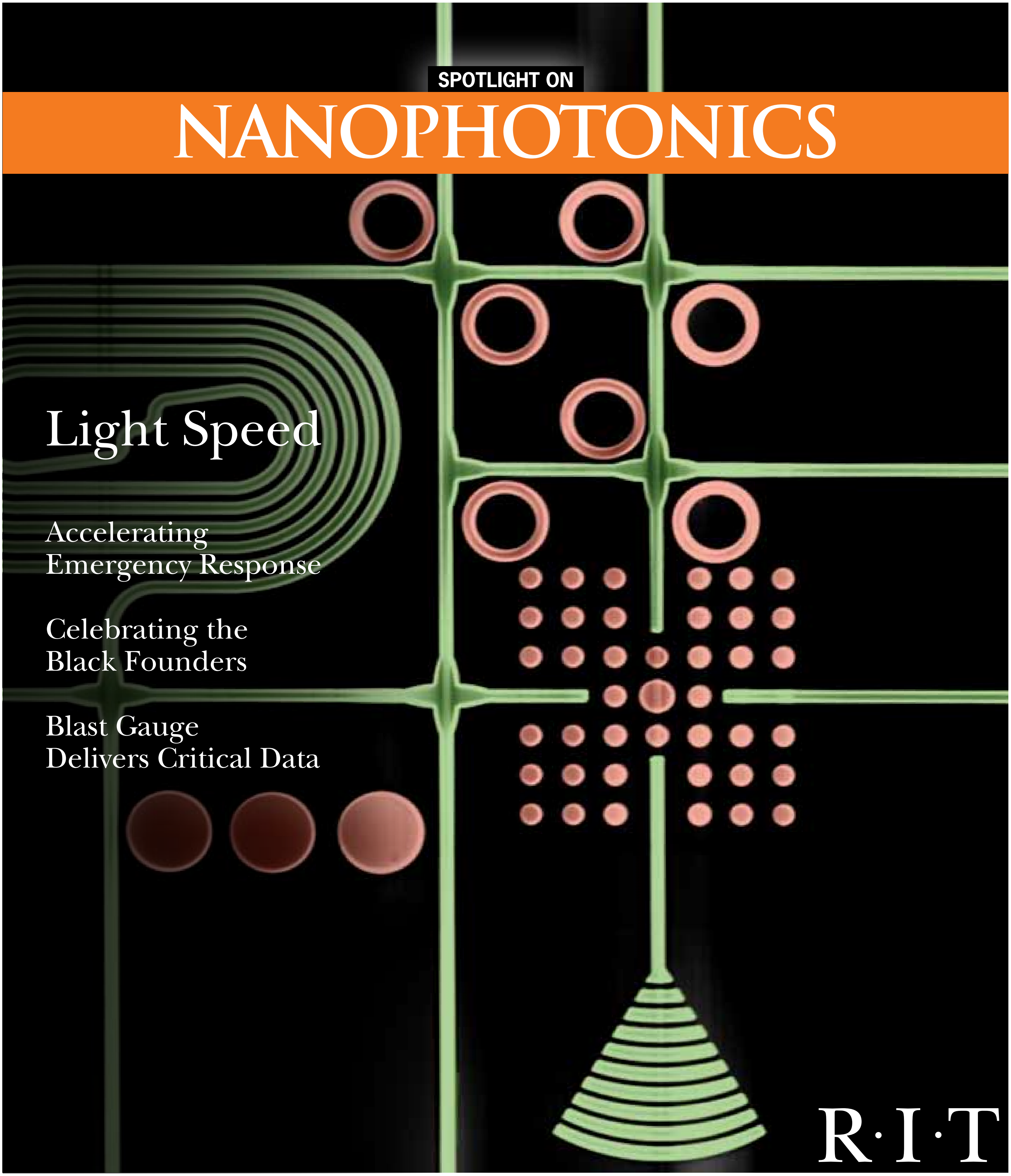
RESEARCH at RIT

The Rochester Institute of Technology Research Report

Spring/Summer 2011



SPOTLIGHT ON

NANOPHOTONICS

Light Speed

Accelerating Emergency Response

Celebrating the Black Founders

Blast Gauge Delivers Critical Data

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RESEARCH at RIT

The Rochester Institute of Technology
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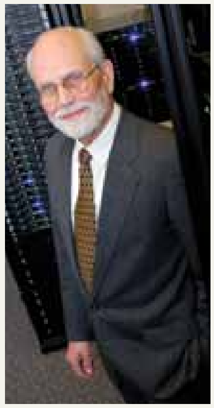
Lighting the Way

Research is about the discovery and dissemination of new ideas, new properties, new methods; but it is also the way to better understand and build on what has come before.



In this, our seventh issue of *Research at RIT*, we focus on the future by discovering the ways that the application of light will lead to the next generation of computers; then on the present with the integration of imaging technologies to develop information tools for emergency responders and the rapid development of a device to conduct field-level triage when soldiers are exposed to improvised explosive device (IED) blasts; and finally to the past by exploring the legacy of our pre-Civil War Black Founding Fathers.

RIT's Dr. Stefan Preble and his team are looking to the future by developing ultra-small devices that leverage the high bandwidth and low power that comes with light. These nanophotonic devices can be integrated with silicon technology providing the speed and performance required of future generations of microelectronics. Applications of this technology, such as communications among multicore computer systems, are already underway, while much further out are the possibilities of quantum computing utilizing the properties of individual photons.

Although research is often focused on future technology development, there are critical needs that require the applications of current technology. The Information Products Laboratory for Emergency Response team is making use of RIT's long history of digital imaging and remote sensing to address today's problems on the ground. The team is converting LIDAR and multispectral, real-time data into meaningful information for use by those who are responding to natural disasters. In this article you will learn how this technology was used to capture data from the recent Haiti earthquake and how that data was rapidly distributed to emergency responders across the country. RIT is also responding to a critical need of the U.S. soldier through the design and development of the Blast Gauge. This small, low-cost device, engineered by Dr. David Borkholder and his team, measures the shockwaves when an IED blast occurs to provide both immediate and future triage of potential brain injury.

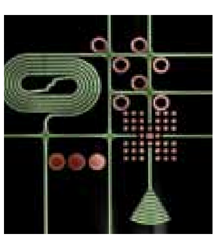
The last article looks at the history of our largely unknown black forefathers who supported the creation of the United States in the late 1700s. Professor Richard Newman focuses his research on Richard Allen, a former slave who worked in Philadelphia, then-capital of the U.S., where George Washington and Thomas Jefferson—each of whom owned slaves—imagined a nation dedicated to the principal of equality. His writings are enlightening us about the culture and injustices in place among underrepresented communities today and reminding us of our responsibilities to these communities.

Enjoy the breadth and the depth of Research at RIT!

Best Regards,

Donald Boyd, Ph.D.
Vice President for Research

Inside this Issue



On the Cover
Photonic integrated circuit on a silicon chip. The circuit consists of waveguides (shaded green) for transferring information at the speed of light between photonic processing elements (shaded red, clockwise from the top: ring resonators, photonic crystals, and disk resonators). The RIT Nanophotonics Group is integrating these photonic elements into the circuits that will enable future optical computers.

Stefan F. Preble, assistant professor of microsystems engineering and leader of RIT's Nanophotonics Group, examines photonic devices designed and fabricated by his team. The researchers make extensive use of RIT's Lobozzo Photonics and Optical Characterization Laboratory, a facility established with a gift from Joseph M. Lobozzo II, the founder of Rochester-based JML Optical Industries Inc.

Light Speed

by Kathy Lindsley

For more than half a century, progress in the production of silicon-based electronic components has made possible smaller, more powerful, more reliable, and cheaper products. But conventional microelectronic technology is beginning to reach its limits. Companies and academic researchers believe photonics will light the way to the next generation of microprocessor, communication, and sensing systems.

Nothing is faster than the speed of light.
"That's really what it comes down to," says Stefan F. Preble, assistant professor of microsystems engineering in RIT's Kate Gleason College of Engineering and leader of RIT's Nanophotonics Group. "Current computer technology is limited by how quickly electrons can move. So there's definitely a motivation to use light for dealing with information."

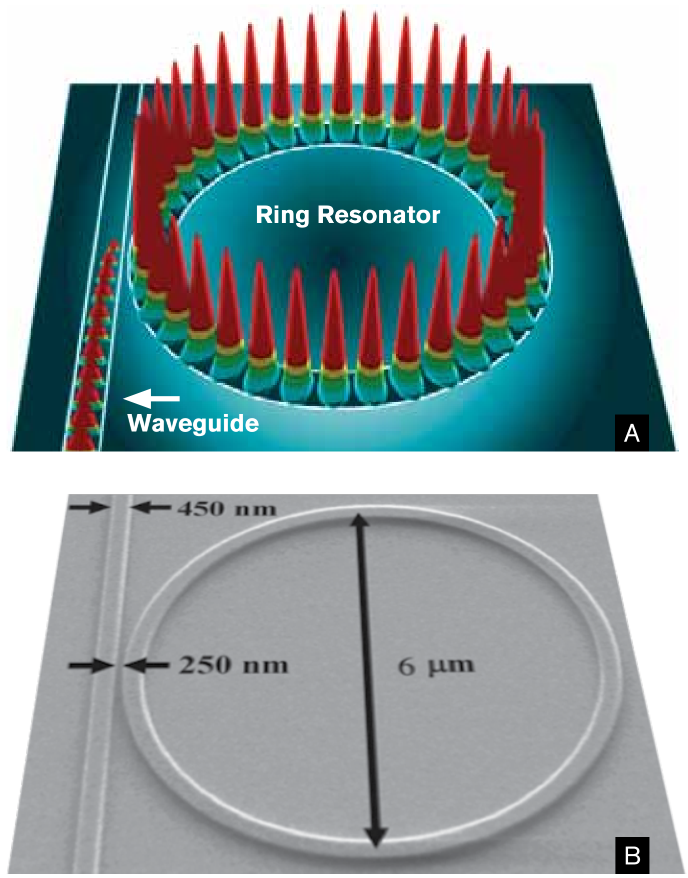
Preble's group is developing ultra-small devices and systems that leverage the high bandwidth, low power, low latency, and sensitivity that are possible with light. They are focusing on integrating nanophotonic devices on a silicon CMOS platform in order to take advantage of the advanced fabrication techniques used in the microelectronics industry. The goal is to directly integrate photonics with current electronic devices.

Although the tremendous potential of nanophotonics has generated much interest, development of the technology for practical use in computers and other products is in the very early stages. "Right now we're really in the prehistorics of what we can do with photonics. At this point, it's possible only to have on order of maybe 1,000 components integrated on a chip," says Preble. "We're trying to develop the technologies, the architectures to scale that up to millions, so that eventually we could have these incredibly powerful computers."

A key to realizing this goal is developing technologies to control the characteristics of light. The basic building block for this is known as the ring resonator. "It is the photonic equivalent of the electronic transistor. While it will likely never replace the electronic transistor, it enables us to process information at the speed and bandwidths of light," says Preble. "With these ring resonators, we can directly turn the light on and off, which allows digital information (in the form of ones and zeros) to be transmitted."

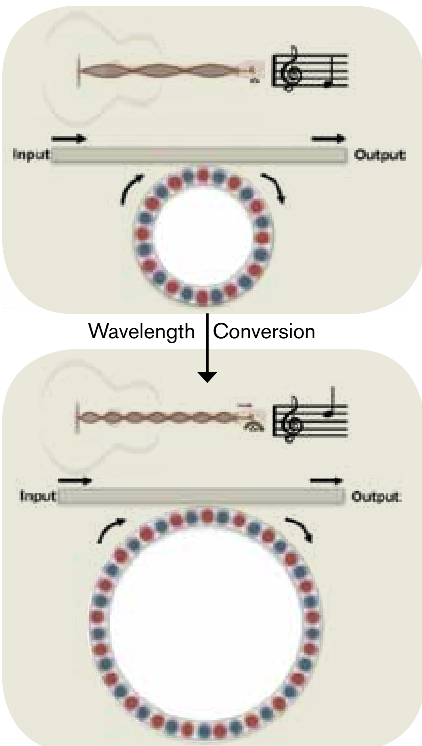
However, ring resonators can do much more, Preble says. "We need to be able to manipulate the speed, frequency, and direction of light."

Preble's work is supported by two of the U.S. Defense Department's most prestigious honors, the Defense Advanced Research Projects Agency (DARPA) Young Faculty Award and

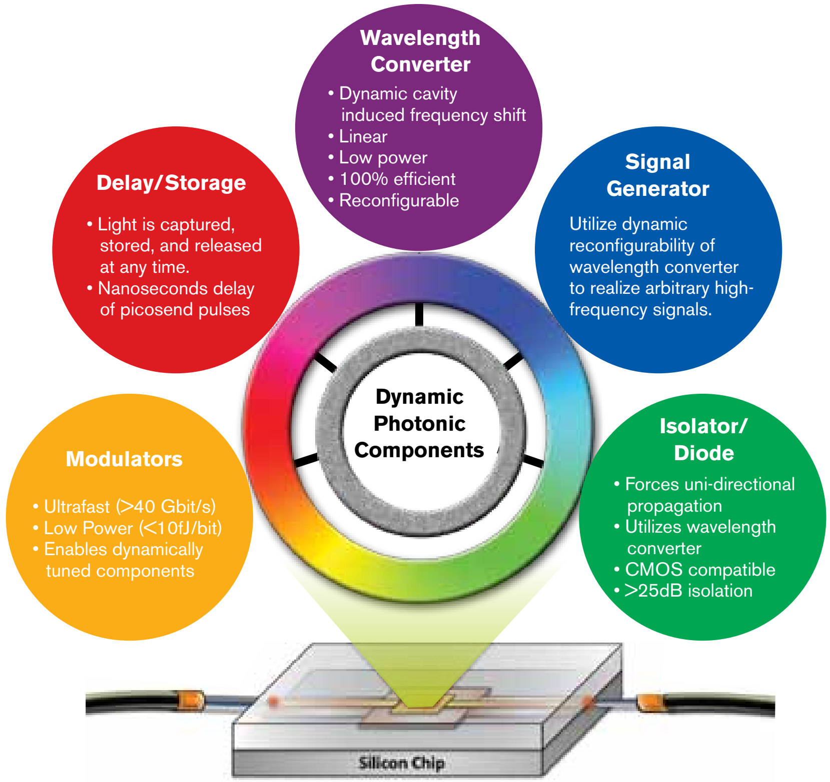


Ring Resonator: The primary building block for photonic circuits (A). Light with a wavelength exactly matching the circumference of the ring is captured, where it can be manipulated by changing the "length" of the cavity. The scanning electron micrograph (B) shows a fabricated silicon ring resonator side-coupled to a waveguide.

VIDEO EXTRA



Changing Wavelength: Tuning the length of the guitar string changes the wavelength of the sound wave. Exactly the same thing happens in a ring resonator—although its length is changed in a different way—through its electro-optic properties.



Dynamic Photonics: Dynamically tuned optical cavities can be used to realize a multitude of photonic components, from modulators to optical diodes. All of these components are CMOS compatible and are efficiently and densely integrated with on-chip electronics. These components could be used for numerous applications, such as interconnects, RF signal generators/processors, and sensing systems.

the Air Force Office of Scientific Research (AFSOR) Young Investigators Research Program Award. He has also received funding from the National Science Foundation, the Semiconductor Research Corporation, and from RIT. Preble, who joined the RIT faculty in 2007, received MS and Ph.D. degrees from Cornell University and a BS in electrical engineering from RIT (2002).

"Dr. Preble is one of the top young researchers in the country working in the fields of nanophotonics and microsystems," says Bruce Smith, professor and director of the RIT microsystems engineering program. "His accomplishments in these highly competitive and prestigious programs bears this out."

The Nanophotonics Group includes four RIT Ph.D. candidates, one postdoctoral researcher, and several undergraduate students.

Dynamic Photonics

The Air Force and the DARPA awards are focused on developing devices and systems to control all of the properties of light. The research is built on Preble's discovery of a new type of wavelength converter.

"Wavelength converters are needed to perform wavelength division multiplexing, where optical signals at different wavelengths are transmitted simultaneously. However, to date, wavelength converters have used schemes that are fundamentally non-linear, making their integration on a microelectronic chip challenging," says Preble.

His device uses a linear effect where the wavelength of light trapped in a ring resonator is changed by dynamically tuning the resonance of the cavity. Preble explains: "You can think of a guitar string as the acoustic equivalent of an optical cavity. By changing the length of a guitar string, you can create a rich set of sounds. We can do exactly the same thing to light by 'changing the length' of optical cavities." An article detailing this work was featured on the May 2007 cover of *Nature Photonics*.

"However, we can do much more than just change the wavelength of light by dynamically changing a resonator," says Preble. The research efforts in his AFOSR and DARPA programs envision not only changing the wavelength of light but developing a whole suite of tools for processing optical signals, such as optical memory/delays, optical isolators, and signal generators. "Dynamic nanophotonics enables unprecedented control of the properties of light, from its color to its speed."

The group has already made significant progress in achieving this control. Recently they demonstrated the slowing of light by a factor of 300, which is four times better than the best previous effort. "So that's a really huge improvement of the technology," says Preble. An article describing this work, "Controlled Storage of Light in Silicon Cavities," was published in the Feb. 1, 2010, issue of *Optics Express*.

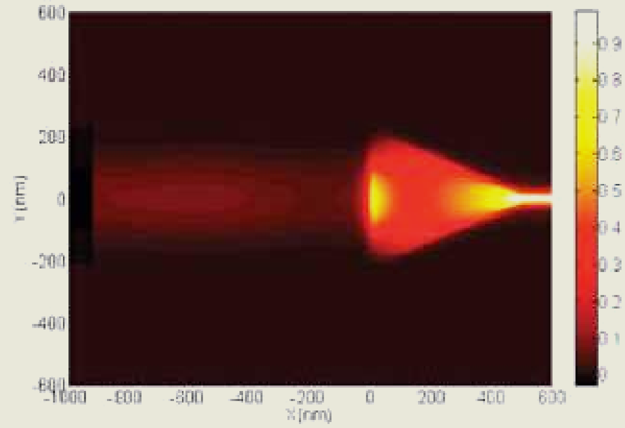
Central to creating these dynamic photonic devices is a high-performance electro-optic modulator. The device uses a high bit-rate electronic signal to modulate a continuous light signal. Previous silicon modulators all suffer from a tradeoff in speed, size, power, voltage, absorption, and temperature stability. The RIT group is working on a new type of silicon electro-optic modulator that utilizes a non-linear effect known as the DC Kerr Effect.

While this effect is small in crystalline silicon, Preble's group has shown that it can be quite large in a different form of silicon: nanocrystals. Preble anticipates that the modulator would represent a dramatic advance in performance and would also have many applications beyond electro-optic signal conversion, ultimately enabling high-performance on-chip wavelength-division multiplexed information processing systems.

Commercial Applications

The DARPA and AFOSR projects are working toward advanced functionalities that may make it into future products. At the same time, the RIT group, in collaboration with the University of Rochester and the University of New Mexico, is developing devices and architectures to improve the performance of the multicore computer systems so pervasive on our desktops today. The project, sponsored by the NSF and the Semiconductor Research Corp., aims to utilize photonics to relay information between the cores.

In current-day multicore systems, communication between the cores is handled electronically. Simply moving the information in this manner consumes a huge amount of power. The researchers are developing a multicore chip architecture that employs a hybrid electronic-photonic network to achieve



A Plasmonic Taper: The 3D nanoplasmonic squeezer developed by RIT's Nanoplasmonics and Metamaterials group couples a dielectric waveguide into the metal-insulator-metal plasmonic taper, which "squeezes" light into an ultra-small spot.

Exploring A Plasmonic Alternative

Zhaolin Lu

Zhaolin Lu and his team at RIT's Nanoplasmonics and Metamaterials lab are exploring the integration of optical and electrical signals.

"Recently, nanoplasmonics has risen from a relatively obscure science to a prominent field of research," says Lu, assistant professor of microsystems engineering. "Our lab is focused on experimental and theoretical aspects of this rapidly developing field." The work has application in areas ranging from the semiconductor industry to development of surface plasmon-enhanced solar cells. Lu has received funding from the National Science Foundation, Department of Defense Advanced Research Projects Agency (DARPA), and the American Chemical Society.

Plasmons are nanoscopic waves in the sea of free electrons inside and on the surface of metals. Surface plasmon-based circuits, which merge electronic and photonic circuits at the nanoscale, offer the potential to carry optical signals and electric currents through the same thin metal circuitry, effectively combining photonics and electronics on the same chip.

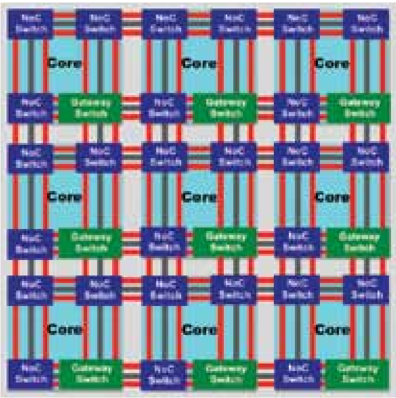
One of the biggest challenges with photonics is that the wavelength of a guided photon is relatively large—on the order of 100 nanometers. That's much larger than what's currently possible with electronic semiconductors, where resolution of 32 or even 26 nanometers is possible. Lu is developing techniques using plasmonics to reduce the wavelength of light to potentially 10 nanometers.

To couple light into a waveguide supporting nanoscale mode size and consequently to squeeze light into an ultra-small spot are critical to imaging quality, optical data storage, manipulation of nanostructures, and optical lithography in the semiconductor industry. The extremely high light intensity resulting from the ultra-small spot can be used to make ultra-small and ultra-fast electric-optic or all-optic modulators.

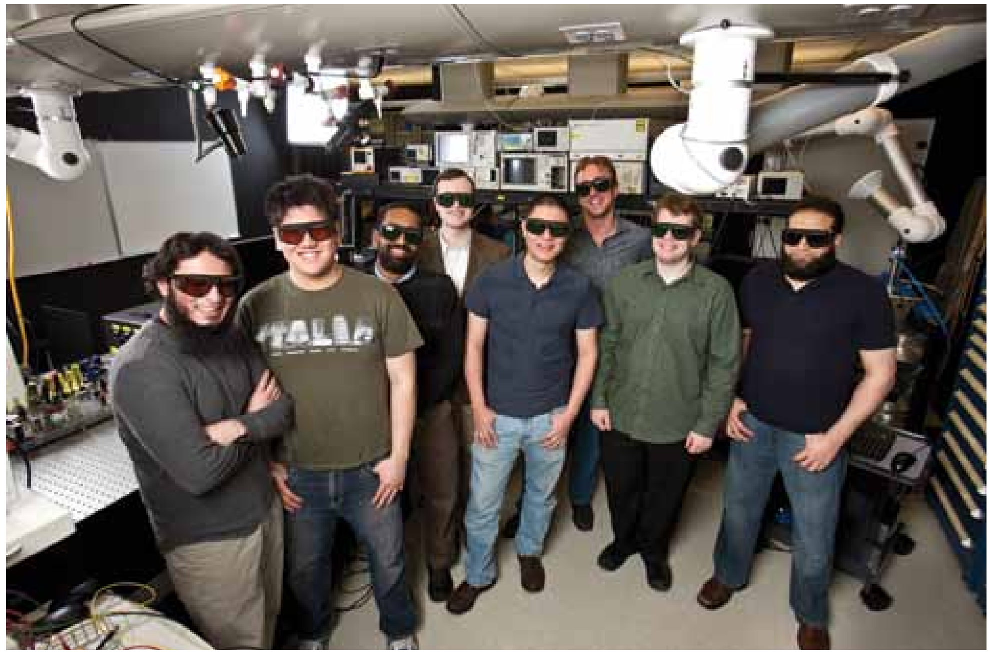
Lu has successfully squeezed a 1550 nanometer infrared beam into a 21 × 24 nanometer spot with 62 percent efficiency. The project coupled light from a dielectric waveguide into a metal-dielectric-metal plasmonic waveguide, a technique developed by the RIT team. Lu's demonstration was covered in "Beam Shaping: Plasmonics Squeeze IR Light into Nanospot," an article published in *Laser Focus World* (January 2009).

"Plasmonic waveguides support nanoscale modes with acceptable propagation loss and are believed to be the technique merging photonics and electronics at nanoscale dimensions," Lu reported. "In this sense, nanoscale confinement of light is the initial motivation to develop surface plasmon-based circuits. A key feature of our device is that it is a planar structure and can be fabricated with standard semiconductor techniques."

Lu, who received his Ph.D. from the University of Delaware, came to RIT in 2007. He has published numerous publications, including a book, *Dispersion Engineered Photonic Crystals* (2008), co-authored with Dennis Prather. In 2008, he received the Texas Instruments/Douglass Harvey Faculty Development Award.



High-speed Electronic-Photonic Network-on-Chip: With the University of Rochester and the University of New Mexico, RIT researchers are developing hybrid photonic-electronic on-chip networks that utilize switches, which route, inject, and eject photonic and electronic packets in the network.



The Nanophotonics Team: The team includes undergraduate and graduate students from RIT's microelectronic engineering and physics programs as well as Ph.D. students from the RIT microsystems engineering program and a postdoc from Texas A&M. They fabricate the photonic chips at the RIT Semiconductor and Microsystems Fabrication Laboratory (SMFL) as well as at Cornell University's Nanoscale Science and Technology Facility (CNF).

low power, low latency, high bandwidth, and reliable interconnections among cores. Because power is in proportion to frequency, the electronic devices need to operate at a moderate 5 gigabits/second; however, the photonic links enable efficient operation at much higher data rates (around 40 gigabits/second).

"The multidimensional learning spans optics and lasers, device physics, electronic circuits, fabrication and process technologies, computer and network architecture, and error control coding," says Paul Ampadu, director of the University of Rochester's Embedded Integrated System-on-Chip Research Group.

"Stefan has always believed in the hybrid photonic/electronic approach to constructing reliable, high-speed, low-energy multicore systems that exploit the unique characteristics of each technology," says Ampadu. "Working with Stefan and his team, one is constantly pushed to seek non-trivial groundbreaking solutions. We truly have a great team with a common vision; indeed, we so enjoy working together that we probably would've undertaken this project even without external funding. We can only look forward to many more of such exciting future collaborative ventures."

The team has already exceeded the initial accomplishment targets.

"This is still in the realm of fundamental academic research," Preble says. "But this project is closest to commercialization. It could conceivably be in our computer chips by 2015 or so."

A Quantum Future

The RIT group is now looking at pushing the limits of light by utilizing the unique properties of individual photons—their quantum behavior—to realize quantum optical computers. "Quantum computers would really revolutionize our world," says Preble. They would represent a fundamental divergence from current technology: Unlike conventional bits in today's computers—which represent information as zeros and ones—quantum bits (qubits) can have multiple values at the same time.

A quantum optical system consists of three basic elements: the photon source, quantum circuit, and detector. Past efforts to create quantum optic devices have been limited by use of large-scale components, such as beam splitters and polarizers, which were not integrated on a single chip. The goal of the RIT project is to integrate all of the components on a chip, creating a system that is low powered, compact, and robust. In addition, it will be rapidly and intelligently reconfigurable by making use of closely integrated CMOS electronics. The initial work is being funded by the university.

"I really feel quite strongly about this as a direction," says Preble. "I think we can make a huge impact on integrating the entire system on a chip."

On the Web

For more information about Stefan Preble's nanophotonics research, visit the website http://www.rit.edu/nanophotonics.

Organic Photovoltaics

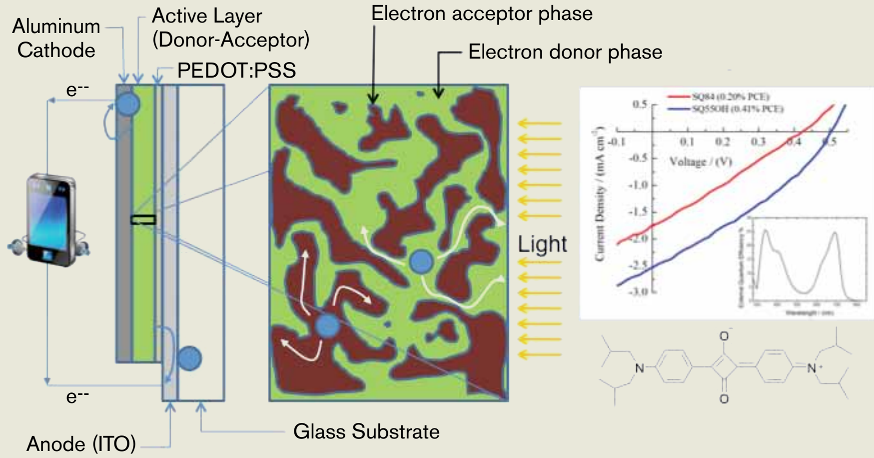
Chris Collison

Dr. Chris Collison, assistant professor of chemistry, and his chemistry research group have developed a model that quantitatively describes comparisons of polymer materials used as dispersants for carbon nanotubes in organic solvents. The effort, funded by the American Chemical Society, has gained international recognition at a host of conferences and peer-reviewed journals, including the *Journal of Physical Chemistry B and C.*

With better polymer dispersants, carbon nanotubes are being utilized for flexible transparent electrodes in emerging photovoltaic devices. Collison, who also serves as the group leader of RIT's Nanopower Research Laboratories' Polymer Photovoltaics group, is developing a tandem layer organic solar cell. Each active layer in the cell converts a different region of the solar spectrum to electricity. These devices will yield low-cost, flexible, and aesthetically pleasing solar cells that are well targeted for consumer electronics.

In organic photovoltaics light is absorbed by an organic material, which is chemically tailored to optimize the device. The excited state that is created migrates to an interface with a second organic "electron acceptor." The resulting electron and hole, now "free," can diffuse through the organics and the electron and hole are captured at two electrodes.

The mechanism for this process is hotly debated and has significant research underway to improve the process. RIT's Polymer Photovoltaics group is one of five international groups making strides with a set of squaraine molecules, which absorb strongly in the near infrared and show immense promise for stable, solution-cast films, vital for low-cost manufacture. The group is also studying the effective dispersion of carbon nanotubes for the spray coating of more sustainable transparent electrodes.



Controls to Enhance Building Efficiencies: Conceptual illustration of organic bulk heterojunction solar cell with Near-Infra-Red (NIR) absorbing active layer. Recent data alongside demonstrates the feasibility of such a device with a new family of squaraine molecules, currently under study in the Collison Group. Excited states are photogenerated and electron transfer occurs at the interface between the NIR active dye and the electron acceptor, typically a C60 soluble fullerene derivative.

Using Light to Produce Flight

Grover Swartzlander

Alan Raisanen

A team of researchers from RIT has proven the existence of stable optical lift—the use of a beam of light to move and manipulate particles at the micrometer scale. This method, similar to air movement over airplane wings generating lift, is used to achieve particle movement using light.

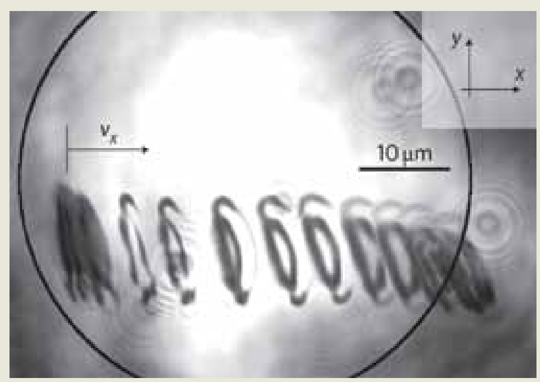
The technique has significant applications in many fields, including biotechnology, astrophysics, and micro-electronics, and could eventually be used to power micro-machines or enable solar sails for long-distance space travel.

"Airplanes and automobile spoilers use the concept of aerodynamic lift to achieve movement," notes Grover Swartzlander, joint associate professor in RIT's department of physics and the Chester F. Carlson Center for Imaging Science. "Our computer model predicts and our experiments prove that sustained optical lift is possible and can be used to make particles move perpendicular to the direction of the light flow. Combined with the previously known 'levitation force' of light, the specially shaped particles can be made to 'fly.'"

Swartzlander's team first developed computerized simulations to test the process and then created a laboratory experiment using milliwatt-scale laser light and microscopic semi-cylindrical rods. As expected, when illuminated with the laser light, the rods exhibited both a "levitation force" in the direction of the beam and a "lift force" perpendicular to the beam.

The rod also rotated into a stable orientation, and subsequently underwent uniform motion. Unlike optical tweezers, which is an alternative method to manipulate particles with a focused beam of light, optical lift occurs in uniform illumination. Numerous rods could be simultaneously lifted and moved in a single uniform beam of light.

The research team included Alan Raisanen, associate director of RIT's Semiconductor and Microsystems Fabrication Laboratory, Timothy Peterson, a master's degree student in RIT's department of computer science, and Alexandra Artusio-Glimpse, a graduate of the RIT photographic technology program and a current doctoral student in the Center for Imaging Science.



Experimental Verification of Optical Lift: Top-view, time-lapsed composite image of a semi-cylindrical rod lifting sideways from left to right near the bottom of a glass chamber, as a result of a transverse optical lift force. The rod initially experiences a torque, then exhibits a distinct translation, with a component of velocity directed toward the right.

In the Field: Remote sensing capabilities play an increasing role in emergency management missions around the world and at home. RIT and the Monroe County Office of Emergency Preparedness have teamed up to demonstrate airborne image acquisition and real-time delivery to emergency management personnel via computers inside a mobile Geographic Information System (GIS) van. RIT's Don McKeown, left, and Jason Faulring, right, fine tune the process of delivering georeferenced image maps to first responders like Justin Cole, senior GIS analyst from Monroe County Department of Environmental Services, center.

Accelerating Emergency Response

by Susan Gawlowicz

The Information Products Laboratory for Emergency Response connects the dots between academia, the remote-sensing industry, and the disaster management community. It creates a network for collaboration and brings together people who use remotely gathered information to address problems on the ground.

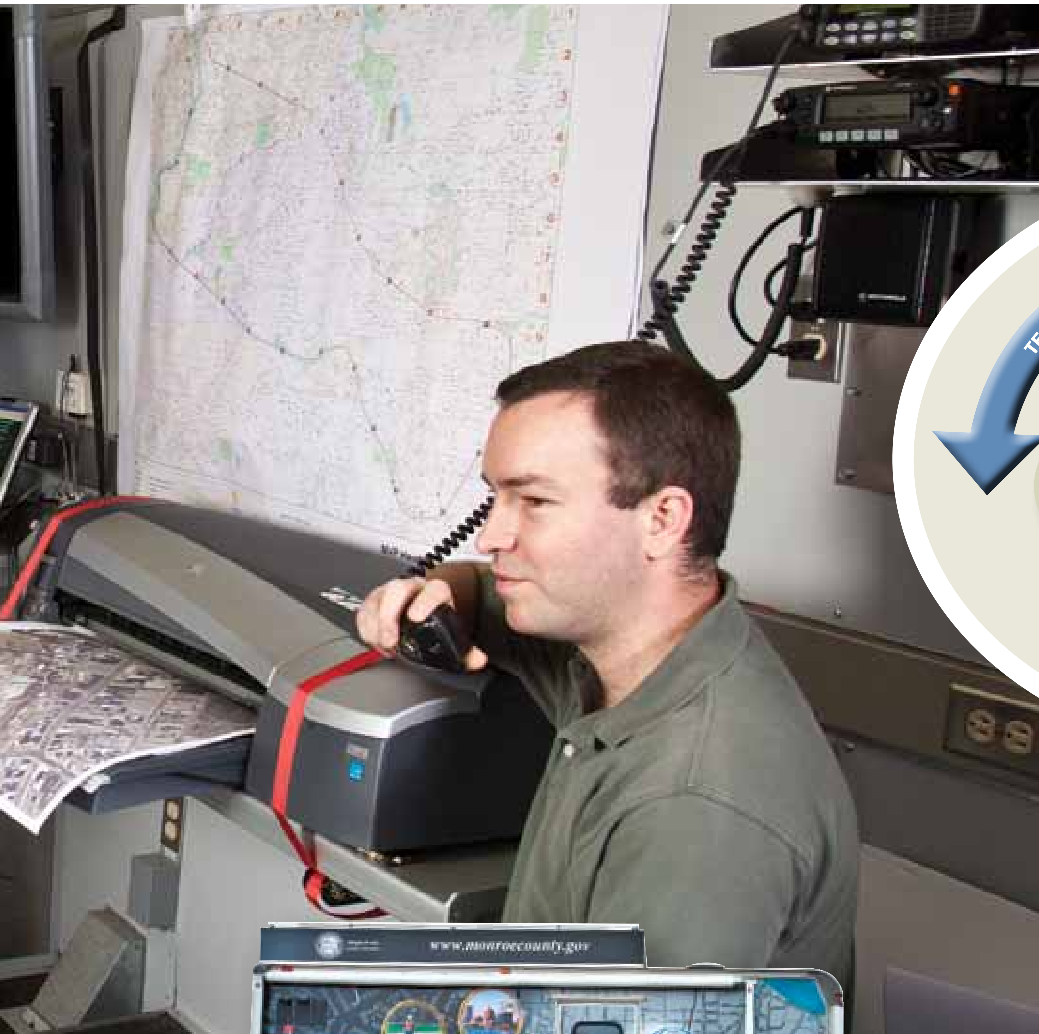
Crisis in Haiti

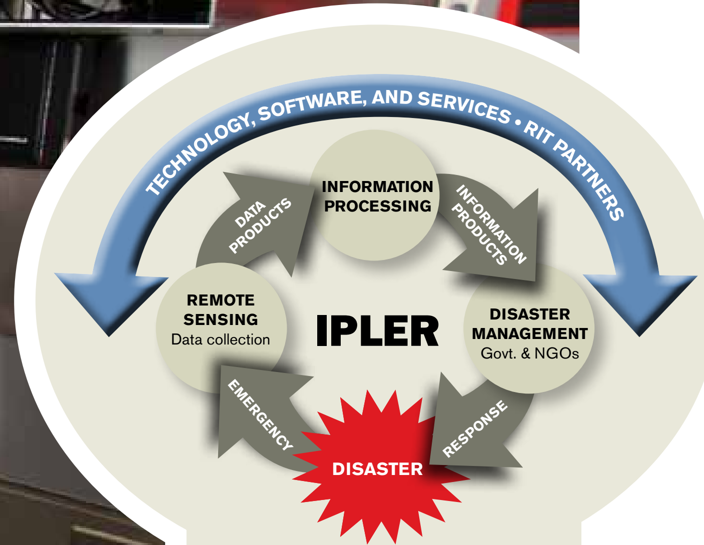
Researchers from Rochester Institute of Technology were the rookies at the virtual conference table. After the earthquake that leveled Port-au-Prince on Jan. 12, 2010, the U.S. Geological Survey gathered the key players for daily briefings—representatives from the Federal Emergency Management Agency, the National Geospatial-Intelligence Agency, the U.S. Department of Defense, NASA, and RIT.

Everyone was there for the same reason: Haiti. Reuters later reported that an estimated 30 to 40 percent of Haitian civil servants had perished in the magnitude 7 earthquake. The destruction extended to Haiti's air traffic control and hampered the international response.

The U.S. Air Force coordinated flight plans a day in advance for U.S. organizations collecting aerial images or providing airlift for ground-based relief. RIT spent seven days flying over Haiti, capturing multispectral images and light-detection and ranging (LIDAR) structural data for the World Bank. The sole university on the teleconference calls was in good company, alongside the military, National Oceanic and Atmospheric Association, Google, and various non-governmental agencies.

"We would talk directly to U.S. Air Force Southern Command





A Systems Approach: This schematic illustrates a systems approach to disaster management, linking RIT researchers, industry partners, and agencies responsible for rescue and relief. The goal of IPLER is to put information products into the hands of emergency responders and decision makers as soon after a disaster as possible.

Monroe County Office of Emergency Preparedness mobile GIS van.

to coordinate the specifics of our flight, that we were going to be over a certain area, at a certain altitude and at a certain time frame," says Don McKeown, distinguished researcher in RIT's Chester F. Carlson Center for Imaging Science.

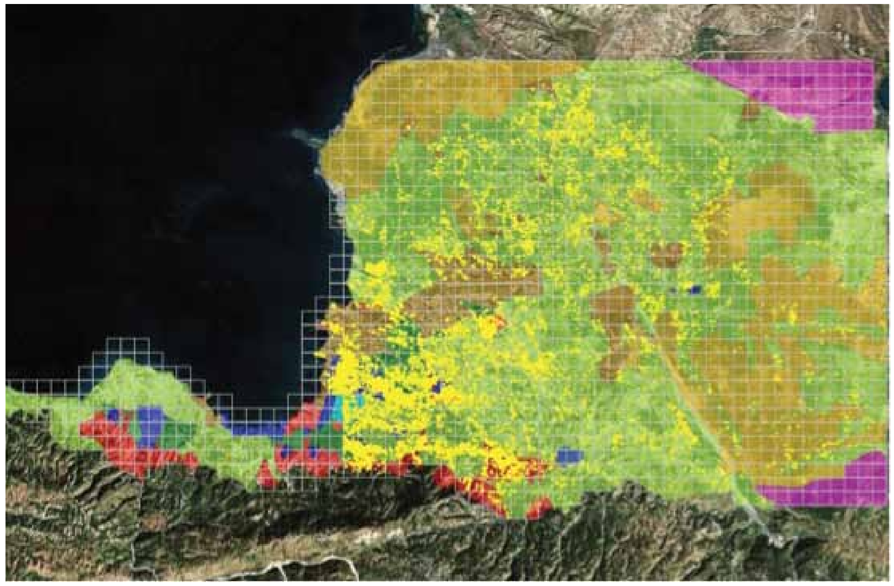
Applied Remote Sensing

How did a group of academics from RIT, a private research university more than 1,700 miles from Haiti, find itself operating alongside the U.S. military and national relief organizations in the rescue and relief effort?

The answer is tucked within the acronym "IPLER." RIT and the University at Buffalo formed the Information Products Laboratory for Emergency Response in July 2009 with a major three-year grant from the National Science Foundation Partnership for Innovation Program. The technology incubator had a tall order: to improve disaster mitigation planning, to research methods for real-time information in response and recovery efforts, and to stimulate economic development. The researchers' successful mission to Haiti proved that IPLER could do all those things.

"Shortly after the inception of the project, IPLER played a remarkable role in the response to the Haiti earthquake that has resulted in the collection of significant data to share with many international organizations," says Sara Nerlove, program director, NSF Partnerships for Innovation Program. "IPLER is using the data to enable the crafting of a valuable detection tool. We are proud to welcome IPLER as one of the newest participants in NSF's disaster preparedness portfolio."

A Record of Devastation: Displaced people set up camp on the outskirts of Jacmel, a hard-hit town on the southern shore of Haiti. RIT engineer Jason Faulring took this picture through a window of the airplane. "The first impression was that you don't see a lot on the ground and then, as you get a little closer, you start to see the devastation and the people moving around and trying to find shelter wherever they could."



High-Resolution Imaging: RIT's multispectral imaging sensor combines four cameras on one platform to capture high-resolution color and thermal infrared imagery. Raw images from Haiti were processed and analyzed to create user-friendly information products, such as the one above, for incident commanders and other decision makers. The colors in this map correspond to types of land use—residential, commercial, and industrial—while the yellow dots indicate heavily damaged buildings.

The incubator is built upon a philosophy of applied remote sensing and partnerships between academic researchers, industry members, and emergency responders working in disaster management.

"The whole focus is to stimulate economic development by moving research out of academia into industry," McKeown says. "The algorithms and information tools that we develop here would be spun off to startup companies or existing commercial partners to use."

Information Products

Information products are not just pictures; they are detailed maps, with every pixel of information translating to the location of a fire hydrant or the level of damage and location of buildings, for instance, and assigned a corresponding latitude and longitude.

Using the processed data from Haiti, David Messinger, associate research professor and director of the Digital Imaging and Remote Sensing Laboratory in the Center for Imaging Science, and Bill Basener, associate professor of mathematics, developed a simple algorithm for finding groups of displaced people sheltering under bright blue tarps. Their work demonstrated how the data could be mined to find specific targets.

"The camera system takes an image," says Messinger. "At the same time it takes that image, there's another system that records exactly where the plane is and exactly where the camera is pointed. You have to try to take the images and the information where you are and stitch them together to create a big mosaic."

A Systems Approach

A unique aspect of IPLER is the range of expertise it can draw on as part of the enhanced Digital Imaging and Remote Sensing Laboratory. The cast of characters includes physicists, systems engineers, algorithm developers, spectroscopists, computer scientists, and LIDAR experts. This dream team of researchers creates an end-to-end chain of data acquisition, processing, and dissemination that makes it unique among the remote-sensing community.

"It's a one-stop shop," says Jan van Aardt, associate professor in the Center for Imaging Science. "The way I think about IPLER is that it's a continuum between the systems that collect the data on which algorithms are applied to arrive at an information product."

The researchers are the facilitators or liaisons for technology transfer and, in some ways, matchmakers between the end user and the provider whose product or service satisfies a need. If the solution isn't readily available, they develop and customize technology to achieve specific results.

"What I think is missing in remote sensing is going to the end users and asking what problem they would like solved," van Aardt says. "People often focus on the different facets—the systems, the algorithms, the information products. They don't talk to each other. And they don't know what's possible, what's needed."

IPLER bridges the gap and facilitates communication between a network of people involved in different aspects of remote sensing and emergency response.

U.S. Air Force photo/Staff Sgt. Desiree N. Palacios

Multi-agency Coordination: The earthquake reduced air traffic control in Haiti to a card table and a few military radios manned by the Air Force. "They had no RADAR coverage," says Jason Faulring, the RIT engineer who captured multispectral images of the destruction in Port-au-Prince. "They had flights coming into the airport every five or six minutes. It was a lot of craning our necks around trying to make sure there wasn't any traffic."

3-Dimensional Photography: The 7.0 earthquake that struck Haiti Jan. 12, 2010, destroyed the National Palace, the presidential residence in Port-au-Prince. The World Bank, in collaboration with ImageCat Inc., funded RIT's efforts to provide imagery of the disaster zone in Haiti. This image combines high-resolution imagery and structural measurements captured by a light detection and ranging instrument. LIDAR uses laser pulses to make 3-dimensional elevation measurements.

The growing list of IPLER's industry partners includes ImageCat Inc., Kucera International, Pictometry International Corp., Digital Globe Inc., Optec International (formerly Geospatial Systems), and Wacom Technology Corp.

End users of information products who have joined the IPLER network consist of the U.S. Forest Service, U.S. Department of Homeland Security, New York State of Office of Homeland Security, and Monroe County Office of Emergency Management.

Case Study: Haiti

When he heard about the earthquake, McKeown sent an e-mail to Ron Eguchi, CEO of ImageCat Inc., in California, wondering if RIT's WASP multispectral imaging sensor would be useful in assessing the damage. Eguchi contacted the World Bank, which liked the idea so much it funded ImageCat, which contracted RIT, which contracted Kucera International, whose Piper Navajo aircraft was already configured to accept RIT's multispectral camera system.

"The World Bank needed a full assessment of damage, not just selected areas or 'snapshots,'" Eguchi says. "The results of our analysis would be used to establish a preliminary damage total and this information would help to establish the rebuilding needs of Haiti."

The flight crew, comprised of RIT engineer Jason Faulring—operating RIT's camera system—and two pilots from Kucera—one flying, one working a LIDAR topographical sensing system—covered 250 square miles during its seven-day mission for the World Bank, collecting 100 to 200 gigabytes of data daily.

RIT generated an estimated 1.5 terabytes of data of the damage in Port-au-Prince, Leogane, and Jacmel. External organizations have downloaded more than 40 terabytes of data from RIT's server.

"We had the most diverse data set of anyone there, including the military." McKeown says. "We had the LIDAR and the high-res imagery collected from the same platform. From all the people there, we're the only ones who had that combination of LIDAR, high-resolution color imagery, and infrared all together."

Retrieving the data, processing and disseminating it took a Herculean effort. Faculty, staff, and students worked through the night to pull the data back to RIT and to stitch the raw images into information maps.

In order to ship data back to the U.S. each day, the New York State Education and Research NETwork (NYSERNet) Internet2 consortium, facilitated by RIT Research Computing, temporarily increased RIT's bandwidth, creating a data pipeline from the University of Puerto Rico at Mayaguez to RIT. Using experimental networking tools, the two universities transferred 50 megabytes a second over thousands of miles.

"You can think of it as a baseball analogy," says Bob Krzaczek, software architect in the Center for Imaging Science. "Brent Bartlett, an RIT postdoctoral researcher in Puerto Rico, was pitching and we were catching. We had to do much of it in sync. We were simultaneously catching from the pitcher in Puerto Rico and then throwing the ball to everyone on the field who needed that data."

A New Image

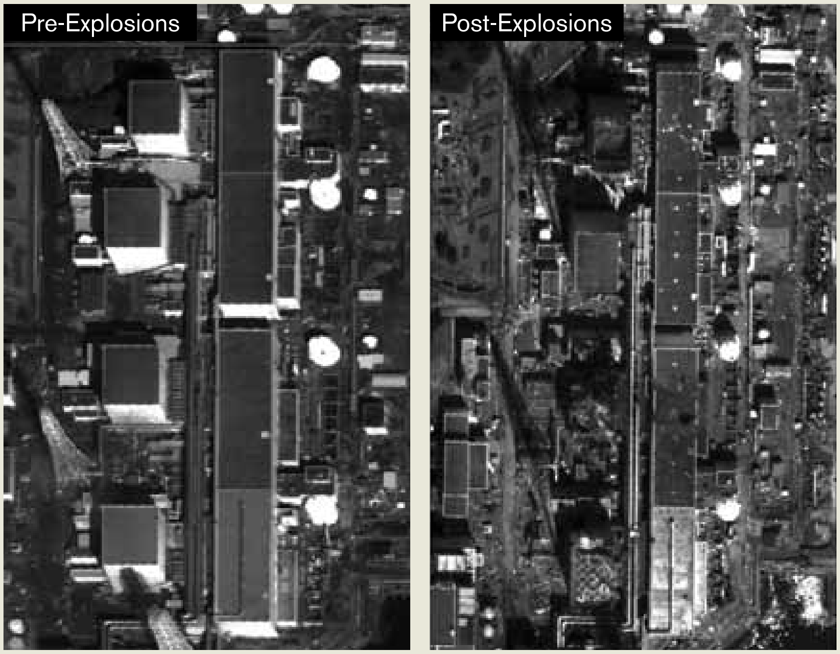
RIT's experience in Haiti increased the profile of IPLER and what it can do. It opened a door to the tightly knit disaster relief community and established relationships with entities the university had never dealt with before the crisis.

"IPLER gives us an opportunity—Haiti was the example of that—to really see the importance of the work we are doing. The research and the direct work with industry translate to a measurable impact on society," says Stefi Baum, director of the Center for Imaging Science. "And we keep finding new opportunities to grow things out of this work and these partnerships."

A grant van Aardt won from Google is a direct spinoff of the Haiti response. U.S. Air Force Capt. Rick Labiak, a graduate student in the Center for Imaging Science working on the project, is exploring the use of LIDAR to capture structural and topographical information for a rapid turnaround tool, giving incident commanders quick and accurate building-damage assessment of an area.

An NSF-sponsored integrated master's degree program at RIT in decision support technologies grew out of IPLER and trains students in policy, economics, and remote sensing aspects of disaster management. The Monroe County Office of Emergency Management, Digital Globe, ImageCat, and Pictometry are IPLER partners participating in the program.

Research in the laboratory is now moving toward automated generation of 3D information products that extract a 3D virtual world from two-dimensional pictures and LIDAR data. RIT is creating an "innovation ecosystem" in which the university drives innovation and pushes it into the marketplace, says McKeown.



Before and After: Images of the Fukushima Nuclear Power Plant processed by the RIT team from WorldView 1 and WorldView 2 satellites. The left photo is from March 12, 2011, after the earthquake and tsunami; the right photo is from March 17 showing the damage from explosions to Units 1, 3, and 4.

Emergency Response in Japan

Researchers at Rochester Institute of Technology processed satellite imagery of regions in Japan affected by the 9.0 magnitude earthquake and tsunami that devastated sections of the country's east coast on March 11, 2011. The U.S. Geological Survey, a member of the International Charter "Space and Major Disasters," organized the volunteer effort involving 10 organizations, including RIT, Harvard University, George Mason University, Penn State, and the Jet Propulsion Laboratory.

RIT's part was to process images of the Fukushima Nuclear Power Plant and the cities of Hachinohe and Kesennuma. At the request of the Japanese, scientists at RIT created before-and-after images that could be printed on large sheets of paper. The team uploaded 30-megabyte PDFs to the U.S. Geological Survey's website for charter members and Japanese emergency responders to access.

The RIT team processed the imagery looking into the reactors and the containment shells taken by a satellite on March 12, the day after the earthquake and tsunami hit and prior to the explosions at the plant. Subsequent image-maps from March 18 showed extensive damage and a smoldering reactor.

"We were tasked with producing an image map of the nuclear plant the morning of March 18th and we uploaded it about 6 that night," says Don McKeown, distinguished researcher in the Carlson Center for Imaging Science.

The 13-hour time difference made the workflow difficult, notes Dave Messinger, associate research professor and director of the digital imaging and remote sensing laboratory. "While we're doing this here, it's the middle of the night there, so the feedback loops are slow."

The RIT team mapped the area surrounding the power plant as well, processing imagery for a broader view of the terrain used as farmland. "We prepared a large image of Fukushima," McKeown adds. "This is an agricultural region potentially subject to restrictions for food originating in this area."

The RIT team, led by McKeown and Messinger, includes graduate students Sanjit Maitra and Weihua "Wayne" Sun in the Center for Imaging Science and staff members Steve Cavilia, Chris DiAngelis, Jason Faulring, and Nina Raqueño. They created the maps using imagery from WorldView 1 and WorldView 2 satellites operated by Digital Globe, a member of RIT's Information Products Laboratory for Emergency Response (IPLER), and GeoEye 1, a high-resolution commercial satellite operated by GeoEye Inc.

"This really fits what IPLER is all about–information products," McKeown says.

On the Web

For more information about the Information Products Laboratory for Emergency Response visit http://ipler.cis.rit.edu/.

Mapping Lake Kivu

Anthony Vodacek

Alvin Spivey

A dangerous level of carbon dioxide and methane gas haunts Lake Kivu, the lake system bordering the African nations of Rwanda and the Democratic Republic of the Congo.

Scientists can't say for sure if the volatile mixture trapped at the bottom of the lake will remain still for another 1,000 years or someday erupt to the surface without warning. With two active volcanoes bordering the lake and frequent earthquakes in the region, the fragility of Lake Kivu is a serious matter to the approximately 2 million people living along the lake.

RIT imaging scientist Anthony Vodacek is part of an international team of researchers that is working to analyze the lake system and promote the development of local scientific and environmental expertise to address the situation.

As part of the larger effort, Vodacek, associate professor in the Chester F. Carlson Center for Imaging Science at RIT, is partnering with Rwandan scientists to map the physical, chemical, and biological characteristics of the lake system. These baseline measurements will help determine the scenarios that may disrupt Lake Kivu and cause a gas release.

Preventing Disaster: RIT imaging scientist Anthony Vodacek is part of an international research team that is working to analyze and ultimately reduce the danger of explosion at Lake Kivu, a volcanic lake that borders the African nations of Rwanda and the Democratic Republic of the Congo.

"By analyzing potential triggers for a catastrophic gas release, we can develop an early warning system," Vodacek notes.

The regional governments are beginning to extract the methane to simultaneously generate electricity and reduce the gas eruption threat. Vodacek attended a workshop in Rwanda in February where scientists discussed safe methods for extracting the gas without disruption to the lake.

In addition, Alvin Spivey, a doctoral degree student in imaging science, is currently working in Rwanda with Vodacek's team to enhance the use of imaging techniques in additional humanitarian initiatives in the country.

Vodacek also co-organized a National Science Foundation sponsored scientific workshop in 2010 to focus international scientific attention on the project and is also working with the Rwandan Ministry of Education to promote exchange programs for Rwandan students looking to study in America.

"Lake Kivu is an international problem and requires an international effort to address it," Vodacek says.

Motion Picture Science

David Long

Filmmaking is a science. Hollywood actors and directors may be the public faces of Hollywood, but there would not be movies without engineers and technologists.

Prior to joining the faculty of RIT's School of Film and Animation, David Long, program chair of RIT's digital cinema BS program, worked on the technical side of filmmaking. As a former imaging scientist at Eastman Kodak Company's Entertainment Imaging Division, part of his job was to use science and engineering principles to render image color and tone appearance the way cinematographers wanted.

"I came from a world where I catered to professional image makers," says Long.

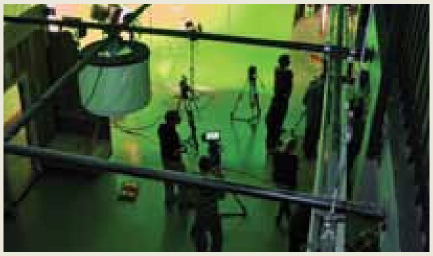
Long, who teaches in RIT's College of Imaging Arts and Sciences, teamed up with RIT's Center for Imaging Science to develop a degree program for students who want to pursue careers solving real-world engineering problems, like color reproduction, post-production engineering, and equipment design for the motion picture industry.

While at Kodak, Long worked on the VISION 2 family of motion picture color negative films. His role on the project was to understand the physics of color reproduction, light capture, and image aesthetics to aid in designing the photographic behaviors of the films. In 2008, The Academy of Motion Picture Arts and Sciences honored Long and three other Kodak employees with an Academy Award for their work on the VISION 2 technology.

"There are just as many if not more engineering and technology jobs in the motion picture industry than creative jobs," Long says. "I always convey to my students that film without technology would merely be theater."

To better reflect its applied science and engineering-based curriculum, the digital cinema degree program is changing its name to motion picture science, pending NYS approval.

"The degree is essentially motion picture engineering," says Long. "Legacy engineering programs are all built upon a foundation in the natural sciences. Electrical engineering is built upon physics; chemical engineering is built upon chemistry. Our degree is built fundamentally on imaging science, a mixture of physics, computer science, optics, and some chemistry.



Film as Science: Students in the digital cinema program conduct a technical evaluation of film and digital motion picture cameras during a green-screen compositing test at the School of Film and Animation's main studio.

Our graduates are prepared to jump into a career in various motion picture technologies whether it's image capture or digital imaging processing or ultimately exhibition, which includes television and Internet broadcasting and theatrical projection."

The program currently enrolls 45 students. It launched in 2007, graduating its first class in May. RIT students all landed jobs as research engineers and post-production engineers.

"We are very excited to have 100 percent placement in the film industry with our first class."

Richard Allen and the Black Founders: Colonial historian and author Richard Newman is dedicated to promoting the lives and legacy of the Black Founders, a group of activists and community leaders that were as important to the founding of the United States as George Washington and John Adams. Chief among these is Richard Allen, founder of the AME Church and the first African-American to eulogize an American president. Newman's book *Freedom's Prophet* is the first comprehensive biography of Allen and his impact on civil rights and black society.

Celebrating the Black Founders

by William Dube

While most Americans have a general knowledge of the modern civil rights movement, African-American activism dates back to the Revolutionary War. History professor Richard Newman is dedicated to promoting the legacy of these Black Founders and their continued impact on American democracy.

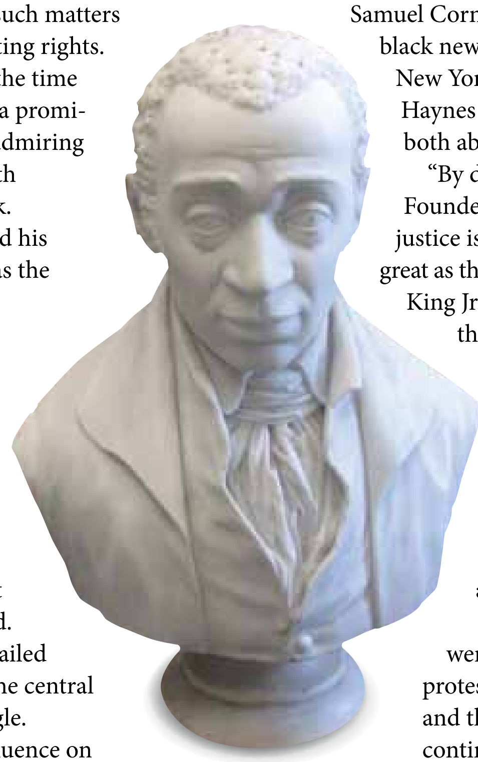
An Unknown Founding Father

Richard Allen of Pennsylvania was a central figure in debates over American freedom during the late 1700s and early 1800s, meditating on such matters as federal power, civil liberties, and voting rights. From Washington's administration to the time of Jacksonian Democracy, he was also a prominent orator and religious leader, with admiring readers stretching from Boston to South Carolina. He also happened to be black.

Allen—a former slave who purchased his own freedom at nearly the same time as the United States was born—was a man of many firsts. He became one of the first black authors to hold a copyright for an anti-slavery pamphlet he published in 1794 and the first African-American to print a eulogy of President George Washington, in 1799. He also founded the African Methodist Episcopal Church (AME), which was one of the first independent black religious institutions in the world. None other than Frederick Douglass hailed Allen's leadership, calling him one of the central influences on the black freedom struggle.

Yet Allen's accomplishments and influence on democratic society have been little publicized in modern history books and discussions of the Founding Fathers. Promoting Allen's legacy and that of his fellow Black Founders has been a central research theme for RIT's Richard Newman for nearly 15 years.

"Allen helped inaugurate our modern conception of democracy," notes Newman, professor of history in the College of Liberal Arts. "At a time when many people supported slavery, and few of the nation's political leaders advocated equality across racial lines, Allen argued that the American dream enshrined liberty and justice for all, regardless of race or ethnicity."



A Forgotten Founding Father: Richard Allen was a black activist and a contemporary of George Washington and Thomas Jefferson. He was one of the central figures in the fight for abolition, and equal rights for African-Americans, during the Constitutional Convention and the early years of the United States.

And Allen was not alone. Prince Hall formed the first black Masonic Lodge during the Revolutionary War and petitioned for equal schooling in Massachusetts, while Samuel Cornish and John Russwurm founded the first black newspaper in the U.S., *Freedom's Journal*, in New York City in 1827. In Connecticut, Lemuel Haynes fought in the Revolution and argued for both abolitionism and equality.

"By detailing the lives of Allen and other Black Founders, I hope to show that the struggle for racial justice is as old as the nation itself," Newman adds. "As great as they were, even Frederick Douglass, Martin Luther King Jr., Fannie Lou Hamer, and others owed a debt to the Black Founders for innovating the first civil rights movements in American culture."

An Underreported History

Newman argues that black contributions to early American history are not widely known in large part because of the specific circumstances these men and women faced at the time.

Prior to the American Revolution, there were few printed outlets for black writing and protest, due to the lack of black-owned newspapers and the prejudices of white publishers, Newman continues. In addition, many colonies outlawed the education of slaves, so there are relatively few diaries or literary archives. And black activists were constantly mindful of possible backlash from white authorities, who worried about slave uprisings, so many activities were conducted in secret.

But during the Revolutionary era, African-Americans used debates over American rights and freedom to focus on racial injustice. They began publishing newspaper essays against slavery, reprinting sermons supporting black equality, and petitioning courts for their own freedom.

"By 1829, African-American writers produced roughly 1,500 pieces of literature of one kind or another," Newman notes. "It's really astonishing."

An Underreported History

1760 Richard Allen born as enslaved child to Benjamin Chew of colonial Pennsylvania.

1765 Colonists protest British Stamp Act, calling themselves "slaves" to the British.

1773 On Jan. 6, enslaved people in Massachusetts petition the colonial legislature for freedom from bondage. In December of that year, Patriot radicals dump British tea into Boston Harbor.

1776: Declaration of Independence enshrines equality as the new American nation's leading principle. That same year, Black Revolutionary War Veteran Lemuel Haynes writes "Liberty Further Extended" in defense of universal freedom.

1780: The state of Pennsylvania issues the first gradual abolition act in the United States, granting people born after this date freedom at age 28.

1783: Richard Allen buys his own freedom from his second master in Delaware; he moves to Philadelphia soon after.

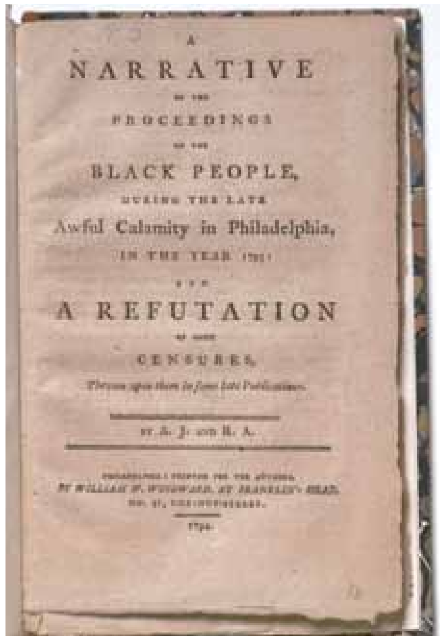
1787: Constitutional Convention meets in Philadelphia to form a "more perfect union" but gives masters rights to reclaim fugitive slaves, among other things. That same year, Allen and Philadelphia blacks form the Free African Society to help build community relations and businesses.

1790: First U.S. Census counts over half a million enslaved people in the North and South.

1791-2: Allen and several black congregants walk out of a segregated white church in Philadelphia.

1794: In January, Richard Allen and Absalom Jones publish the first copyrighted document by African-Americans in Philadelphia claiming equal citizenship and challenging Americans to end racial discrimination and slavery. In July, Allen's Bethel African Methodist Episcopal Church, one of the first autonomous black churches in the United States, is dedicated in Philadelphia.

1799: Allen delivers a eulogy of George Washington in his AME Church, pushing Americans to become abolitionists, a story published in newspapers in Philadelphia, New York City, and Baltimore. That same year, a black anti-slavery petition is rejected in Congress on the grounds that African-Americans were not citizens.



A NARRATIVE OF THE PROCEEDINGS OF THE BLACK PEOPLE, DURING THE LATE Awful Calamity in Philadelphia, IN THE YEAR 1793: AND A REFUTATION OF SOME CENSURES, Thrown upon them in some late Publications.

BY A. J. AND R. A.

1794.

Pamphlets of Protest: The pamphlet was the chief vehicle used by early black activists to communicate their message. The above, co-written by Richard Allen, promoted equal treatment for blacks in Philadelphia in the 1790s.

To uncover the true depth of early black protest, Newman has had to be a private investigator as well as an historian. This included traveling to historic sites, museums and libraries across the country and searching the archives of the AME Church, the Massachusetts and Pennsylvania Historical Societies and the writings of Frederick Douglass.

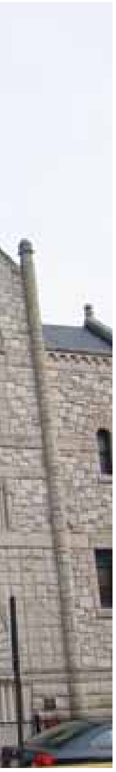
In addition, Newman spent years working at the Library Company of Philadelphia, one of the nation's oldest libraries, where he focused on Richard Allen's world. He learned that Allen lived only blocks away from the Pennsylvania State House, where Jefferson, Madison, and Washington—each of whom owned slaves—had imagined a nation dedicated to the principle of equality. Allen believed his job was to rectify that contradiction.

Newman unearthed numerous documents detailing the broad push for abolition and black rights during the new nation's first few decades, many of which had been marginalized even among scholars.

This included early pamphlets and petitions written by Allen and other black activists chronicling their efforts to end segregation, ban the overseas slave trade (which occurred in 1808), and destroy slavery itself (which grew from 700,000 enslaved people in 1790 to over 2 million by the 1830s). Newman also examined early court cases brought by both abolitionists and black reformers in Pennsylvania and Massachusetts that attempted to set legal precedents for the anti-slavery movement.

As Allen wrote in a stirring 1794 memorial to white Congressmen assembling in Philadelphia, which served as the nation's temporary capital until 1800, "if you love your children, if you love your country, if you love the God of love, clear your hands from slaves, burthen not your children or your country with them."

"It is really fascinating to think about how these men and women thought they



Mother Bethel AME Church: Richard Allen founded the African Methodist Epicopal Church, which is now one of the largest black churches in the U.S. Richard Newman conducted numerous investigations of the Allen archives at the Mother Bethel Church in Philadelphia. The church also serves as a key monument to Allen and the Black Founders.

could change people's minds," Newman says. "Many people did not even see Allen as a citizen! When he and other African-Americans petitioned the federal government to end slavery and the slave trade in 1799, the petition was given back to them. 'We the people' does not mean them, one slaveholder shouted. But Allen kept fighting."

Newman adds, "In researching Black Founders it became apparent that an accurate record of the early civil rights struggle would depend on reprinting their original words and ideas. By seeing what black activists actually wrote in the era of Thomas Jefferson, Americans as a whole could better understand the long struggle for equality. This is not a recent development."

Creating the Record

To accomplish this goal, Newman has written and spoken widely on the topic of the Black Founders.

He worked with fellow historians Patrick Rael, chair of the department of history at Bowdoin College, and Phil Lapsansky, an archivist with the Library Company of Philadelphia, to edit the book *Pamphlets of Protest: An Anthology of Early African-American Protest Literature, 1790-1860*. It is one of the first comprehensive surveys of early African-American writing, chronicling the sophisticated use of the pamphlet form by black authors, who saw it as an innovative technology of freedom.

"Spanning from the American Revolution through the Civil War, this volume brings together for the first time representative writings of the nation's most powerful and (too often) most under-appreciated critics of slavery and white supremacy," says James Brewer Stewart, the James Wallace Professor of History at Macalester College.

Newman followed that work with *The Transformation of American Abolitionism*,

1808:	Congress bans the overseas slave trade.
1818:	Frederick Douglass born as enslaved child in Maryland.
1830:	Enslaved population in the southern United States grows to over two million people. Richard Allen holds first national convention of black activists in Philadelphia.
1831:	In March, Richard Allen dies in Philadelphia at the age of 71. That same year, white abolitionist William Garrison publishes *The Liberator* in Boston.
1852:	On July 5, Frederick Douglass gives his most famous speech, "What to the Slave is the Fourth of July?"
1860	Abraham Lincoln elected; by the winter of 1861, seven southern states secede, led by South Carolina, which declares Lincoln's administration "hostile to slavery."
1863:	Lincoln issues Emancipation Proclamation; Douglass meets Lincoln in the White House.
1865:	Civil War ends; Congress issues the 13th Amendment, banning slavery in the U.S.
1893:	At Chicago World's Fair, Frederick Douglass hails Richard Allen as one of the nation's greatest figures.
1895:	Frederick Douglass dies.
1896:	Supreme Court issues decision in Plessy versus Ferguson, which establishes "separate but equal" as the law of the land.
1954:	Brown vs. Topeka Board of Education Supreme Court case declared state laws establishing separate public schools for black and white students unconstitutional.
1955:	Montgomery Bus Boycott begins when Rosa Parks, a member of the Allen's AME Church in Alabama, refuses to give up her seat to a white person on a local bus.
1963:	Rev. Dr. Martin Luther King Jr. gives his "I Have A Dream" speech in Washington.
1964:	Civil Rights Act of 1964 is passed. It outlawed major forms of discrimination against blacks and women.
1964:	Civil Rights Protest and Race Riot in Rochester in July.
1965:	Malcolm X visits Rochester.
2008:	Barack Obama elected president of the United States.

a book on the way that African-American protesters changed the anti-slavery movement. Most recently, he authored *Freedom's Prophet: Richard Allen, the AME Church, and the Black Founding Fathers*, the first comprehensive biography of Allen, chronicling his life and influence on latter-day reformers including William Lloyd Garrison and Frederick Douglass.

"This compelling study joins the first ranks of recent work that has profoundly expanded our understanding of the formation of African-American community and identity in pre-Civil War America," notes distinguished historian James Oliver Horton, author of *Slavery and the Making of America*.

Freedom's Prophet won *Forward Magazine's* 2009 Book of the Year Award for Biography and was nominated for several other awards. Newman has discussed the book on public radio and on C-SPAN's Book-TV and *Freedom's Prophet* was reviewed by numerous national publications, including *The New York Review of Books* and *The New Republic*.

"A diligent and creative scholar, Newman weaves a forceful biography from slivers of scattered evidence found in old newspapers, probate inventories, court decisions, and church records," Alan Taylor wrote in *The New Republic*.

The publicity and acclaim for the book has led to a new examination of Allen and his importance as a historical figure both by scholars and the general public.

"It truly has been gratifying to have been able to play a part in increasing Richard Allen's renown and prominence as a seminal figure in American history," Newman says.

Promoting Black History via C-SPAN: Newman participated in a special C-SPAN series on American history. The network broadcast from his classroom during his lecture on Richard Allen and the Black Founders. Newman has also promoted Allen's legacy through a series of workshops for high school history teachers through a grant from the National Endowment for the Humanities.

The Black Founders: Until recently, Richard Allen and his contemporaries were not generally acknowledged as Founding Fathers. Richard Newman has sought to promote the equally important role the Black Founders played in the founding of the United States.

A Lasting Legacy

Newman has also worked to enhance academic consideration of early black history and increase the teaching and understanding of the subject in high school and college classrooms.

He serves as co-editor of the book series *Race in the Atlantic World 1700-1900* through University of Georgia Press, which seeks to promote writing and scholarship in black history across several continents, and as a distinguished lecturer for the Organization of American Historians, conducting talks on the Black Founders at college campuses across the country.

Newman also co-organized the international symposium "Atlantic Emancipations" at the University of Pennsylvania's McNeil Center in 2008, which brought together nearly 40 leading scholars in African-American history for the commemoration of the 200th anniversary of the end of the international slave trade.

Newman has also conducted a series of summer workshops sponsored by the National Endowment for the Humanities that seeks to provide high school history teachers with a better understanding of early black history and assist them in incorporating the Black Founders into their curricula.

"The easiest way to guarantee that future generations of Americans remember the Black Founders is to tell their story right along with the better-known Founding Fathers, in high school and college classrooms, history museums, and Independence Day celebrations," Newman says. "It is my hope the research and outreach efforts I have undertaken will ultimately ensure that the work of Richard Allen and his compatriots will be as well known as the contributions of Jefferson, Washington, and Adams."

On the Web
Learn more about the Richard Allen and his legacy at http://www.motherbethel.org/.

Enhancing Native American Communities

Roger Dube

Jeffrey Burnette

Jason Younker

RIT imaging scientists are working with the Ganondagan State Historic Site—a Native American resource and education center—and the New York State Department of Parks and Recreation to map the spread of swallow wart, an invasive species and poisonous plant that can trick monarch butterflies into laying their eggs in its pods due to the plant's similarity to native milk weed pods.

"Butterfly eggs laid in swallow wart will not hatch, so the spread of these plants is negatively impacting the local monarch population, while also inhibiting native plants and the overall ecology of the region," notes Roger Dube, professor of imaging science at RIT. "We are using global positioning technology to analyze the spread of the plant and to assist in collection."

The RIT team uses GPS to identify and locate swallow wart infestations, and then works with parks and recreation to eradicate the plants. A pilot removal program was undertaken last summer at Ganondagan and the team hopes to work with the tribes of the Iroquois Confederacy as well as parks and recreation to duplicate the effort at other sites throughout the state.

Preventing Invasive Species Growth: Workers remove swallow wart from the Ganondagan State Historic Site. RIT is working with Ganondagan to map the spread and assist in removal of the invasive species, which is endangering the local plant and butterfly populations.

The project is part of a larger partnership between RIT and Ganondagan to integrate the use of Native American techniques to support modern sustainability and environmental responsibility efforts in the region. The initiative also includes Jason Younker, associate professor of anthropology, and Jeffrey Burnette, lecturer in economics.

Environmental Policy, Politics, and Oysters

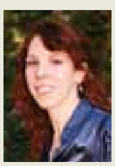


Photo by Sonia Keiner.

Christine Keiner

Research by RIT professor Christine Keiner is shedding new light on how a combination of political, economic, and social factors maintained Maryland's iconic oyster industry for most of the 20th century despite intense pressure to privatize the rich oyster reefs of the Chesapeake Bay, the nation's largest estuary.

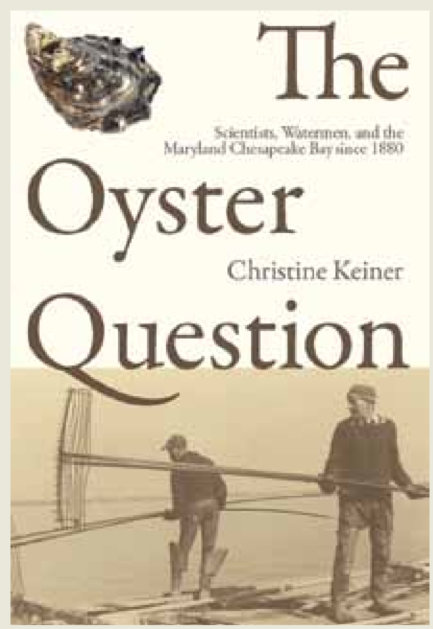
Keiner, associate professor of science, technology and society in the College of Liberal Arts, integrated perspectives from environmental, agricultural, political, and social history to chronicle the decisions that enabled the Maryland Chesapeake oyster industry to survive as a regulated commons in an increasingly industrialized and privatized world economic system.

Her book on the subject, *The Oyster Question: Scientists, Watermen, and the Maryland Chesapeake Bay since 1880,* was published by the University of Georgia Press in 2010 and has since been released in paperback. The book won the 2010 book prize from the Forum for the History of Science in America, which focuses on research, scholarship, and education surrounding the history of scientific inquiry and practice in the United States.

"Rather than epitomizing the 'tragedy of the commons' thesis, the Maryland oyster fishery has served as a positive, if imperfect, model for a world undergoing increased corporate control of natural resources," Keiner says. "Through this book I hope to provide answers as to how and why this industry managed to survive for so long, to help provide a useful historical foundation for current environmental policymaking efforts in both the Chesapeake region and beyond."

While many experts have argued that a lack of regulation enabled oystermen to exploit the bay to the point of ruin, Keiner offers an opposing view in which state officials, scientists, and oystermen created a regulated commons that sustained tidewater communities for decades.

Keiner's research is one of the first comprehensive environmental histories of the Maryland oyster industry and also provides new insights regarding the evolution of U.S. environmental politics at the state rather than the federal level.



A New History of the Chesapeake: RIT professor Christine Keiner has completed one of the first environmental histories devoted to Maryland's iconic oyster industry, centered around the Chesapeake Bay, the nation's largest estuary.

Wearable Blast Gauge: An RIT team led by David Borkholder has engineered and tested a device that collects data about a soldier's exposure to explosive blasts. The gauge is attached to a soldier's uniform or helmet and could assist with field triage.

Blast Gauge Delivers Critical Data

By Kara Teske

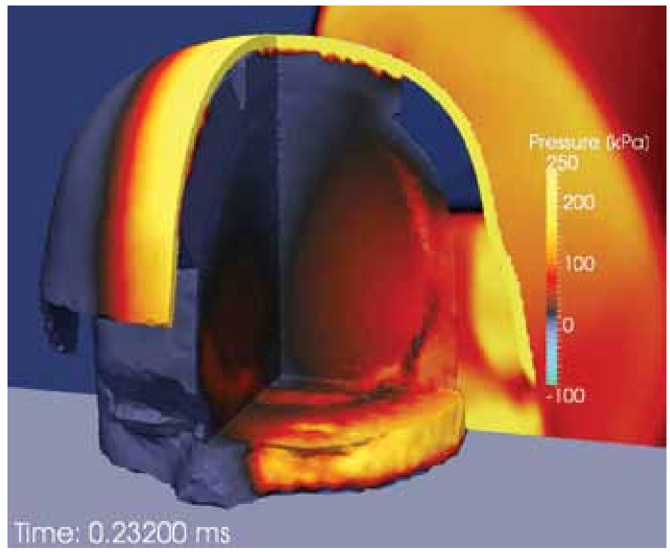
Traumatic brain injury is emerging as a significant challenge for veterans. RIT assembled a response team that engineered a dosimeter device to monitor blast exposure, which in the future could assist with field triage to identify injury long before physical and cognitive symptoms arise.

A Reality of War

According to the Defense and Veterans Brain Injury Center established by Congress, 188,270 service members have suffered a traumatic brain injury in the last decade. The extent of injury is often difficult to discern, making diagnosis and selection of appropriate medical treatment challenging.

When a solider is exposed to a blast, shockwaves can cause a series of complex mechanical and physical reactions in the brain. These blast waves can induce tissue strains and stress, which may result in brain damage. Currently, no experimental data for humans exists to correlate pressure and stress on the brain with an actual explosive event that could assist with predicting brain injury. Through an effort funded by the Defense Advance Research Projects Agency (DARPA), a team of RIT engineers has responded to this critical need by designing, engineering, and testing a blast measurement device that in the near future could be used to assist with field triage.

Dr. David Borkholder, associate professor of electrical and microelectronic engineering, assembled a project team consisting of Dr. Lynn Fuller, professor of electrical and microelectronic engineering; two senior engineers, Gary Parrett and Werner Fassler; a recent RIT engineering graduate, Matthew Waldron; and staff assistant JoEllyn Tufano. Andrew Blair, an Army ROTC cadet; Stefan Wojick, a former U.S. Marine; Aalyia Shaukat; and Sigitas Rimkus, all undergraduate engineering students, are also involved in the project, participating in design work as well as system testing.



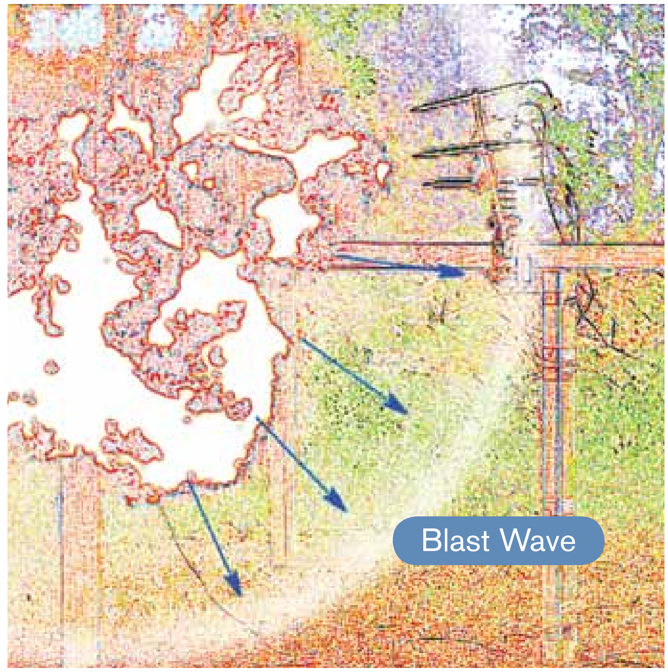
Simulation created and provided by Dr. Raul Radovitzky, Massachusetts Institute of Technology.

Blast Exposure: When a solider is exposed to a blast, a compression wave propagates through the cranial cavity, causing strain and stress to the brain.

Blast Gauge Response Team: RIT assembled a multidisciplinary team that in 12 months designed, engineered, and tested a data-logging device for use in the battlefield.

Engineering a Solution

To provide information for field triage and long-term care, the blast gauge measures pressure, 3-axis head acceleration, and logs the time of the event. In addition, and perhaps even more challenging, the device is intended to be a disposable weighing less than one ounce and constructed from off-the-shelf components. “To equip a mass of deployed soldiers, each carrying significant weight, it is critical the device be lightweight and disposable,” explains Borkholder. “While the core technology exists, the challenge is customizing the capabilities through creative engineering and integrating the components into a single system that provides a practical solution for the military.”



Supersonic Wave: A supersonic wave collides with the crash test dummy during a validation test conducted in South Carolina at NEWTEC Services Group, Inc. The data collected will help characterize the space and improve the accuracy of the device.

It's not as simple as knowing when a blast occurs and that a soldier was exposed. The impact and characteristics of a blast depend on the explosive itself and the physical environment and orientation of the soldier. Blast wave interactions with structures can result in reflected waves, which influence overall exposure dose and resulting injury. Accurate measurement of full exposure coupled with integrated analysis algorithms provides specific information that may enable field triage immediately following an explosive event, and that may aid in determination of the most appropriate long-term treatment.

Another challenge addressed by the algorithm is determining when a true explosive event occurs. Acceleration events, as simple as dropping a helmet or tripping, could trigger a false event. The algorithm is able to distinguish and trigger on true blast events, thereby avoiding false triggers associated with acceleration. To protect the sensor from the environment and non-pressure events, while still allowing accurate measurement of the pressure waveform associated with explosive blast, the team designed a protective dome over the sensor, which was tooled in RIT's Mechanical Engineering Machine Shop by Robert Kraynik.

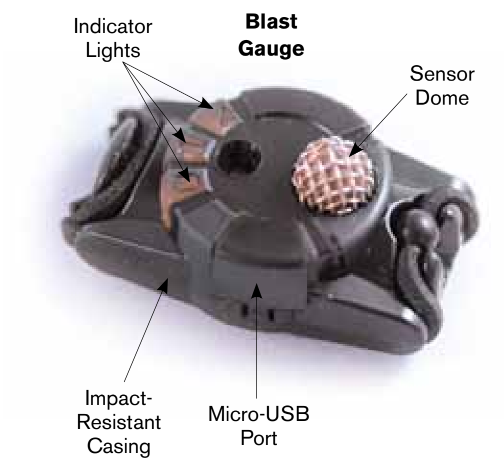
A microprocessor controls the device and integrates all commercially available components. The team developed an electrical architecture that effectively minimizes the components, which equates to savings in power, weight, and cost. Embedded software interfaces with the sensors at speeds fast enough to capture the rapid blast events. Significant pressure changes occur in a few millionths of a second and the device needs to collect data, determine if it is a blast event, and store only real blast events. "Being able to collect this information continuously and at fast enough speeds was no trivial task," adds Borkholder.

Three light-emitting diode (LED) lights provide exposure information to the soldier while a micro-USB port allows a field medic the ability to download the data.

Initial prototyping was conducted using the Brinkman Machine Tools and Manufacturing Laboratory's 3-D printer. "This tool was especially helpful in quickly prototyping housings and mounting mechanisms." Kim Sherman, founder of Think Design and lecturer in industrial design, helped to refine the design and functionality of the device. The unit was designed with a flexible mounting system allowing comfortable attachment to the soldier's helmet, vest, or gear, and to physical structures such as within vehicle cabins.

Field Validation

Extensive explosive testing was conducted at RIT and in South Carolina at NEWTEC Services Group, Inc. At RIT, the team developed a safe way to create an explosive event using propane and oxygen. The constructed cannon generates pressure in a matter of milliseconds that resembles that of a real explosive event.



Blast Gauge: The data-logging device measures pressure, resulting head acceleration, and time to help correlate blast events with injuries. The compact device weighs less than one ounce, making it easy for soldiers to wear.

Explosives Testing: Weighted crash test dummies are used to simulate a soldier in the field. A number of orientations are used to allow the team to characterize the space and inform the device algorithms.

The on-campus setup allowed the team to refine their device before traveling to South Carolina for field explosives testing. In South Carolina the team worked with Keith Williams, a retired Navy SEAL, to conduct the explosives testing using weighted crash test dummies to simulate a soldier in the field. A number of orientations were used to allow the team to characterize the space and inform the device algorithms.

Back at RIT, additional testing was conducted in the Center for Integrated Manufacturing Studies' Environmental Chambers to see how the device withstands extreme heat, cold, and humidity. An acceleration shaker also helps to validate the gauge's ability to distinguish a pressure event from an acceleration event to avoid false positives.

First Generation

The first-generation devices were provided to DARPA for field testing this April. Because it is such a complex problem significant data needs to be logged along with tracking soldier deficits over time to be able to correlate blast exposure with injury. "The more sensors that we are able to deploy, the stronger the data will be," explains Borkholder. Once enough information is gathered, a field medic will be able to use the device's data to determine what a soldier has been exposed to and assist with field triage.

In just 12 months the RIT team responded to this critical need by designing, engineering, testing, and providing first-generation units for testing. "This is a unique project for academia," Borkholder says. "It mirrors the rapid product development usually found in industry." There are very specific performance specifications and expected outcomes that were continually refined in close collaboration with DARPA program manager Jeff Rogers based on the latest research on traumatic brain injury, he explained. Borkholder's experience in industry and as an entrepreneur provided him with the know-how to deliver a complete system design product in an academic setting. "The laboratories and capabilities at RIT are truly unique for a university," adds Borkholder. "These facilities allowed us to respond quickly with a tangible solution for DARPA." This research has resulted in the formation of a company, BlackBox Biometrics™, which plans to commercialize the device in 2011.

Note:
The views, opinions, and/or findings contained in this article are those of the author and should not be interpreted as representing the official views or policies, either expressed or implied, of the Defense Advanced Research Projects Agency or the Department of Defense.

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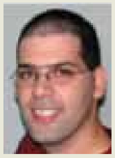
On the Web
To learn more about David Borkholder and his research, visit people.rit.edu/dabeee.

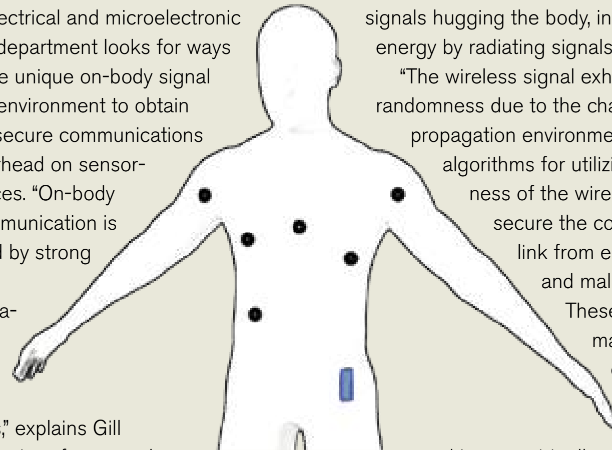
Wireless Body Sensor Networks



Gill Tsouri

Expected growth of elderly populations and the corresponding increase in healthcare costs mandate systems for automated monitoring of physiological conditions, triage, and remote diagnosis. Automated physiological monitoring plays a part in smart-soldier applications and assessment of modern battlefields as well. Wireless communication has a critical role in facilitating the technology by allowing the gathering of data from compact sensor-nodes distributed on the body and by providing a link to the Internet for remote diagnosis. A body sensor-node operates under strict design constraints, such as low computation power and energy consumption. The wireless transceiver is the largest energy-consuming component, and securing the communication link requires resources unavailable to a compact sensor-node.

Ongoing research in the Communications Lab at the electrical and microelectronic engineering department looks for ways of utilizing the unique on-body signal propagation environment to obtain reliable and secure communications with low overhead on sensor-node resources. "On-body wireless communication is characterized by strong and dynamic signal attenuation due to mobility and shadowing of body parts," explains Gill Tsouri, assistant professor and director of the Communications Lab. "Our research aims to utilize the tendency of wirelessly propagating signals to bend around the curvature of the body as an alternative to existing methods of transmission.



Wireless Body Sensor Networking: Wireless sensor-nodes facilitate automated monitoring of physiological condition, triage, and remote diagnosis

The result is a communication link based on signals hugging the body, instead of wasting energy by radiating signals to open space.

"The wireless signal exhibits intrinsic randomness due to the changing signal propagation environment. We design algorithms for utilizing the randomness of the wireless signal to secure the communication link from eavesdropping and malicious attacks. These algorithms make use of existing data-carrying signals and impose virtually no overhead on system resources."

A prototype is being developed and tested in the Communications Lab with application to wireless electrocardiogram systems. The work is supported by Blue Highway, a Welch-Allyn company.

Veterans with Hearing Loss

Allen Ford

According the U.S. Department of Veterans Affairs, more than 128,000 veterans have returned from overseas combat in the past decade with tinnitus, which is a debilitating ringing in the ears, or some level of hearing loss. These veterans return home finding it difficult to communicate, and according to Allen Ford, assistant professor and coordinator of RIT's Veterans with Hearing Loss program, they struggle to overcome their new disability.

"They sometimes feel embarrassed, isolated, frustrated, and angry," explains Ford. "Depression is a common side effect of hearing loss because the veterans become isolated from other people around them."

The Veterans with Hearing Loss program is designed to empower these veterans by retraining them for their post-combat lives. Through the GI Bill, individuals receive tuition, housing, and book allowances to cover the cost of attending a state-run college or university. As a "Yellow Ribbon" partner, RIT and the VA pick up the additional cost associated with a private university education. Students receive support through RIT's National Technical Institute for the Deaf, which provides educational access services that include note taking, C-Print captioning, and audiology services for cochlear implant mapping.

Cochlear Implant Mapping: Amanda Picioli, an audiologist with RIT's National Technical Institute for the Deaf, programs a student's implant to ensure its maximum effectiveness. Mapping is among the access services available to participants of the Veterans with Hearing Loss program.

"All of this means that veterans with a hearing loss who come to RIT benefit from world-class private university education at little or no cost," says Ford.

Coordinators of RIT's Veterans with Hearing Loss program are reaching out nationally to encourage participation by qualified veterans. For more information, visit www.rit.edu/ntid/veterans.

Innovation and Entrepreneurship

by William Dube

When an RIT student has an idea for a new company, when a faculty member wants to commercialize a technology, or when an alum is looking to develop a business, they have to look no farther than the RIT campus to get the assistance necessary to make their idea a reality.

Taking Ideas to Market: Bill Jones, director of RIT's Venture Creations business incubator, works with RIT faculty, students, and alumni to help transform research and entrepreneurial initiatives into working business enterprises. The incubator currently houses 24 companies and the Clean Energy Incubator, a partnership with RIT's Golisano Institute for Sustainability and the New York State Energy Research and Development Authority.

Creating Business on Campus

The Venture Creations business incubator utilizes RIT's research and educational expertise to create new business opportunities and assist current incubator companies in business planning, research and development, and technology commercialization.

"We serve as a conduit through which RIT faculty, students, and alums can develop their innovations into entrepreneurial ventures and assist additional entrepreneurs in bringing their ideas to market," says Bill Jones, interim director of Venture Creations.

The incubator focuses on three domains: sustainability, imaging, and bio-x, which correlate to RIT's strategic research priorities, and currently houses 24 companies accounting for over 100 full-time positions.

Tenants include Flux Data, cofounded by an RIT alumnus, which manufactures multispectral imaging systems and provided camera technology for use on the International Space Station, as well as the software development firm Darkwind Media, which was started by three RIT students and grew out of medical imaging research conducted by the department of medical sciences.

Jones and his staff work with incubator companies to develop a business model, assess potential markets, and analyze the components necessary to bring a product to market. Companies work on a three-year cycle that includes initial research and development, commercialization and production, followed by ultimate graduation from the incubator.

"Our goal is to assist startups through the initial development process and provide the technical and business expertise necessary to develop a solid profit-making model," Jones adds. "RIT's traditional strengths in imaging, sustainability, and bio-x on top of the university's strong business connections also allow us to provide additional research support, market contacts, and investment opportunities to our tenants."

Advancing New York's Clean Energy Sector

One of Venture Creations' central initiatives is the Clean Energy Incubator (CEI), a New York state funded program designed to assist early stage clean energy companies and promote regional economic development in alternative energy industries. The incubator, co-managed by RIT's Golisano Institute for Sustainability (GIS), is one of six statewide and was created in 2009 by the New York State Energy Research and Development Authority (NYSERDA) as part of the state's comprehensive clean energy initiative.

"These efforts in Rochester mirror NYSERDA initiatives across the state and signal a transformation of the economy and transportation sector to better address the needs and opportunities of clean energy processes and technologies," says Frank Murray, president and CEO of NYSERDA.

Greening the Economy and the Planet: Mark Coleman, manager of technical development for he Clean Energy Incubator, stands with two engineers in Sweetwater Energy's facility at CEI. The incubator works with alternative energy startups to develop business plans, assess market opportunities, and enhance product design and commercialization.

Sweetwater Energy: The company has developed a patented process to manufacture a sugar concentrate that can be used to produce ethanol. Sweetwater President Jerry Horton notes that the support the company has received from the Clean Energy Incubator has been invaluable in its success.

"Rochester has a tremendous potential to be a center for the growing clean energy economy and this incubator is enhancing continued economic development in a host of areas, including alternative fuels, wind energy, solar power, and fuel cell development," adds Mark Coleman, manager of technical development for the Clean Energy Incubator.

CEI assists firms in all aspects of business planning and also works to connect companies with technical expertise and facilities available through the Golisano Institute and RIT. Some of the services available through this relationship include nanomaterial analysis, intelligent testing and diagnostics, clean technology assessment, and design for manufacturing and assembly. GIS and RIT also have significant government and industry contacts and assist CEI companies in accessing state and federal funding and developing partnerships with industry.

"The Rochester Clean Energy Incubator is unique in the state because of the scientific, engineering, and development support we receive through our collaboration with GIS and the entire RIT academic and research innovation ecosystem," adds Coleman. "We can provide access to world-class labs and equipment that most of our tenants would otherwise be unable to afford, greatly enhancing technology development and ultimate commercialization."

Sweetwater Ethanol and Emerald Technologies are CEI companies that illustrate the unique advantages the incubator provides and the growing momentum for a more energy-efficient world.

Developing Affordable Energy Alternatives

One of the main barriers to the enhanced development and use of ethanol as a fuel source is the costs and efficiency losses associated with the actual process of transforming biomass into ethanol, including the movement of agricultural stocks from farms to refinery plants.

CEI firm Sweetwater Energy sought to address this by creating an entirely new model for harvesting and storing sugars from both starch-based and cellulose-based agricultural biomass. Instead of farmers drying their corn and trucking it to a refinery, the company's Sweet-Machines™ separate the water and sugar from the entire plant right on the farm. The sugars are then concentrated and shipped to ethanol refineries, chemical refineries, and jet fuel refineries, while the fibrous material either is used right on the farm as an animal feed or is pelletized for use as a fuel.

"Our system uses less water and less energy than conventional ethanol production and reduces the cost per gallon produced by 30 percent," notes Jerry Horton, founder and president of Sweetwater Energy. "It also eliminates the need for costly drying operations to prep the biomass and creates a more profitable revenue model for farmers."

When Horton initially contacted RIT,

Emerald Technologies: Glenn Caccamise, Channel Manager at Emerald Technologies (left), demonstrates the OptiCool Data Center Cooling Solution to Bob Bianchi, President at Productivity Partners (right). The product is a more energy efficient and less costly option for cooling large computer data centers. The company is currently working with RIT to pilot the system at several computer labs on campus.

he was interested in creating an ethanol refinery complex. He discussed his plan with Richard DeMartino, director of RIT's Simone Center for Innovation and Entrepreneurship, who was concerned that Horton's plan might be overly ambitious.

"He encouraged me to work where my core knowledge is and connected me with two MBA students who helped me revise my business plan," Horton says.

Together, Horton and the two students realized the true value proposition Horton possessed was in his ability to produce liquid feedstock that could be sold to ethanol producers.

"We felt that my background in food processing and farming fit more into producing sugary feedstock than ethanol," he adds. "It was an area few other companies had gotten into and created a niche Sweetwater could exploit."

Horton then worked with the Golisano Institute to develop and optimize his production process, ultimately creating a system that was more efficient and less energy-intensive than previous processes.

The company is already marketing its sugar concentrate to numerous fuel producers and manufacturers and is also constructing a new refinery and manufacturing facility that will allow it to move beyond the pilot stage and ramp up production.

"Sweetwater Energy and Emerald Technologies are a perfect example of how market opportunity and entrepreneurial drive can be combined with university resources to meet a central environmental need effecting society," adds Jones. "The results include improved environmental quality, a new company that produces jobs and tax dollars for the community, and an opportunity for RIT faculty, staff, and students to both play a role in developing new technology and reap the benefits of that technology."

Creating Greener Data Centers

Jeff Burke had an idea for a new business that could meet a growing market and environmental need in the information technologies (IT) sector.

Large computer data centers generate significant heat, and sophisticated cooling systems are necessary to prevent damage to the equipment. The overall energy use of these centers is a central cost and environmental issue as electricity is 10% of the total cost of ownership and emissions from data centers accounts for almost 15% of the total for the IT sector.

Burke, a former executive with Xerox and PAETEC with 25 years in the high-tech industry, saw an opportunity in the commercialization of more energy-efficient cooling technology for use in all data centers. He formed Emerald Technologies to capitalize on the opportunity.

The company joined CEI in 2010 and has recently released its OptiCool™ Data Center Cooling Solution. The system uses an oil-free, pumped refrigerant and modular cooling unit design that increases cooling capacity, decreases overall energy use, and takes up significantly less floor space than traditional methods of cooling.

"Today, the most common form of data center cooling is Computer Room Air Conditioning, which is very inefficient and is largely based on technology developed in the 1970s," Burke says. "OptiCool has the potential to reduce data center energy consumption by up to 95% and increase equipment capacity by up to 100%."

Emerald Technologies is working with the RIT community to operationally showcase OptiCool on campus, reduce the university's overall energy use, and assist in achieving the President's Climate Commitment objectives. In addition, GIS resources have also assisted the company in submitting a grant proposal to NYSERDA to commercialize the OptiCool solution and ultimately assist other organizations with data center cooling efficiency across the state of New York.

On the Web

For more information about Venture Creations and the Clean Energy Incubator, visit www.rit.edu/research/vc.

Research Awards and Honors

by William Dube

RIT values the research contributions of its faculty and staff across the campus and honors these accomplishments through the Principal Investigators' Reception. Below are some of the members of the RIT community who have received significant university, national, and international awards this year.

Distinguished Public Service Awards

The Four Presidents Distinguished Public Service Award was created by Alfred L. Davis, vice president emeritus, on the occasion of the 65th year of his association with RIT, to commemorate the dedication of the last four RIT presidents in their service to the Rochester community. The award is presented annually to a member of the RIT faculty or staff whose public service and commitment mirrors that of the four presidents who worked with Davis. The Bruce R. James '64 Distinguished Public Service Award is presented annually to an RIT student and commemorates the public service of Bruce James, former U.S. Public Printer and chairman emeritus of the RIT Board of Trustees.

Four Presidents Award

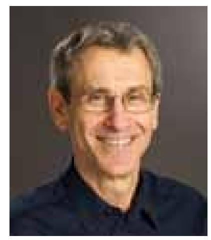
Mary-Beth Cooper, senior vice president for student affairs, was awarded the 2011 Four President's Award. Cooper joined RIT in 2001 and focuses on delivering high-quality services and support to RIT's student body and campus community. In addition to her university activities, she serves as chair of the corporate board of directors of the YMCA of Greater Rochester and co-chairs the Tocqueville Society of the United Way of Rochester. In June 2005, she was named one of Rochester's most influential women by the *Rochester Business Journal*.

Bruce James Award

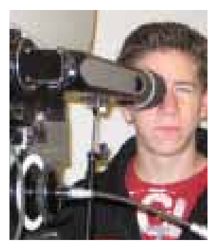
Julianna Johnson, a fourth-year graphic design major, has been selected to receive the 2010 Bruce R. James Award. Johnson is a nontraditional student who returned to college in her 40s and came to RIT in 2009 after graduating from Tompkins Cortland Community College. She has a 4.0 GPA and received the National Foundation Women's Scholarship from the American Association for the Advancement of Retired Persons in 2009 as well as the RIT Women's Council Scholarship in 2010.

National and International Recognition

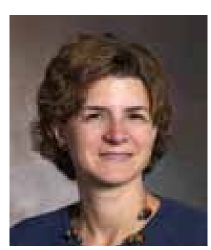
James Winebrake, dean of the College of Liberal Arts, has been appointed to the New York State Energy Planning Board. The advisory committee develops policy recommendations designed to assist the state in meeting its energy needs, while also promoting clean energy development. Winebrake was appointed to the board by the governor of New York in November of 2010.



Rich Tannen, professor in the School of American Crafts, was selected to participate in "Six Degrees of Separation," the Furniture Society's 2010 international exhibition of studio furniture. The international arts association presents a showcase of fine-art furniture in conjunction with its annual conference. Tannen is a noted furniture designer whose work has been exhibited by the National Museum of American Art and the Fuller Craft Museum.

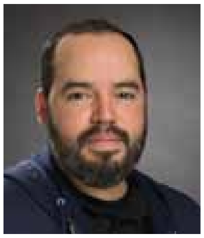


The film *Pursuit*, directed by **Jaron Downs,** a third-year film and video major, was selected for inclusion in the 2011 Connecticut Film Festival. The short chronicles the struggles of a young actor and his effort to gain the support of his widowed father. Downs has also worked as a grip and production assistant on several additional productions, including the feature film *Detention*, starring comedian Dane Cook.

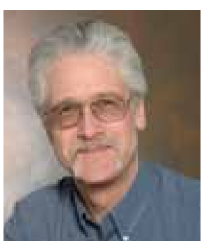


Jaqueline Mozrall, associate dean of the Kate Gleason College of Engineering, led a multidisciplinary team that won a K-12 Education

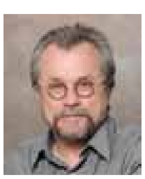
Award from the Toyota-USA Foundation. Funds associated with the award will be used to create the Relevant Education in Math and Science Program, designed to promote engineering education and outreach among 5^{th} through 12^{th} grade students.



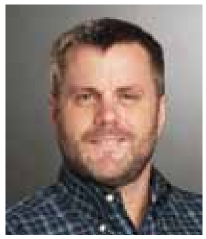
Rudolfo Montez, a doctoral student in astrophysical sciences and technology, received the 2010 Roger Doxsey Prize from the American Astronomical Society. Montez was honored for his research related to X-ray imaging of planetary nebulae in partnership with NASA's Chandra X-ray Observatory and the European Space Agency. The award is named in honor of the noted astronomer who was a key developer of the Hubble Space Telescope.



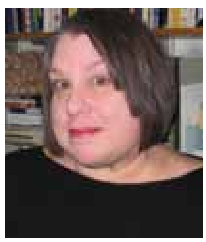
John Schott, Fredrick and Anna B. Weidman Professor in the Center for Imaging Science, and **Nima Pahlevan,** a doctoral candidate in imaging science, received the 2011 Alexander Goetz Award from the Geoscience and Remote Sensing Society. They were recognized for their use of novel imaging techniques to analyze inland water ecosystems.



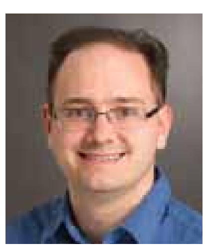
In addition, **William Middleton,** associate professor of sociology and anthropology, **David Messinger,** director of the Digital Imaging and Remote Sensing Laboratory, and **Kelly Canham,** a Ph.D. student in imaging science, received a Goetz Award for their imaging analysis of ancient archeological sites in the Oaxaca state of Mexico. Only seven Goetz awards were given out nationally.



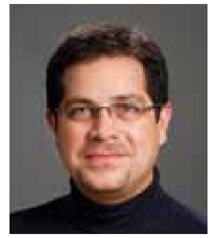
Benjamin Lawrance, the Barber B. Conable Jr. Endowed Chair in International Relations, has been named a 2011 University Teachers Fellow by the National Endowment for the Humanities. Through the fellowship Lawrance will conduct the study, Africa's Stolen Childhood: The Illegal Enslavement of African Children in the 19^{th} and 20^{th} Centuries.



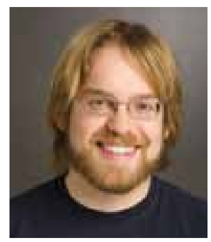
Adrianne Carageogre, associate professor of film and animation, has been elected vice president of the board of directors of the University Film and Video Association. In that post she will help oversee programming in professional development, film and video preservation, and education and training. The UFVA, founded in 1947, is an international academic society dedicated to the study and promotion of film, video, and media arts.



Matthew Fluet, assistant professor of computer science, was chosen as program chair for the Association for Computing Machinery's 2010 Workshop on ML. The annual symposium is the leading academic forum for research and development related to the ML computer programming language. ACM was founded in 1947 and is the world's oldest scientific computing society.



Ruben Proano, assistant professor of industrial engineering, was selected to present at the 2010 United Nations Midday Forum on Making Combination Vaccines More Accessible. The Midday Forum Programme sponsors talks by international experts at the U.N. World Headquarter on pertinent global issues in health care, economic development, and the environment. Proano, an expert in operations research, discussed how to price vaccines optimally to satisfy countries' vaccine demand while providing a reasonable profit for producers.



Artwork Evolution, a collaborative artwork application developed by **Paul Solt,** a computer science graduate student, was featured at the 2010 International Conference and Exhibition on Computer Graphics and Interactive Techniques. The app, which enables the creation of digital artwork on mobile devices, is now available through Apple's Mac App store.

Rose Marie Toscano, professor of liberal studies at NTID, was appointed co-chair of the National Task Force on Health Care Careers for the Deaf and Hard-of-Hearing Community. The committee, made up of health care experts, business leaders, and deaf advocates, will present policy proposals designed to increase opportunities in the health care professions for the deaf and hard of hearing.

About This Section

This listing is a sample of awards and honors that have been received by RIT faculty and staff over the past year. For more information, please visit www.rit.edu/news.

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