truly helped GTRI put together a new plan – "a very simple strategic plan," he calls it. Management also adjusted the makeup of the GTRI national advisory committee, a move that Truly remembers as being very helpful.

Among other things, the new plan stressed becoming involved in a number of non-defense areas, as well as a growing emphasis on industry customers in general. It also sought to sharpen the focus of GTRI's defense-related research.

Janice Rogers, assistant to the director at the time, recalled some of the non-defense transitions. These included, for example, utilizing GTRI's extensive radar expertise to improve breast-cancer imaging and other medical applications, and the use of imaging and geographical information systems for such applications as weather mapping, cloud mapping and predictability analysis.

For the Office of Naval Research, GTRI created the ULTRA armored patrol vehicle to evaluate potential technology options for improving survivability in light armored vehicles. The concept vehicle combined advanced armor technologies with modern vehicle design and a diesel engine.

Truly's shakeup included a transition for Rogers. He asked her to fill a new position: director of administration.

"I got to branch out, which I really enjoyed," Rogers remembered recently. "One of the first things I had to do was revamp the GTRI policies and procedures manual. Up until then everything was kind of unspoken – this person does this and that person does that. But under Richard Truly we codified a lot."

It was an important move for an organization dependent on contract research, she added.

Growth wasn't meteoric during the early to mid-1990s, Truly recalled, but the feared contraction never took place. "GTRI did grow, and we got into some new areas. But I think fundamentally it was pretty much the same core organization when I left as when I got there."

Connecting with Industry

GTRI's efforts to decrease reliance on military contracts and diversify its customers began to show results quickly. By 1994, while defense support remained the heart of the budget, it decreased from about 76 percent to just over 70 percent. Other categories increased – industry to 16.6 percent; state and local to 1.5 percent, and federal non-defense, 9.6 percent.

Management renewed emphasis on industry partnerships, including a project between GTRI and Shaw Industries to reduce carpet waste. Additional research initiatives were successfully begun in transportation, education and medical technology, as well as modeling, simulation and testing.

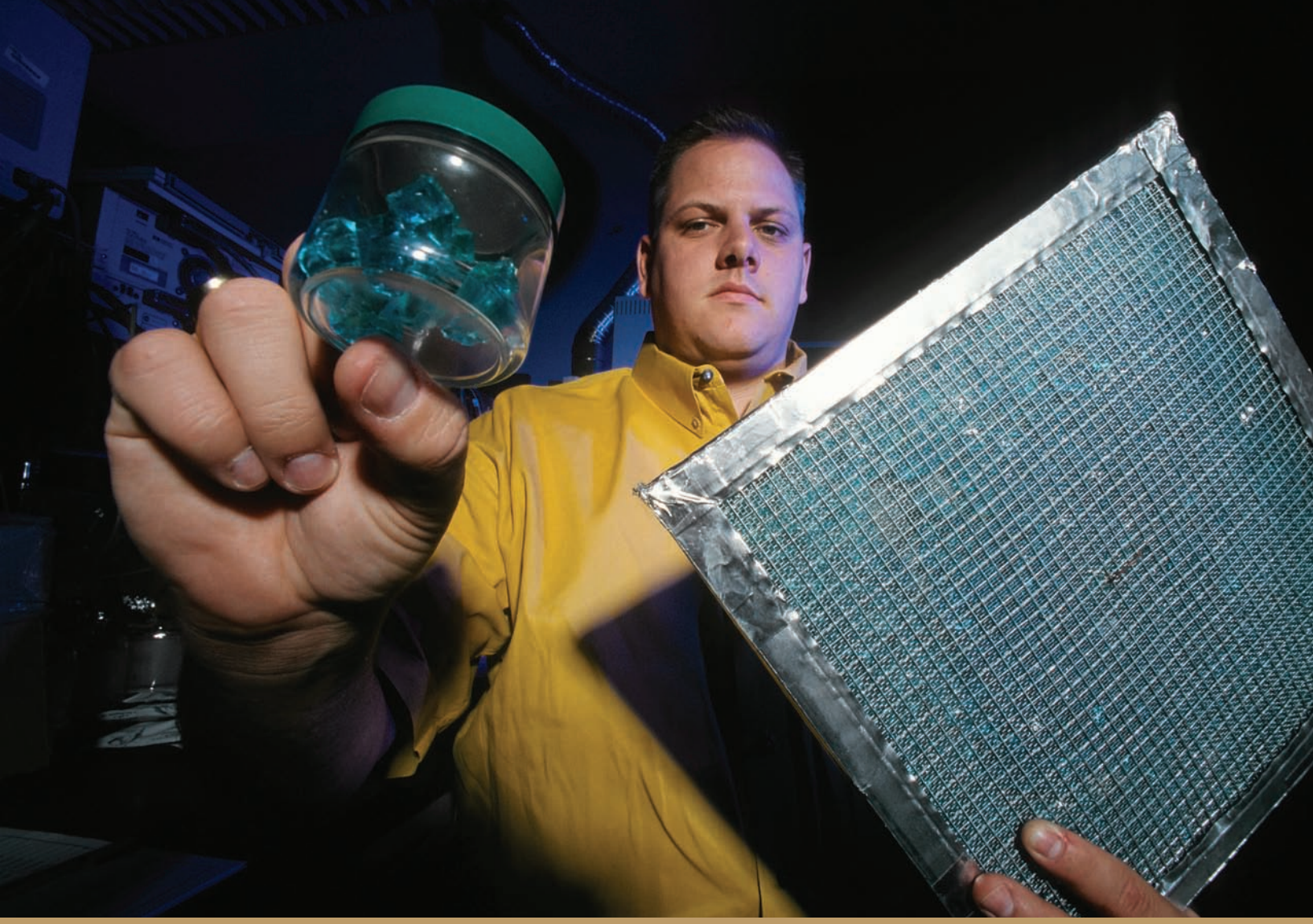
As costs and community opposition shut down urban-road expansion across the country during the '90s, a number of GTRI transportation projects addressed ways to manage traffic flow. Meanwhile, Foundations for the Future, funded by a major AT&T grant, utilized GTRI expertise to integrate technology into Georgia's K-12 classrooms. The University of Georgia and Morris Brown Research Institute also participated in that program.

In 1997, Edward K. Reedy, a Georgia Tech research engineer since 1970, took over as director when Truly resigned to head the National Renewable Energy Laboratory in Golden, Colo. Though Reedy came from the research side, he was no stranger to leadership – he had been director of a large GTRI lab for 10 years.

(continued on page 61)

GTRI showcased its expertise in modernizing existing military hardware by moving the MH-53 Pave Low helicopter from a cargo transport vehicle to one that supported special operations.

Through the Air National Guard Electronic Warfare program, GTRI developed FalconView, a software program that allows military planners to analyze and display geographic data used for mission planning. It is shown here being used on the flight deck of a C-130.



In the 1990s, GTRI researchers – including research scientist Robert Hendry shown here – developed and patented a hydrogel air-cleaning media that removed 50 percent of respirable-sized airborne particles and 80 to 90 percent of gaseous air pollutants.

"I felt we had to get back into a stronger growth mode," Reedy said recently. "It was obvious our DoD funding profile was not going to increase significantly at that time. So, without de-emphasizing our defense-related work, we re-emphasized working for the state of Georgia, as well as with industry."

GTRI re-emphasized a number of state initiatives, including research conducted for Georgia's large and economically important poultry industry.

"I think probably the thing I was most pleased about during my directorship was construction of the Food Processing Technology Building, which gave GTRI's poultry-related research effort a permanent home," Reedy said.

He added that he's also proud of helping create the Glen P. Robinson Jr. endowed research chair in electro-optics at GTRI – the Research Institute's first such research chair. Robinson also endowed a chair in non-linear science at Georgia Tech's School of Physics.

In April 1997, GTRI began a $17 million contract with mPhase Technologies Inc. to develop a system that incorporated Digital Subscriber Line communications with digital signal processing and filtering. The research focused on Internet Protocol Television (IPTV) precursor technologies that enabled telephone companies to deliver TV to subscribers over existing copper lines.

The GTRI of the 1990s continued to be active and creative in its core areas of expertise. One particular success was FalconView™, a software package that lets military planners use laptops to analyze and display geographical data crucial to planning aircraft missions. Developed through GTRI's Air National Guard Electronic Warfare Program, FalconView has been improved many times and now has more than 45,000 users.

In recent years, GTRI and Georgia Tech's Aerospace Systems Design Laboratory produced an unmanned aerial vehicle (UAV) powered by fuel cells running on compressed hydrogen. Fuel cells don't presently produce enough power to propel passenger aircraft, but they can power smaller vehicles such as UAVs.

When the Air Force identified a potential issue in the electronic protection system of the A-10 aircraft, GTRI researchers moved quickly to address the problem. Researcher Melanie Hill was part of the team that worked on the aircraft at Warner Robins Air Logistics Center in Georgia.

GTRI researchers also provided engineering and technical guidance for the Global Justice XML Data Model initiative, which is used by the AMBER Alert system. This voluntary partnership among law enforcement agencies and the news media quickly provides information to the public when a child is declared missing or abducted.

And, as baby boomers reach retirement age, GTRI has been following the marketplace potential for a range of medical and health-related technologies, including assistive technologies.

"GTRI has always been an organization that's flexible and quick on its feet and able to adapt to a changing market," Reedy said. "We took advantage of that to get GTRI back in a strong growth direction."

It worked, assisted by growth in GTRI's core areas as well. Research awards in the millennial year of 2000 topped $100 million.

Today's Explosive Growth

When Stephen E. Cross took over as GTRI director in September 2003, he was also was named a professor in the School of Industrial and Systems Engineering. He soon set a course that emphasized growth in both traditional and new areas, as well as a closer relationship with Georgia Tech's academic side.

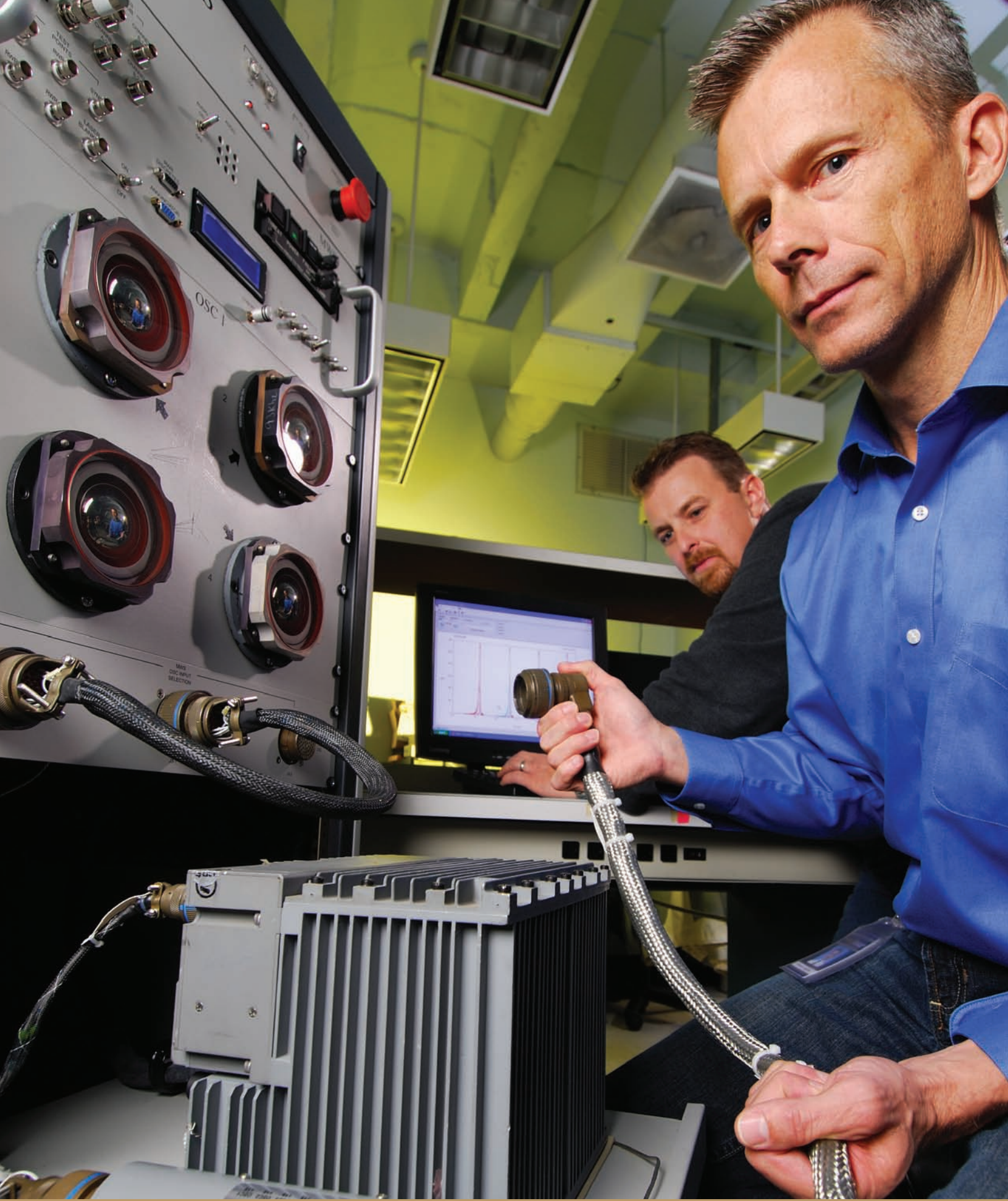
The results of that decision were soon obvious – GTRI's research awards for fiscal 2009 topped $200 million, up 63 percent over a three-year period. GTRI now has nearly 1,500 employees, including some 700 research faculty. It has added 120 research faculty members over the past year, and expects to add at least 100 more in the near term.

Just as important, both GTRI and Georgia Tech management are on the same page about the role of the Research Institute within the university. GTRI is the applied research arm of Georgia Tech. It works closely and collaboratively with the academic colleges, but it is a business embedded in a university.

"I believe new ideas occur at the boundaries of technical and scientific fields," Cross said. "That is one reason why the university's interdisciplinary focus is so right for our future."

GTRI's future promises to be as accomplished as its past. Few at Georgia Tech doubt that GTRI scientists and engineers will be enjoying the opportunity, as well as the challenge, of solving real-world problems for a long time to come.

"I can't imagine having a more ideal place to work," said Fred Dyer, the 40-year GTRI veteran. "I could recommend it to anybody, because of the great people and the great opportunity to do a variety of things that serve a very useful purpose."



In just two months in 2006, GTRI researchers developed a working prototype device that provided a critical upgrade to a military aircraft missile warning system. Similar projects would normally require a year to complete. Shown are researchers Alan Freeland (left) and Jeff Hallman.

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Project Director: Kirk Englehardt, GTRI Communications Office

Managing Editor: John Toon, Georgia Tech Research News & Publications Office

Design: Inward Solutions

Principal Photographer: Gary Meek, Gary W. Meek Photography

Writers: Kirk Englehardt, Gary Goettling, Rick Robinson, John Toon, Abby Vogel

Copy Editor: Lincoln Bates

Proofreading: Steve Cross, Kirk Englehardt, Martha Farley, Tom Horton, Ann Jaudon, Kathryn Knox, Marie Little Tom McDermott, Amber Rice, Rick Robinson, Lisa Sills, John Toon, Abby Vogel

Other Content: Rebecca Caravati, Dennis Crain, Todd Phillips

Other Photography: Caroline Joe (Page 6), iStockphoto.com (Page 12), U.S. Army (Page 16), GTRI Red Balloon Team (Page 20), Erik Lesser (Page 23), Brian Childress (Page 25), iStockphoto.com (Page 26), Georgia Department of Economic Development (Page 27), iStockphoto.com (Page 29, top), Rick Robinson (Page 29, bottom), Aberdeen Test Center (Page 32), Rob Felt (Page 34), Tristan Hall, National Park Service (Page 35), Softeq (Page 39), Rick Robinson (Page 41), Georgia General Assembly (Page 44. top), Renita Folds (Pages 45, 46 and 47), GTRI archives (Pages 48, 50, 53, 54, 56, 57 and 61), Office of Naval Research (Page 58), U.S. Department of Defense (Page 59), Stanley Leary (Page 60), GTRI (Page 62), Stanley Leary (Page 65).

Printing: Tucker-Castleberry Printing

Sponsor Review: Leslee Littleton

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