annual report 02

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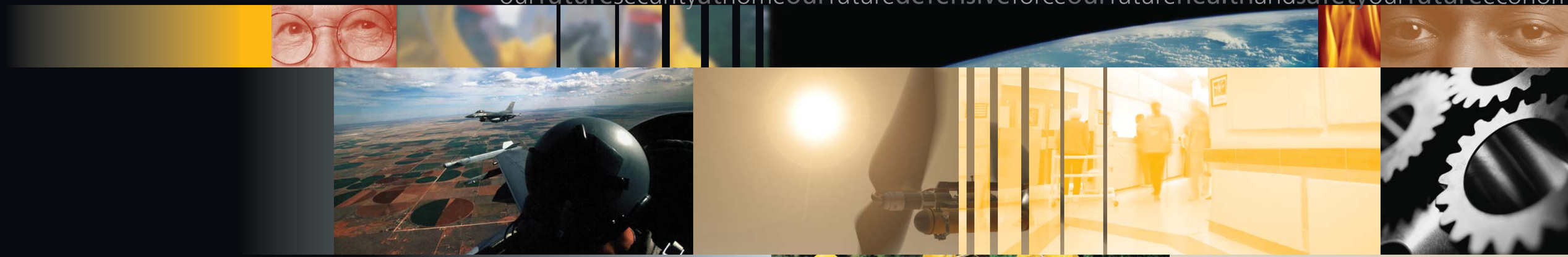

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GTRI

SECURING AMERICA'S FUTURE

Georgia Tech Research Institute

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our mission and values

AMERICA'S FUTURE

GTRI will plan and conduct focused programs of innovative research and development, education, and economic development that advance the global competitiveness and security of Georgia, the region, and the nation.

GTRI's business philosophy includes the following core values:

- Personal and organizational integrity underlie all that we do.
- A commitment to quality, value, and customer satisfaction defines our future.
- Competence and creativity are the foundations of our success.
- An open, supportive environment fosters efficiency and teamwork.
- Continuous development of our people enhances individual achievement.

SECURING AMERICA'S FUTURE

Recent world events have led many people to re-examine their assumptions about what the future holds.

Will the future be safe?

Will it be remotely similar to the past?

How do we prepare for the future in a world that has changed?

G T R I

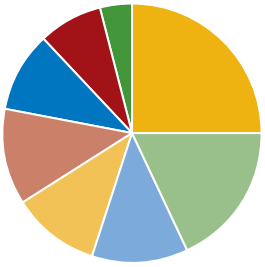
Georgia Tech Research Institute

Creating Solutions Through Innovation

SECURING AMERICA'S FUTURE

Here at GTRI, we asked ourselves the same questions—and in some cases, we looked to our research for answers.

The uncertainty surrounding world events has reinforced the importance of one of our primary missions: to support the security of the United States and its citizens.



GTRI FY 2002 Major Customers

(% of research expenditures)

U.S. Air Force	24.8
U.S. Army	18.3
State of Georgia	12.4
Other Department of Defense	12.0
Industry - Federal Subcontracts	11.1
U.S. Navy	9.7
Industry - Commercial	7.7
Federal Non-DoD	4.0

This annual report highlights ways in which GTRI is helping to secure the future—a safe future that will never be exactly like the past. In this report, we highlight the technological leadership that GTRI is providing for a changing world. We explain how we are enhancing homeland security, outfitting the warrior of the future, improving life, health and safety, and helping to strengthen the U.S. economy.

Fiscal Performance

FY 02 was an outstanding year for GTRI. Contract research awards totaled $115 million, the most in our history—and a 14.1 percent increase over last year's $100.8 million in awards. We continued reducing our rates through proactive cost analysis and by growing our research base.

Organizational Changes

During FY 02, GTRI established the Research Operations Office in Orlando, Florida, led by Ron Wagner, and an office in Albuquerque, New Mexico, led by Sam Blankenship. After the retirement of Evan Chastain, associate director for institute services, his duties were assumed by Janice Rogers, director of administration, and George Harrison, director of research operations. Robert Lang was named director of compliance assurance. Following a national search, Gary Gimmestad was selected to hold the Glen P. Robinson Endowed Chair in Electro-Optics, GTRI's first endowed chair.

Research Achievements

Among the GTRI research projects that will help ensure a safe and secure future are:

Center for Emergency Response Technology, Instruction, and Policy (CERTIP)—Three years of research by GTRI-based CERTIP brought President George W. Bush to campus in March 2002, accompanied by U.S. Homeland Security Director Tom Ridge, to view police, firefighters, and rescue teams using campus-developed technology to respond to a mock terror attack (pp. 4,7).

Meta-materials—With campus and national colleagues, GTRI researchers are developing and validating physics models of materials containing nanoparticulates and nanoassemblies—structures whose size scales overlap quantum and classical physics. The models will be used to investigate the manufacture of meta-materials for national defense and other applications (p. 8).

Internet voting—GTRI researchers are addressing social and technical issues related to voting on the Internet; they've catalogued scenarios and data models for Internet voting and identified key data elements for voter registration and vote collection (p. 14).

Commercialization of technology—GTRI researchers have signed a commercial licensing agreement and filed a patent on localized noise masking. In effect, this approach masks sound in a local area, such as an office cubicle; other possible applications abound (p. 18).

Individual Achievements

Many GTRI employees whose technological leadership is making the world a more secure place have been recognized by outside organizations for their research performance:

Robert Michelson received the prestigious international Pirelli Award and a cash prize for the diffusion of scientific culture through the best multimedia project arising from any educational institution in the world—given for his work on the biologically inspired Entomopter aerial robot (p. 15).

Krishan Ahuja was recognized in the *Aviation Week and Space Technology* "Laurels" magazine issue for leadership in aerospace engineering. He also was elected a Fellow of the American Institute of Aeronautics and Astronautics.

Ronald Bohlander was selected as a Fellow of the Society of Manufacturing Engineers.

Dale Blair was named an Institute of Electrical and Electronics Engineers Fellow.

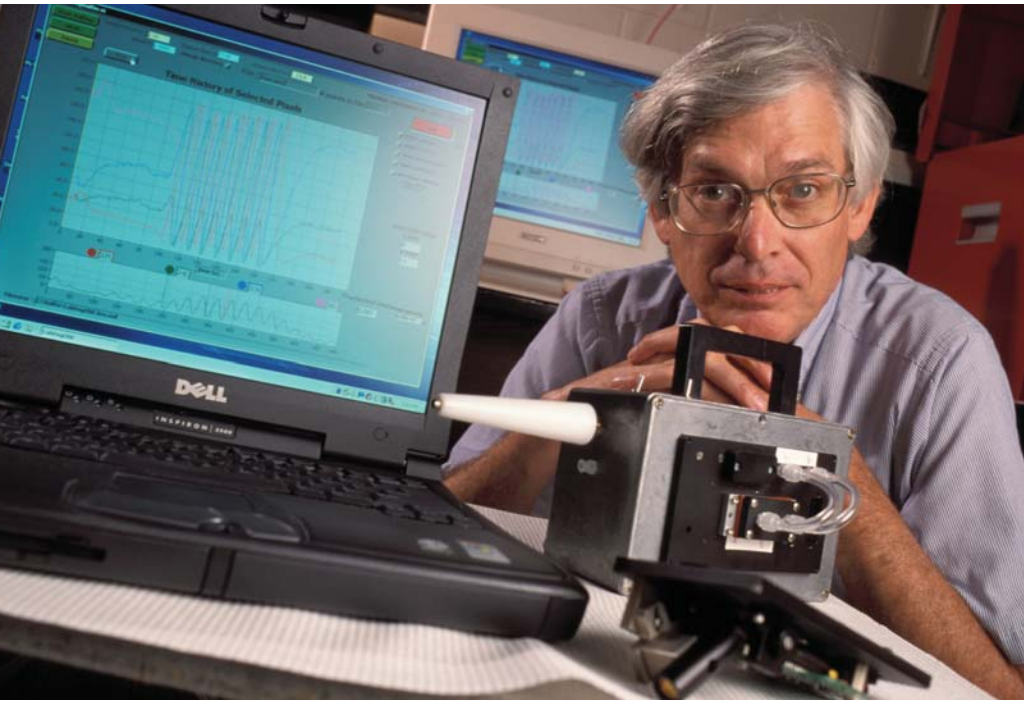
FY 03 will bring new and continuing developments and challenges. In early 2003, we broke ground for the new FoodPAC building, which will house agricultural technology and food safety research. Georgia Tech also will complete the search for a new director of GTRI.

After 33 years as a faculty member at Georgia Tech—the last six of which I have served as vice president of Tech and director of GTRI—I am planning to retire.

I am extremely proud of what the employees of GTRI have accomplished together not only during FY 02, but also during my six years at the helm of this great organization. Together, we have explored new and diverse research areas, played a key role in advancing Georgia Tech's reputation and prestige, and helped GTRI achieve its best financial status since the mid-1980s.

I am certain that I am leaving with the future of GTRI in a secure place—the responsible, bright, and conscientious hands of my colleagues.

Dr. Edward K. Reedy
Vice President, Georgia Institute of Technology
Director, Georgia Tech Research Institute



(Left) A biosensor under development at the Georgia Tech Research Institute will be able to rapidly detect chemical and biological contaminants, such as anthrax. Senior Research Scientist Dan Campbell shows components of the prototype system.

(Above) GTRI is collaborating with University of Georgia researchers in a national resource center for agricultural counter-terrorism research and education. Target threat areas include animal and food production.

Emergency Response Center Contributes to Homeland Security

With growing national and state interest in homeland defense, researchers at the Center for Emergency Response Technology, Instruction, and Policy (CERTIP) at GTRI are assisting local and regional agencies in preparing for terrorism threats. The Center is a public-private partnership that fosters basic and applied research to enhance emergency response and consequence management for both natural and human-caused disasters.

Researchers have been working closely with representatives of Georgia's Homeland Security Task Force, primarily the Georgia Emergency Management Agency and the Department of Public Safety, to develop affordable technologies and training for first responders. Technologies include a biosensor for detecting biological contaminants, such as anthrax, and the Medical Reachback System for Internet transmission of vital patient information from the field to a command post.

Additionally, CERTIP is collaborating with University of Georgia researchers in a national resource center for agricultural counter-terrorism research and education. The Center for Security of Agriculture and Environment provides scientific expertise to address the intentional use of pathogens and chemicals to create terror. Target threat areas include animal and food production, distribution centers, fields, water supplies, and the atmosphere.

In addition, CERTIP researchers are assisting the City of Atlanta Security Task Force with technologies to improve personnel and passenger safety at Atlanta's Hartsfield International Airport. Projects include development of a knowledge management system and a comprehensive physical and environmental security system.

Hazmat Training Gets a Boost

Growing concern about the national threat posed by terrorism has prompted increased activity and visibility for GTRI. In March 2002, President George W. Bush visited Georgia Tech to observe an emergency response exercise highlighting the hazardous materials training and technology being developed at GTRI for use by first responders. Exercises such as this, carried out by local emergency personnel and researchers at the Center for Emergency Response Technology, Instruction, and Policy, are designed to enhance response capabilities.

Also in 2002, the Georgia Emergency Management Agency designated the GTRI training program as the Hazardous Materials Training Center of Excellence. The award means that GTRI now will conduct hazardous materials training for the state's fire departments, thus ensuring more effective and coordinated responses.

Finally, a collaborative effort by GTRI, the Georgia Army National Guard, the Georgia Bureau of Investigation, and the Agency for Toxic Substances and Disease Registry is currently under way to develop the Georgia Emergency Response Training and Operations Center. This hazardous materials training and technology test bed north of Atlanta in Cobb County will consolidate the assets of federal, state, and local agencies in one complex.

GTRI researchers conduct hazardous materials training for Georgia fire departments, thus ensuring more effective and coordinated responses. In 2002, the Georgia Emergency Management Agency designated the training program as the Hazardous Materials Training Center of Excellence.

Researchers are leading a technology consortium that supports the activities of the National Guard Bureau's Counterdrug Office. Among GTRI's contributions are a digital mapping portal and a decision support system that captures, records, and generates timely information for law enforcement agencies.

GTRI Leads National Guard Technology Consortium

GTRI recently assumed a new role as leader of a technology consortium for the National Guard Bureau Counterdrug Office. The consortium was formed to support the agency's counter-drug efforts across the country. It involves 21 other organizations and is providing unbiased technical expertise and technology to the National Guard, and law enforcement and civil support agencies.

The consortium operates under a five-year, $46 million contract with Georgia Tech. Researchers have received funding from the National Guard, U.S. Southern Command, the Central Measurements and Signatures Intelligence Office, the U.S. Army Corps of Engineers, and the U.S. Air Force.

This major effort builds on the successes of the GTRI-developed Counterdrug Geographical Regional Assessment Sensor System. The program includes a digital mapping portal and a decision support system that captures, records, and generates timely information for law enforcement agencies.

Key technologies in the system include geographical information systems, electro-optical sensors, remote sensing, radios and streaming video communications, virtual reality, and the information technology architecture to integrate and interface these technologies with the National Guard and its customers.

(Above) Emergency response workers simulated a chlorine gas emergency during a demonstration held for President George W. Bush and Secretary of Homeland Defense Tom Ridge on the Georgia Tech campus in March 2002. Also, President Bush saw demonstrations of three GTRI technologies designed to help emergency workers.

First Responder Technologies Demonstrated for President Bush

New technologies and training that may help emergency workers improve their response to disasters prompted a visit from President George W. Bush to the Georgia Institute of Technology in March 2002. Researchers at the Center for Emergency Response Technology, Instruction, and Policy (CERTIP) demonstrated technologies they are developing to enhance response capabilities. During the President's visit, Atlanta area emergency workers and CERTIP employees staged a mock chlorine gas release. President Bush and Homeland Security Director Tom Ridge watched, along with Georgia Tech President Wayne Clough (center in photo above), Tom Bevan, director of CERTIP and Georgia Tech's Homeland Defense Initiative (second from right in photo above) and GTRI senior research scientist Kevin Kamperman (left in photo above).

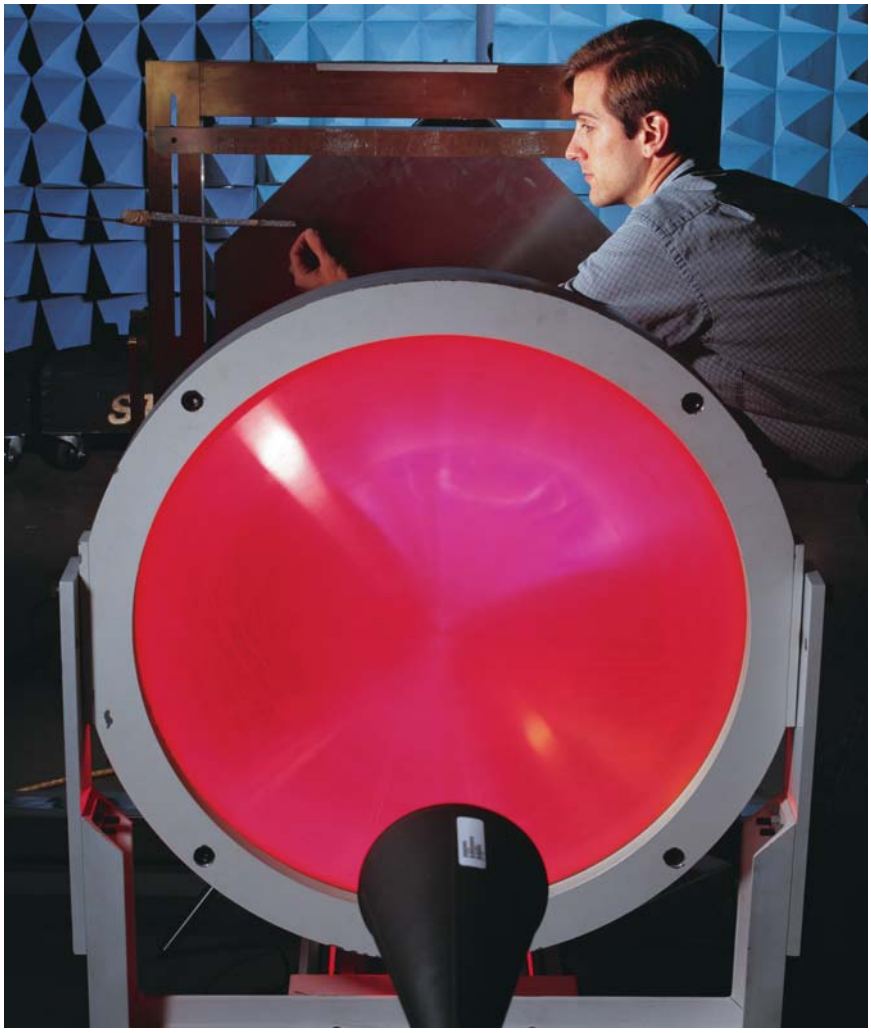
(Above) President Bush thanked researchers at the GTRI Center for Emergency Response Technology, Instruction, and Policy (CERTIP) for organizing a disaster drill he watched during his visit to campus. Bush also praised first responders for their dedication.

Modeling Next-Generation Satellite Technology

Satellites of the future are getting smaller. Scientists at GTRI have helped the U.S. Air Force Research Laboratory (AFRL) determine that deployment of clusters of microsatellites, orbiting in formation and electronically networked to act as a single large radar-antenna aperture, is a concept with merit.

Engineers have completed three years of modeling, simulation, and signal processing studies for the ground-based, moving target indication mission of the TechSat 21 program. Now, GTRI researchers are helping the AFRL plan experiments for a trio of microsatellites they plan to launch in 2006. The benefits of microsatellites over conventional hardware include inherent redundancy, multi-mission capability, and significantly lower cost because of mass production.

This artist's rendering represents the U.S. Air Force Research Laboratory's proposed TechSat 21 microsatellite configuration. A virtual antenna array, composed of multiple satellites sharing information, could aid military maneuvers worldwide. Engineers at GTRI have studied the concept—along with other research teams elsewhere—and have concluded that it has merit.



Probing Microwave Scatter

Controlling microwave scatter is an essential function of modern defense platforms. Yet, the physical variables affecting scatter are often poorly characterized, especially when designs include realistic manufacturing and materials.

With support from the U.S. Office of Naval Research, GTRI scientists have developed new, cost-effective measurement techniques for studying microwave scatter from inhomogeneous structures and materials. Combining a focused microwave beam with near-field holography to probe both radiating and non-radiating fields, the researchers are gaining further insight into electromagnetic scattering and developing a tool for microwave signature diagnosis.

A focused microwave beam and near-field holography are key to developing cost-effective, near-field measurement techniques for inhomogenous structures and materials. Research Engineer Ed Hopkins aligns the microwave probe to the sample.

Decision Support Systems for the U.S. Navy

Each year, the U.S. Navy and Marines deploy RQ-2 Pioneer Unmanned Aerial Vehicle (UAV) systems to remote locations. These detachments may deploy for weeks or months at a time, and they require large volumes of information, including operation and maintenance technical manuals.

Working with the UAV Fleet Support Team at Patuxent River, Maryland, GTRI engineers have developed a Web-based information management and UAV Maintainer's Performance Support System (UMEPSS) that will be integrated and tested at the RQ-2 training command at the outlying field in Choctaw, Florida.

Once the system is tested, evaluated, and fully fielded, maintenance and operation personnel will be able to log on through a Web portal and access nearly all the necessary information to operate and sustain the UAV systems. Users will receive automatic downloads of the most current RQ-2 technical manuals and will have laptop computer (or portable electronic display device) access to refresher training, shift pass-down information, and enhanced testing and troubleshooting techniques.

The integrated Web/UMEPSS system will result in improved UAV system readiness and allow fleet users to make better, quicker decisions about how to proceed, even when they are in the middle of nowhere.

Testing and Evaluating Military Training

Modern military training exercises are designed to simulate real-life battle situations. However, further testing is necessary to determine how realistic and/or effective these training exercises are.

In settings varying from swampy coasts to desert encampments, U.S. military commanders rely on an innovative, GTRI-designed and distributed system, Realistic Operational Communications Scenarios (ROCS), to test and evaluate advanced tactical systems, operations, and equipment, such as amphibious assault vehicles. Designed with an open, modular architecture, ROCS is scaleable and extendable. It can grow and change with different military units' testing, evaluation, and training needs.

U.S. military commanders rely on an innovative GTRI-designed distributed system, Realistic Operational Communications Scenarios, to test and evaluate advanced tactical systems, operations, and equipment such as amphibious assault vehicles.

Powering the Soldier of the Future

Sensors, electronic weapons, and communications gear will provide an increasingly important advantage for tomorrow's soldiers, but this equipment requires a reliable power supply to operate in the field. To reduce the need for heavy battery packs and chargers, GTRI researchers are part of a team developing a low-temperature, solid oxide fuel cell that could help power the soldier of the future.

GTRI is also addressing the system engineering issues surrounding compact fuel cells for soldiers, and larger transportation and distributed electricity generation systems. Researchers are examining unique combinations of fuel cells, batteries, and capacitors for special sensing applications and studying tiny hybrid systems, and developing solutions that will make fuel cells more efficient and practical. The work is done through the Center for Innovative Fuel Cell and Battery Technologies, in collaboration with researchers from Georgia Tech's College of Engineering.

Hybrid electrical power sources composed of fuel cells, batteries, and capacitors could help meet unique military needs for sustained power, long-term power storage, and bursts of peak power. David Parekh, director of the Center for Innovative Fuel Cell and Battery Technologies, shows a GTRI-developed hybrid system.

GTRI researchers are studying whether developing tornadoes emit very low-frequency sounds that could give forecasters an early detection method. Shown installing test equipment is Paul Hultz, a graduate student.

Early Warning Technologies Could Provide Forecasters with New Prediction Methods for Severe Weather

Exploring the potential of cloud-to-cloud lightning strikes as an early warning sign of tornadoes, the Severe Storms Research Center (SSRC) at GTRI has developed a passive lightning path tracker. The system uses Federal Aviation Administration radar as a signal source. Reflected energy from the lightning path is shown on the tracker's two-dimensional display at GTRI's Cobb County Research Facility. The system provides the range and azimuth of the lightning path. To date, researchers have observed several lightning paths extending more than 10 miles.

GTRI researchers also hope to discover whether developing tornadoes emit low-frequency sounds that could give forecasters another early detection method. The SSRC recently purchased a series of very low-frequency microphones, which researchers plan to install in locations around the Southeast.

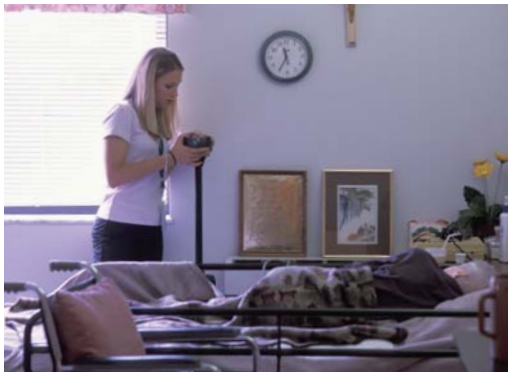
Meanwhile, the SSRC and the Florida State University Department of Meteorology are negotiating a collaboration for testing the University's mobile radar unit during tornado season this spring. Work is continuing on enhancements to the National Severe Storm Laboratory's Warning Decision Support System to customize it for Georgia's severe weather conditions.

Researchers Hope to Reduce Noise, Improve Sleep in Nursing Homes

Noise, even in modest amounts, disturbs the sleep of nursing home residents, according to GTRI and Emory University researchers. Now, the research team of acoustical engineers and health scientists is studying ways to improve sleeping conditions for nursing home patients—and ultimately their health and quality of life—with a few interventions in their surroundings.

Researchers have determined that nursing home noises usually fall into one of three broad categories: talking, mechanical noises, and other activities.

With these findings in mind, GTRI engineers created several low-cost, noise-reducing interventions, which they have tested with noise measurement equipment in eight metro Atlanta nursing homes. The results are promising. One of the interventions—sound-absorbing fiberglass panels that hang on hallway walls—has reduced noise by a factor of 16, which is equivalent to the difference between music booming from 16 speakers versus just one speaker.



(Above, left) Researchers Krishan Ahuja and Bettye Rose Connell discuss noise-reduction research. (Above, right) Rebecca Douglas, a Georgia Tech student, measures sound levels in a nursing home resident's room.

Researchers have also tested an intervention to reduce television noise by moving the speakers from the television set to the headboards of nursing home beds. They are also experimenting with tiny speakers embedded in pillows.

MedEPSS to Provide Better Information for Hospitals and Healthcare Personnel

A pilot project being developed through the Logistics and Maintenance Applied Research Center at GTRI may one day provide significant assistance to healthcare workers. The Medical Electronic Performance Support System (MedEPSS) consists of Web-based software that acts as a job aid and reference tool for nurses, admissions personnel, and other hospital workers.

Based on the award winning maintainer's electronic performance support system design, developed at GTRI for maintenance personnel in the military, MedEPSS offers similar benefits, such as access to patient history, prescription information, automated symptom identification and information, and Web-based resources. With such critical information at their fingertips, healthcare workers can make informed decisions easily.

MedEPSS puts refresher training, patient history, and prescription lists at the fingertips of medical staffers.

The system also can be used to speed admissions procedures and reduce billing and paperwork errors, a common problem in many hospitals. Likewise, MedEPSS can provide immediate and enhanced refresher training for these workers.

Developed in partnership with Grady Memorial Hospital in Atlanta, the system will one day provide the healthcare industry with a new generation of performance support systems that are user-friendly, integrated, and secure.

Researchers Explore the Social and Technical Issues of Internet Voting

Future elections may be more convenient, more accurate, and faster for both voters and elections officials if researchers can improve the technology for voting via the Internet. Equally important are the social challenges of making the technology available to potential voters and then encouraging them to use it.

With interest in voting reform and modernization increasing since the 2000 presidential election, GTRI researchers have been studying some of the social and technical issues surrounding the future implementation of Internet voting. These issues include voter privacy, data modeling for voter registration, standards for voting systems, access to the Internet, and the potential of the Internet to improve low voter turnout.

Among its accomplishments to date, the Internet voting research team has: developed a catalog of scenarios and data models for Internet voting; identified the key data elements for voter registration and vote collection; published GTRI Voter Privacy Principles; explored the impact of variations in the access to and experience with Internet technology; mapped the initial legal framework required for Internet voting; directed a student design team in a ballot design software project; and participated in the Institute of Electrical and Electronics Engineers' Voting Equipment Standards Project.

GTRI Helps with Occupational Health and Safety Issues

For more than two decades, GTRI has helped small businesses in Georgia comply with Occupational Safety and Health Administration (OSHA) regulations by providing free health and safety consultation services. In 2002, Georgia Tech paid more than 450 visits to small businesses and conducted 15 free seminars across the state.

As an OSHA Training Institute Education Center, GTRI provides safety and health courses under a non-financial cooperative agreement with OSHA, a branch of the U.S. Department of Labor. Last year, this program reached about 1,400 students from the public and private sectors.

GTRI also administers the Safety, Health Achievement, and Recognition Program for OSHA. The program certifies small businesses with exemplary health and safety records. In 2002, two companies in Georgia participated in the program.

In addition, GTRI health and safety professionals participated in clean-up efforts at Ground Zero in New York City in spring 2002. The group provided support to OSHA by assisting companies in the massive removal and recovery process that occurred after the Sept. 11 terrorist attacks on the World Trade Center.

In a project done for NASA's Institute for Advanced Concepts and the Ohio Aerospace Institute, GTRI researchers evaluated the potential for using a flapping-wing air vehicle known as the Entomopter for exploring Mars. The artist's rendering depicts how the device might look flying on Mars, and refueling and taking off from a rover crawling across the surface.

Flying on Mars

Robotic landers, rovers, and orbiting spacecraft have provided intriguing details about certain portions of Mars. Scientists hope to explore more of the Red Planet using low-altitude flying vehicles, but Mars' thin atmosphere severely limits the capabilities of conventional aircraft and helicopters.

GTRI researchers are evaluating the potential of a revolutionary flapping-wing air vehicle, known as the Entomopter, whose ability to take off, hover, and land in the thin air could make it ideal for the unique mission. Refueled by a rover crawling across the surface, a pair of Entomopters could cross canyons, boulders, and other features that would halt surface-based vehicles. Equipped with video cameras and sensors, the Entomopters could range across the surface, relaying information back to the rover—and even landing to obtain samples.

GTRI's evaluation of the Entomopter concept has been supported by the National Aeronautics and Space Administration's Institute for Advanced Concepts.

Wireless Technology Optimizes Food Production Processes

A wireless, mobile information network, soon to be rolled out at Rich-SeaPak in Brunswick, Georgia, will help the food products company produce the perfect appetizer.

GTRI scientists in the Food Processing Technology Division developed key elements of the system, which uses hand-held personal computers and stationary, touch-screen computing stations along the food-processing line where workers make breaded cheese sticks.

Replacing clipboards and handwritten notations, the wireless technology allows quality assurance and operations personnel to monitor more variables with greater frequency. This information, in turn, allows quality and production personnel to adjust processes so the production line runs as efficiently as possible. With more detailed identification and control of production variables, Rich-SeaPak expects to maintain a more uniform product, increase yield, and minimize costs.

Ultimately, with improvements in sensor technology, GTRI researchers envision a fully automated, information-driven production line that not only analyzes the product as it moves through the process, but also self-corrects to maintain optimal efficiency.

Hand-held computers are helping Rich-SeaPak workers maintain a more uniform product, increase yield, and minimize costs.

Researchers have developed a water disinfection system that is expected to improve food processing industry performance, and at a lower cost than the current disinfection method. Researchers John Pierson of GTRI (left) and Larry Forney of Georgia Tech's School of Chemical Engineering test water samples.

Research Helps Food Processing Industry Conserve Water

It's not often a new approach comes along that does a better job at a lower cost, but that is the case with a water disinfection system developed for the food processing industry by researchers in the Georgia Tech School of Chemical Engineering and GTRI.

Federal regulations prohibit reuse of water that has touched food during processing unless the water is disinfected to certain standards. Exposure to ultraviolet (UV) light kills most microorganisms in water, but the penetrating power of UV lights decreases quickly with depth and is easily blocked. Existing means of disinfection leave much liquid untreated, especially gray or reused water.

Georgia Tech engineers have designed a lab-scale device that rotates a layer of water so that all the liquid is equally disinfected when exposed to UV light. The process also consumes less energy than conventional methods because of the improved flow.

Under a FoodPAC-funded initiative, the research team is exploring the technology's use for recycling water from fruit and vegetable washing. The water disinfection system could be applied in other industrial processes to reduce the consumption of potable water.

GTRI Commercialization Expertise Boosts High-Tech Company

To boost economic development in Georgia, GTRI is lending its commercialization expertise to high-tech start-up companies.

EG Technology (EGT), for instance, is improving the transmission of digital video. Until now, increasing bandwidth capacity on telecommunications networks has required expensive, time-consuming infrastructure upgrades, such as new fiber or more equipment in the field. EGT proprietary software uses digital compression and perceptual coding to reduce the size of video files without affecting quality. This allows network operators to use bandwidth more efficiently within existing infrastructure—in essence, "pumping up" thin pipes to yield additional capacity and lower costs. With EGT's software, cable television operators can broadcast more channels into homes over the same network infrastructure. It also allows them to introduce new high-bandwidth services, such as video-on-demand and network personal video recording.

In January 2002, EGT received $5.5 million in venture capital, first-round funding that has been used to fine-tune its software and expand its staff from 12 full-time employees to more than 20. Now, EGT is beta-testing its product with major equipment manufacturers and network operators. The product is expected to hit the commercial market in the second quarter of 2003.

During its initial development phase, GTRI assisted EGT with specification reviews and understanding the competitive landscape. As EGT begins to manufacture its product, GTRI will continue to play a strategic and tactical role to include reviewing physical design, safety and regulatory requirements, and testing for quality and compatibility.

GTRI researchers lent their commercialization expertise to start-up company EG Technology, which has developed software to use telecommunications bandwidth more efficiently within existing infrastructure, decreasing the need for installing more fiber or equipment in the field.

GTRI Helps Faculty Move Innovations Out of the Lab and Into Commercial Markets

GTRI researchers have devised a modular system of curtains that not only provides visual privacy, but also blocks out unwanted noise. The invention reduces noise by more than 12 decibels and can be used for either high- or low-frequency noise.

Originally developed to battle night-time noise in nursing homes, these "Quiet Curtains" have both consumer and commercial applications and are easy to clean and transport. Researchers recently measured noise levels in a manufacturing plant in which engineering offices are located directly above a production floor. Now, they are devising curtain concepts that could be deployed in such noise-intensive environments.

The same group of researchers—via the Georgia Tech Office of Technology Licensing—has also signed a commercial licensing agreement and filed a patent on a concept called localized noise masking. In effect, it masks sound in a local area without affecting others. For example, an office worker in a cubicle could flip a switch to mask the sound of a co-worker's telephone conversation. Researchers cite hundreds of privacy applications for the device. In addition, it could bring relief to those who sleep with snorers in the household.

A company launched by GTRI faculty is marketing radio-frequency identification tags that track the location and condition of high-value assets, ranging from pharmaceutical drugs to aircraft engines. These "talking tags," developed at GTRI, also monitor the stored equipment's condition and alert appropriate maintenance authorities. Shown with prototype equipment are Ben Medin Jr. and Gisele Welch.

Meanwhile, in GTRI's Logistics and Maintenance Applied Research Center, researchers have developed radio-frequency identification tags that track the location and condition of high-value assets, ranging from pharmaceutical drugs to aircraft engines. For example, if an airplane operating in the field needs a new engine, logistics staff can quickly find the right configuration to match its requirements in a warehouse. About the size of a cell phone, these "talking tags" also monitor the stored equipment's condition, such as possible condensation inside an engine, and alert appropriate maintenance authorities.

These sensors are unique because of their ability to work without traditional infrastructure technology, which requires fixed-site interrogators to track location —an innovation that significantly lowers total ownership costs. A faculty-owned company formed to market the technology recently began deliveries to its first customer, the U.S. Navy.

profiles

SECURING AMERICA'S FUTURE

Researcher Gary Gimmestad Devises Remote Sensing Technology Applications for Air Quality and Transportation Problems

Researcher Gary Gimmestad not only stays abreast of the latest in new electro-optical technology, he also devises ways to integrate it with other technology to solve some of society's most challenging problems.

Gimmestad was appointed in 2002 to the first endowed chair in GTRI—the Glen Robinson Chair in Electro-Optics. As the senior faculty leader in remote sensing technologies, he focuses on two key areas: air quality and transportation safety.

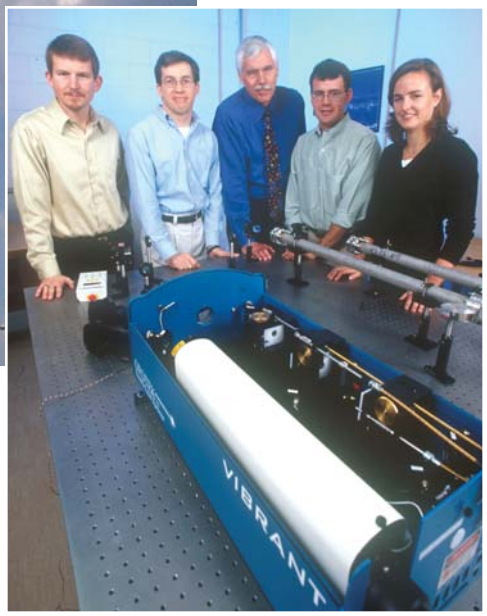
Excited about the future of his lab's studies, Gimmestad says, "The endowment funds will give our research much more continuity and stability." Gimmestad's research team is designing and testing a next-generation, ozone-monitoring technology called NEXLASER. Building upon existing light detection and ranging technology, this automated system will help ozone forecasting to become faster and cheaper. The team has already completed a laboratory system and is working on a field prototype. Later, researchers will deploy a network of NEXLASER sensors to sample air up to 10,000 feet above Atlanta.

"Until now, air-quality measurements have been done at the ground level," Gimmestad explains. "That makes sense because we live at ground level, but the problem is really three dimensional—what's going on above the ground."

Another of Gimmestad's projects is a high-tech fog warning system built for a 14-mile stretch of Interstate 75 in South Georgia. A series of sensors is installed along the highway, and during clear conditions, light beams from transmitters miss receivers. When fog or smoke particles are in the air, the light scatters, which causes the sensors to detect it and send a message to an on-site computer. The computer automatically posts messages on large signs built over the highway to alert motorists to hazardous conditions, and it also alerts highway officials in Atlanta.

The highway warning system also can be used for alerting drivers to visibility problems caused by dust and snow. State transportation departments around the country and in Canada have expressed interest in adapting the system. With the project in its final stages, Gimmestad is evaluating the system's accuracy and maintenance requirements. Already, it has received recognition with an Award of Excellence from the California Alliance for Advanced Transportation Systems in the Best Rural Project category.

"Electro-optics is a tremendously creative endeavor," Gimmestad adds. "What we can accomplish seems to be limited only by our imaginations and our ability to synthesize ideas."



(Above) Gary Gimmestad led a team of GTRI engineers who designed a fog warning system on Interstate 75 in south Georgia for the Georgia Department of Transportation.

(Right) Gimmestad also led a GTRI research team in designing the next generation of ozone-monitoring technology. Based on light detection and ranging (LIDAR) technology developed by NOAA, the GTRI version will make ozone monitoring continuous and affordable, and results will be available via the Internet in real time. Shown (l-r) are Jack Wood, Dave Roberts, Gary Gimmestad, John Stewart, and Leanne West.

profiles

SECURING AMERICA'S FUTURE

Rebecca Douglas, a Georgia Tech junior majoring in aerospace engineering, worked in GTRI's Aerospace, Transportation, and Advanced Systems Laboratory on a project to reduce noise in nursing homes.

Hands-On Experience Gives Future Aerospace Engineer a Head Start

Undergraduate research in GTRI has allowed 20-year-old Rebecca Douglas to glimpse a future career in aerospace engineering. "I never expected that I would be working in such an interactive environment as GTRI," says Douglas, a Georgia Tech junior who interned in GTRI's Aerospace, Transportation, and Advanced Systems Laboratory in the summer of 2002. "The research engineers I worked with not only gave me their suggestions, but were open to my own."

During her internship, Douglas worked on research projects such as: reducing ambient noise in nursing homes with fiberglass panels, reducing the temperature of jet exhaust to make it easier for workers to load cargo planes while aircraft engines are running; and testing jet acoustics—determining how noise can be decreased by altering jet flow, wind tunnel speed, and the angle of flaps.

Douglas, an aerospace engineering major, says the hands-on experience has given her a head start on many new subjects she is encountering in school this year.

A native of Baton Rouge, Louisiana, Douglas plans to get a master's degree after graduation and pursue a career in research. "Working at GTRI has given me a better grasp of how research is conducted. It's far more detailed than I thought," she observes, noting that her most challenging assignment, from both a physical and mental perspective, was the nursing-home noise project.

"We had to figure out temporary ways to hang acoustical panels in four different nursing homes," Douglas explains. "And because each testing environment was different, it was difficult to differentiate between the good data, bad data, and what data should be similar."

Electrical Engineering Student Explores Technology Magic

Last year, Spiro Sarris spent what he calls an "ideal summer" building and testing radar-related, radio-frequency electrical systems as a student researcher in the Radar Systems Division of the Sensors and Electronic Applications Laboratory at GTRI.

"A lot of people don't know anything about electrical systems, such as the operation of a microwave oven. They just think it happens, like magic," says this fifth-year electrical engineering senior at Georgia Tech. "Now, I am figuring it out."

When he came to GTRI, Sarris asked "not to sit in front of a computer all day," and his request was granted. He was assigned "soup-to-nuts" engineering tasks that exercised his love of building,

Spiro Sarris (right) is a Georgia Tech senior majoring in electrical engineering. He worked with GTRI researchers Aram Partizian and T.L. Spangler in the Radar Systems Division of the Sensors and Electronic Applications Laboratory in the summer of 2002.

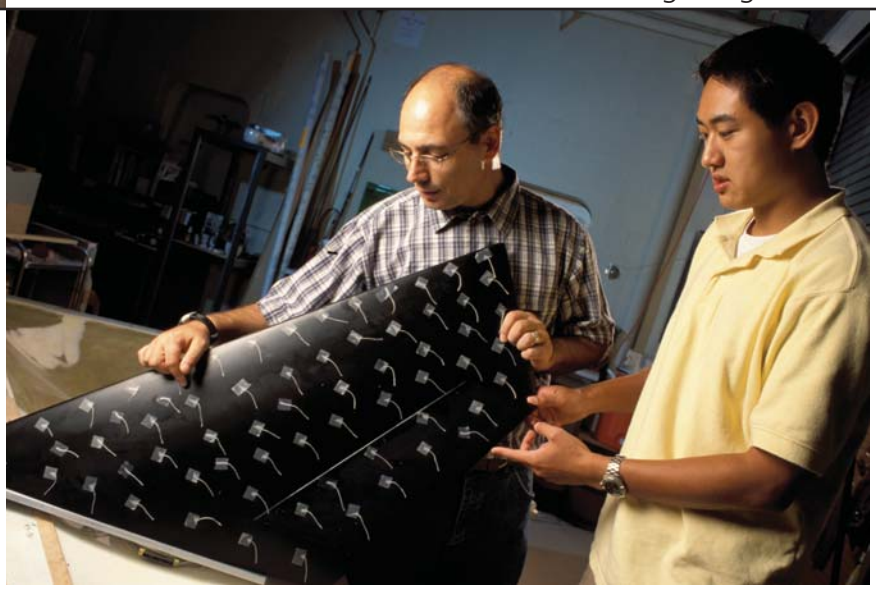
(Below) Senior mechanical engineering major Michael Huang (right) worked with GTRI senior research engineer Michael Amitay to improve the performance of the Stingray, a joint NASA, Boeing, and GTRI initiative for a future unmanned aerial vehicle that features "synthetic jets."

first realized with the Erector sets and Legos he played with as a child in his Duluth, Georgia, home.

In one GTRI project, Sarris worked with Aram Partizian, a senior research scientist, and T.L. Spangler, a senior research engineer, installing hardware on Georgia Tech's Electronic Protection Mobile Test Vehicle—a mobile laboratory truck that tests and characterizes radar sensor defense applications. "I worked with real devices that I could hold in my hand, assemble, and test," he says.

In another project, Sarris built a memory circuit, which involved analyzing an existing design, characterizing digital and microwave components, assembling and testing a completed breadboard, and giving an oral presentation of his results.

After attending graduate school, Sarris says he wants to "break the physical limitations of current technology—develop things not yet in existence."



Mechanical Engineering Senior Aspires to Aeronautical Design Career

Michael Huang knows what he likes—fast airplanes and cool cars. This mechanical engineering senior had his share of model autos and balsa wooden airplanes that flew by finger power while growing up in Richmond, Virginia.

Now, he wants to design and build the real machines from the ground up. Those machines share a lot of similarities, he says. Airplanes are "10 percent aeronautics," and the rest is like a car— "the engine, the chassis, the neat stuff," Huang, a mechanical engineering student at Georgia Tech, explains.

So, Huang was glad to finally use what he has learned in three years of classroom instruction during his student research summer internship at GTRI. He worked on two different flow-control problems, one on an unmanned aerial vehicle (UAV) and another in dental technology.

With senior research engineer Michael Amitay, Huang worked to improve the performance of the Stingray, a joint NASA, Boeing, and GTRI initiative for a future UAV that features "synthetic jets." He helped design the fiberglass skin, manufacture the superstructure of Stingray models, and conduct preliminary wind tunnel experiments.

The dental technology project, which is part of GTRI's Health Initiative Program, taught Huang about particle-laden jet flows and state-of-the-art measurement techniques. Most dentists now use drills to remove tooth decay, but next-generation tools feature painless air abrasion. Huang's job was to determine how to control that jet.

He plans to become a design engineer after graduation. The taste of problem-solving he got at GTRI is, he says, "just the kind of stuff I look forward to doing."

GTRI

GTRI Laboratories and Field Offices

Headquartered in Atlanta, GTRI also has laboratories and field offices at eight additional locations in the United States:

Albuquerque, New Mexico
- New Mexico Field Office

Arlington, Virginia
- Washington, D.C. Field Office

Atlanta, Georgia
- GTRI Headquarters
- Electronic Systems Laboratory
- Electro-Optics, Environment, and Materials Laboratory
- Information Technology and Telecommunications Laboratory
- Signatures Technology Laboratory

Cobb County, Georgia
- Aerospace, Transportation, and Advanced Systems Laboratory
- Sensors and Electromagnetic Applications Laboratory

Dayton, Ohio
- Dayton Field Office

Eglin Air Force Base, Florida
- Eglin Field Office

Huntsville, Alabama
- Huntsville Research Laboratory

Orlando, Florida
- Orlando Research Operations

Quantico, Virginia
- Quantico Field Office

Warner Robins, Georgia
- Warner Robins Field Office

GTRI Intergovernmental Personnel Agreements

GTRI researchers make added contributions to national technology and policy development by working in national organizations through the Intergovernmental Personnel Agreement (IPA) Program. This program allows scientists and engineers to collaborate directly with colleagues in federal agencies while retaining their GTRI faculty status. GTRI faculty who served as IPAs during FY 02 include:

Arlington, Virginia
- Larry E. Corey, Defense Advanced Research Projects Agency
- Parker C. Horner, Department of Defense Washington Headquarters Service
- Benjamin P. Riley, Office of Naval Research
- Thomas J. Singleton, Office of Naval Research
- Juan A. Vitali, Office of Secretary of Defense, Operational Test and Evaluation

Atlanta, Georgia
- Richard S. Combes, Department of Energy, Atlanta Regional Support Office
- Rochie E. Tschirhart, Army Environmental Policy Institute
- W. Richard Wright, Army Environmental Policy Institute

Chantilly, Virginia
- Eric E. Sundberg, National Reconnaissance Office
- Hal E. Hagemeier, National Space Security Architect

Eglin Air Force Base, Florida
- Gregory K. Jenkins, Air Armament Center

Norfolk, Virginia
- Gregory T. Johnson, U.S. Joint Forces Command

Huntsville, Alabama
- James H. Kirkland, U.S. Army Space and Missile Defense Command
- Tilton D. Price, U.S. Army Space and Missile Defense Command
- Sherry L. Sexton, National Missile Defense DOC

Kirtland Air Force Base, New Mexico
- Thomas M. Davis, Air Force Research Laboratory
- L. Douglas Rigdon, Air Force Research Laboratory
- James D. Ledbetter, Air Force Research Laboratory
- Marion L. Williams, Air Force Operational Test and Evaluation Center

Newport, Rhode Island
- Mark Moffett, Naval Undersea Warfare Center

Norfolk, Virginia
- Charles T. Mauro, Operational Test and Evaluation Force

Orlando, Florida
- Steven C. Gordon, Air Force Agency for Modeling and Simulation

Quantico, Virginia
- Marty G. Meyers, Marine Corps Systems Command

Redstone Arsenal, Alabama
- Julian L. Cothran, U.S. Army Program Executive Office, Tactical Missiles and Smart Munitions
- Matthew C. Donohue, U.S. Army Aviation and Missile Command
- Gerald S. Smith, U.S. Army Program Executive Office, Tactical Missiles and Smart Munitions
- Steven P. Smith, U.S. Army Aviation and Missile Command
- Barry M. Ward, U.S. Army Aviation and Missile Command

Washington, D.C.

- Theodore D. Barna, National Defense University
- Sharon A. Bucci, Department of the Army, Directorate of Environmental Programs
- Gary E. Carter, Office of the Chief of Naval Operations
- Donald C. Daniel, National Defense University
- Joseph J. Eash, National Defense University
- Catherine B. Joseph, U.S. Environmental Protection Agency

Wright Patterson Air Force Base, Ohio

- William R. Bohaboy, Air Force Research Laboratory
- H. Lynn Duncan, Reconnaissance System Program Office
- F. Paul Johnson, Air Force Research Laboratory
- Zdzislaw H. Lewantowicz, Air Force Research Laboratory
- Dave G. Morton, Air Force Research Laboratory
- Joseph A. Sugrue, National Air Intelligence Center
- Stephen E. Woodall, Air Force Research Laboratory

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John J. Welch Jr., U.S. Air Force, retired; Executive Vice President, Burdeshaw Associates

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Department of Industry, Trade, and Tourism, p. 4 right; U.S. Department of Defense, p. 6 inset, 11; Stanley Leary, p. 7 top, 8, 10; U.S. Air Force Research Laboratory, p. 9; PHOTODISC, p. 14, 17 bottom; Ohio Aerospace Institute/NASA Institute for Advanced Concepts, p. 15; Wayne Daley, p. 19 top; and T. Michael Keza, p. 19 bottom.