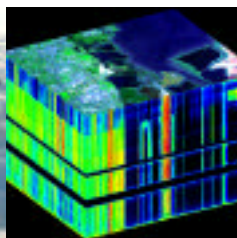
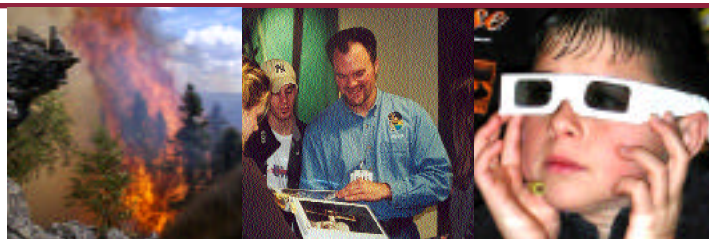


Imaging



Connection

The Newsletter of the Chester F. Carlson Center for Imaging Science

Spring 2001

Satellites May Comb Earth for Wildfires Imaging Scientists Play Lead Role in NASA Project

Imagine a global satellite system that would detect small forest fires before they spread out of control. A global fire alarm would give firefighters the upper hand, preventing wildfires from destroying millions of acres as happened last summer in the western United States.

Scientists at Rochester Institute of Technology's Chester F. Carlson Center for Imaging Science are exploring concepts for satellite systems to locate wildfires when they start. The project represents an application of RIT's First in Class Initiative, a program designed to facilitate partnerships between the university, industry and government.

RIT's expertise in remote sensing will play the lead role in the global fire-monitoring system. The university will work in conjunction with NASA's Regional Applications Center Northeast (RACNE) at Cayuga Community College (CCC) in Auburn, N.Y. The two partners will collaborate with Telespazio, an Italian aerospace company that specializes in satellite operations and communications.

In fiscal year 2000, Congress included a \$2.3 million appropriation in NASA's budget to initiate the FIRES project. Since then, total funding has reached nearly \$5 million with an additional \$2.5 million set aside in the 2001 budget.

Congressman James Walsh of Syracuse, who chairs the VA/HUD/Independent Agencies subcommittee, championed the funding.

RIT will develop requirements for the fire-detection instrument for the satellite remote-sensing system



during the first phase of the project known as forest fire (infrared) imaging experimental system or FIRES. At CCC, RACNE—established to promote the use of remote sensing information at the state and local level—will survey potential users such as local, state and federal agencies. And for its part, Telespazio

will provide expertise on spacecraft, satellite system communications and ground control systems.

"FIRES will result in a concept for a satellite system that will greatly enhance the global detection of wildfires," says Michael Richardson, RIT distinguished researcher and FIRES project manager. "RIT's role is to prove the underlying science and establish the feasibility of a multisatellite operational system."

Through data analysis and modeling of wildfires, RIT will explore the use of infrared thermal sensors and small, sensitive detectors to locate hot spots on earth more accurately and rapidly than existing weather satellites. Larger pixels used by weather satellites provide global coverage, but at a lower resolution than necessary for efficient fire monitoring, Richardson explains.

During the project's first phase, RIT imaging science professor Anthony Vodacek, FIRES principal investigator, and his team will evaluate different fire detection approaches. To test the preliminary technology, the team will fly RIT's airborne sensor over Montezuma Wildlife Refuge in Western New York during a prescribed burn using an aircraft especially equipped to capture thermal data.

Walsh foresees future benefits

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CIS Grad Trains Shuttle Crews

When the space shuttle flies, RIT alumnus Robert Scharf gets pictures—hundreds of them.

Scharf (Imaging Science, '94) works for Lockheed Martin Space Operations in the Image Science and Analysis Group at NASA's Johnson Space Center in Houston. His group, which was created as a result of the 1986 Challenger accident, pores over films and still photos of every shuttle mission, looking for anything abnormal.

Scharf's role is to talk to shuttle crews and others at NASA to determine what imaging information will help them. He prepares the astronauts to shoot needed photos, and during the flights, Scharf is in mission control, working with the team that aims the shuttle's remote-controlled cameras.

These days, the focus is on the International Space Station, and Scharf is leading a group working on external survey activities for the project. As the ISS progresses, the

team compiles images and passes the information along to others working on the project—providing a close look at the station to people who may never actually see it.

He previously did similar work on 10 shuttle missions to the Russian space station Mir. He ultimately developed a book of Mir's external configurations, written in English and Cyrillic. The book proved immensely helpful to American astronauts visiting the station and remained onboard until Mir's recent demise.

Although Houston is a long way from Scharf's roots in Horseheads, N.Y., he very much enjoys the position he's held since 1995.

"It's great to work with the astronauts," he says, and his job is constantly evolving. His imaging science background crosses several disciplines, allowing him to communicate comfortably with people from diverse backgrounds.

Six years after receiving his B.S., Scharf established the Elizabeth Ellen



Robert Scharf talks to RIT students at the Johnson Space Center.

Locke Memorial Scholarship in honor of his godmother. "She worked for Westinghouse and assembled critical parts of the cameras that went on the first moon landing in 1969," Scharf says. "So I think it's interesting that she had a connection to imaging science." The scholarship was first awarded last year, to Seth A. Weith-Glushko of Franklin Lakes, N.J.

When he was a student, Scharf received the Ezra Randall Andrews Scholarship funded by the Gosnell family. "I realized what a difference this can make, and I was glad to be able to help others in this way."

CIS Plays Key Role in NASA's Airplane Observatory

A jet plane mounted with a powerful telescope will soon give astronomers a closer platform to the heavens. Scientists will fly the skies aboard NASA's largest airborne observatory to capture and process images of the universe, thanks to software developed at Rochester Institute of Technology.

When complete, the Stratospheric Observatory for Infrared Astronomy, or SOFIA, will take flight in a modified Boeing 747SP airplane, equipped with a 2-meter telescope and a suite of infrared cameras and spectrometers. With these instruments, SOFIA will collect important new data about planets, stars and galaxies in the infrared region of the electromagnetic spectrum.

The Universities Space Research Association (USRA), an organization

of more than 80 universities, manages the SOFIA project for NASA. RIT's role is to design a system to manage, process and analyze data produced by SOFIA's instruments.



An efficient way of handling astronomical data has long been the vision of Ian Gatley, director of the Chester F. Carlson Center for Imaging Science (CIS) at RIT. He devised the concept of a data cycle system for SOFIA based on his experience managing systems such as SOFIA's predecessor, NASA's Kuiper Airborne

Observatory, and a remote infrared observatory in Antarctica.

RIT's Joel Kastner, associate professor of astronomical imaging and SOFIA data cycle system (DCS) deputy lead scientist, and Robert Krzaczek, CIS computer systems manager and DCS deputy lead engineer, are designing and developing the core of SOFIA's data cycle system. The entire system is a multi-institutional effort managed by USRA.

The system will process and calibrate raw data, save the processed data to the SOFIA archive, and notify astronomers via e-mail when their data is processed and available for analysis. To achieve that level of complexity, the software must interface smoothly with the instruments, the aircraft and the data

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Update: The Center's Outreach Activities

The CIS outreach program moved into high gear over the winter with faculty, staff, and students spreading the word about RIT's imaging science program in school districts throughout New York.

Following the plan developed in the fall by members of the department's outreach committee, teams of people from CIS personally

contacted over a dozen separate schools in an effort to develop long-term partnerships. The initial contact with each prospective partner is used to determine the type of interaction the school's

faculty and administrators feel would be most beneficial to their students. Once that's been established the CIS outreach team begins planning an activity which is tailored to meet the school's specific needs. As a result, each interaction is unique, and is intended to heighten awareness of the imaging science program among the secondary schools.

One of our more ambitious projects resulted from a request by Dake Middle School in West Irondequoit for help in teaching their eighth-graders about the properties of light. After two months of planning, a



Here are some of the graduate students, faculty and staff who participated. Thanks to everyone who helped to make our first outing a success.

group of 15 CIS volunteers set up six separate demonstrations in the school's library, and over the course of an entire day gave 250 students a chance to learn first hand about spectroscopy, diffraction, polarization, and radiometry. The feedback from this session was very positive, and a select group of students from Dake



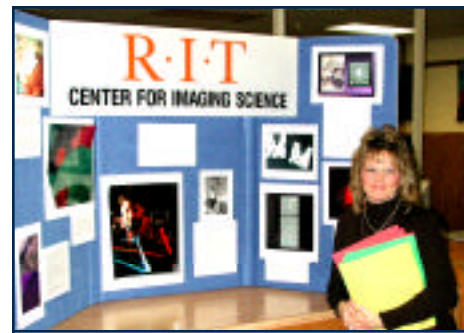
Dake Middle School student learns about polarization.

will be making a follow-up visit to CIS to get a more in-depth look at visual perception, remote sensing, and color science.

Strong ties were also forged as the result of another recent outreach initiative. CIS teamed with five local school districts on a winning

proposal for a "Targeted Instructional Staff Development" grant from the state Department of Education. The purpose of the grant is to increase student achievement by bringing new, innovative instructional techniques into the classroom. The CIS recommendation to focus on the use of imaging technology and image processing to convey mathematical and scientific principles was adopted by the proposal team, and the state awarded \$200,000 to pursue this concept.

While projects such as these form the basis for relationships which should bring in more imaging science students over the next several years, the outreach team has high hopes that this summer's CIS internship program will have a near-term impact on our enrollment. Team members are



Colleen Desimone welcoming Dake Middle school students to an imaging science experience in their library.

currently evaluating applications from high school juniors looking for a two-month paid internship in the department. Up to six interns will be chosen to work side-by-side with faculty and staff researchers throughout the summer, getting valuable experience and learning more about the employment opportunities available to imaging scientists after graduation.

Funding from the Industrial Associates program is being used to support CIS outreach and recruitment



Rob Light, an imaging science graduate student, explains how to use the spectrometer.

efforts. CIS Director Ian Gatley feels this is an effective way to use these resources. "Our industrial partners have made it clear that they want more imaging science graduates. Therefore, using the resources of the Industrial Associates program

to bring more students into the department is a wonderful way to provide our members a return on their investment." Gatley is also confident that the outreach team's efforts will have a profound effect on the recognition of imaging science as a growing, dynamic field of study.

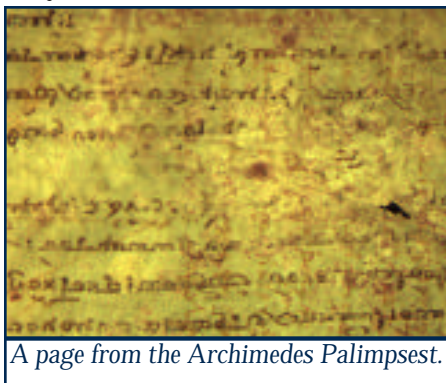
For More Information about our CIS School Partnership Program visit:

www.cis.rit.edu/info/partnership/top.html

RIT Scientists Shine Light on 10th Century Document

A medieval copy of an ancient text by Archimedes will see the light of day thanks to new millennium technology.

Researchers at the Center for Imaging Science are recovering the text from five sample pages of the Archimedes Palimpsest, the 10th century Byzantine manuscript that sold for \$2 million in 1998 at Christie's auction house in New York City. The manuscript is the earliest transcription of the Greek mathematician's writings and the only known source of his "Method



A page from the Archimedes Palimpsest.

of Mechanical Theorems," which combined mathematics and physics.

The anonymous owner of the manuscript has entrusted the document to the care of the Walters

Art Gallery in Baltimore for conservation and study. In the fall, the museum will select the imaging methods best suited for recovering the text in the entire manuscript. In addition to RIT, a group at Johns Hopkins University is also exploring imaging techniques under consideration.

Archimedes, who lived from about 287 to 212 B.C., was a mathematician, engineer and physicist whose work predated Newton's calculus, and detailed the physics of flotation and the lever. The 10th century transcription of his text was defaced two centuries later by a monk who scraped and washed away the theorems for a clean surface on which to copy a Greek prayer book.

At RIT, Robert Johnston, archeologist and professor emeritus, and Roger L. Easton Jr. of the Chester F. Carlson Center for Imaging Science are using a variety of ultraviolet, visible and infrared wavelengths to separate the faint script and 55 geometrical drawings from the liturgical text. The scientists digitally manipulate the images with special software at the Xerox Digital



Dr. Easton, on the right, gathered with other CIS faculty, staff, and students to view an ABC News report about this CIS project.

Imaging Technology Center.

"It's another opportunity to apply imaging science technology to reveal ancient documents that would be lost without it," Johnston says. "The technology we're using wouldn't have been possible five or 10 years ago. The project is another good example of a cooperative effort between academia and industry."

In addition to Johnston and Easton, the team also includes RIT graduate students Charles Dickinson and Lichao Wei, and Keith Knox, principal scientist, at Xerox Corp. The group's ground breaking work was recently featured on ABC's World News Tonight.

Rhody Returns From Sabbatical

Dr. Harvey Rhody, chair of the Imaging Science graduate program, recently returned from a productive winter term sabbatical in southern California. He used this time to pursue key research and academic initiatives on behalf of CIS.

Rhody worked extensively with Boeing's Seal Beach division to examine ways to adapt CIS data pipelining capabilities to new remote sensing systems. "It's exciting that we may be able to extend our core technology as the system for collaborative R&D in the Boeing hyperspectral imaging program and,



Harvey enjoying a day with his family while away on sabbatical.

at the same time, develop our own technology," Rhody said.

Rhody also devoted a time to authoring material for a new online

course in digital image processing. "Having to do all of my RIT interactions from far away has given me a perspective on online work that will be helpful in working with students." This new course was launched at the beginning of the spring 2001 term.

Although Rhody was glad to return to his duties on campus, he looks forward to his next sabbatical. "My assessment is that the RIT intentions of a leave for professional growth and development are very worthy. I wish I had done this sooner and more often!"

Gatley Named Interim COS Dean

The College of Science soon will be in search of a new dean. After seven years of leadership, Robert Clark has decided to step down as dean at the end of this academic year. He will focus his attention on developing First-in-Class initiatives for COS.

Clark's tenure as dean has seen the funding, construction and opening of the new addition to the Gosnell Building, as well as an enhancement of the scholarly research and professional development of faculty and students within the college.

"Bob's personal integrity and extensive RIT knowledge and experience were the perfect combination of traits needed for the college during the tenure of his deanship," says Stanley McKenzie, provost and vice president for

academic affairs. "We are indeed fortunate that Bob's long-time career at RIT is not yet concluded as he turns his focus to developing First in Class initiatives for the College of Science in the micro-science arena."

Beginning July 1, Ian Gatley, director of the Chester F. Carlson Center for Imaging Science (CIS), will serve as the interim dean for COS.

Before joining RIT in 1997, Gatley served as an astronomer and chair of the Infrared Steering Committee for the National Optical Astronomy Observatories in Tucson, Arizona, and as a senior scientific officer of the United Kingdom Infrared Telescope in Hawaii

A national search process for a permanent dean will get underway this spring.



Dr. Ian Gatley

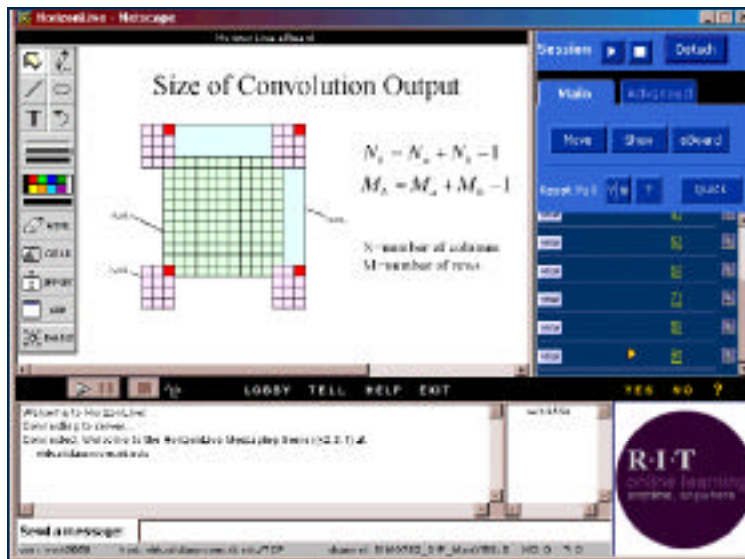
Several new department heads will assume their leadership roles in July, including Sophia Maggelakis in mathematics and statistics and Richard Doolittle in allied health. Peter Cardegna will be the interim department head of physics replacing Art Kovacs, who will take on a special project with Gatley.

Distance Learning Continues Full Speed Ahead

This past fall, the Chester F. Carlson Center for Imaging Science began offering a Master of Science degree in Imaging Science with a color track via distance learning. The new program, which is supported by the Imaging and Publishing Initiative that was established under President Albert Simone's First-in-Class program, has been well received by students.

The following statement by one student echoes comments heard from others in the program. "I started school again, working on my MS in Imaging Science at RIT through their online learning program. It really was an answer to my problems. I was commuting a lot and going to school in Boston wasn't

feasible because of time, not to mention that no Boston school really had a program I was interested in.



The Imaging Science program at RIT is unique." The program has eliminated problems such as scheduling conflicts and geographic constraints.

The first courses offered by the program were Linear Math I and II, and Vision and Psychophysics. This spring, Geometrical Optics and Introduction to Digital Image Processing are being offered.

Although the core course sequence begins in the fall, interested students may enroll for elective courses or begin the application process at any time. This program is designed so that students can complete the degree in three years beginning in the fall by taking one or two courses each quarter.

New courses will be introduced to the program each quarter. For more information see: <http://www.cis.rit.edu/education/distance.shtml>.

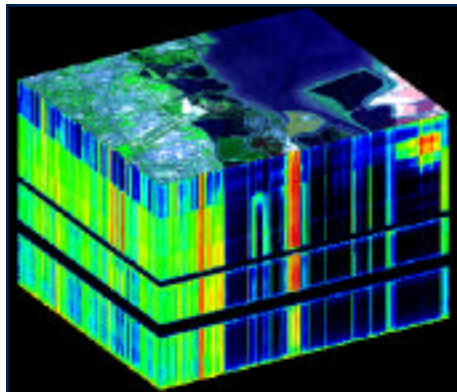
Spectral Sensing Lab Wins Major Navy Grant

The U.S. Navy will soon be able to detect submerged mines, map pollution levels and nuisance vegetation in water, predict water clarity along shorelines, and monitor emissions released from factory smoke stacks with the help of remote-sensing technology developed at Rochester Institute of Technology.

The Department of Defense's Office of Naval Research recently announced it will award RIT a \$2.4 million grant to develop new methods for processing raw data captured by satellite or airborne sensors and converting it into useful information. More than 150 universities nationwide competed for the grant, known as a Multidisciplinary University Research Initiative (MURI). Of this group only 48 were chosen for funding. RIT was the only recipient in New York State.

A team of scientists at RIT's Laboratory for Advanced Spectral Sensing (LASS) in the Chester F. Carlson Center for Imaging Science will devise ways to process and analyze hyperspectral data, or information captured in many wavelengths. Principal investigator John Schott, director of LASS and the Digital Imaging and Remote Sensing Lab, will lead the project. Team

members include RIT imaging scientists Anthony Vodacek and Michael Richardson, as well as colleagues from Cornell University and the University of California at Irvine.



Work done under the MURI grant will focus on processing hyperspectral images like this one from a NASA airborne sensor.

LASS exemplifies RIT's First in Class Initiative, an Institute-wide program that forms partnerships with industry and U.S. government agencies. LASS uses cutting-edge expertise in remote sensing and spectral science to solve difficult problems related to capturing and analyzing complex information. A new generation of satellite and airborne sensors collect data in spectral bands ranging from visible

through infrared wavelengths.

"These instruments can capture data well beyond the capabilities of the human eye," Richardson says. "The RIT team will develop methods enabling precise information to be extracted from the captured data."

"The RIT MURI is focused on development of techniques to merge physical models with advanced computational algorithms to allow us to extract more information from these new imaging systems." Schott says.

"The volumes of raw data produced by these sensors can overwhelm both human interpreters and conventional computational tools," he adds. "We hope to use models of the physical processes involved in the formation of the hyperspectral images to help guide the computational algorithms. This should allow us to see more things (i.e. extract more information) and do it more efficiently so that operational analysis of these images can be done largely if not entirely by computer."

The Navy can use this information to determine water clarity and depth, and the suitability of a location for landing troops. The project, funded for a minimum of three years, will begin in May.

FIRES *from cover*

stemming from the collaboration on the FIRES project. "The joint project is challenging research with spin-off technology potential to help keep our young talented graduates in New York state," Walsh says.

Adds Vodacek, "Projects such as FIRES are important to universities like RIT because they enhance capability and provide students with valuable hands-on experience."

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archive. This common interface will make the system user-friendly and useful to the entire astronomy community—a breakthrough in information-sharing.

Connecting different phases of data collection and analysis will streamline otherwise cumbersome methods for collecting and accessing data produced by the observatory.

Successfully demonstrated last year in prototype form, the data cycle system will also generate predictions of what scientists might see through the telescope. USRA recently extended its contract with RIT an additional two years.

More information about SOFIA is available on the Website, www.sofia.arc.nasa.gov

Electronic copies of the
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can be found at:

www.cis.rit.edu

