

# Imaging



# Connection

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

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## Imaging Science – H.S. Elective

A group of students at Victor Senior High School are learning how imaging science underpins some of the most critical technology of our time from SARS screening to the Mars rovers and medical diagnostics to military systems and homeland security.

Victor is the first school in the Rochester area—and possibly in the country—to offer an elective in imaging science, a blend of physics, chemistry, mathematics and computer science. Students there are learning how scientists create imaging-information systems to capture data on different wavelengths and solve scientific problems. For instance, the U.S. Forest Service uses special cameras on airplanes to detect heat on the infrared wavelength, which can help locate and track wildfires.

Mathematics teacher Shaun Goodrich introduced the unique elective with an eye to her students' futures, exposing them for the first time to this multidisciplinary field in which the camera is only one element of a larger system.



*Shaun Goodrich, Victor High School (pictured on the left) and Bob Callens, Honeoye Falls-Lima High School (on the right) teamed up to develop this elective imaging science course. Shaun is currently teaching it at Victor High.*

"I see it as a nice bridge between high school and college," Goodrich says. "It is another avenue to discover."

A growing field, imaging science has been a mainstay at RIT since 1985. RIT is the only university in the country to offer undergraduate and graduate degree programs in this field of study.

Like college freshmen, Goodrich's class of high school juniors and seniors learns about imaging science through lectures, hands-on laboratories and visits from RIT imaging science faculty.

"The curriculum is similar to the freshman-level class at RIT," says Joe Pow, associate director at RIT's Chester F. Carlson Center for Imaging

Science. "It's based on the imaging chain—a conceptual model that describes everything involved in creating a visual rendering of an object or phenomenon."

Last summer, Pow worked closely with Goodrich and Robert Callens from Honeoye Falls-Lima High School to develop a series of lessons and experiments appropriate for high school students. The teachers had previously learned about introducing imaging science into the classroom during an image-processing workshop held at RIT three years ago.

Next year, Callens will teach a new yearlong physics elective at HF-L that will include the study of imaging science.

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# Benchmarking American Museum Art Imaging

Digital photography is quickly becoming the preferred method of creating image archives in museums, libraries, and other repositories of cultural heritage. As these institutions embrace digital technologies, there is a need to understand its limitations and opportunities in comparison to conventional film-based photography.

Rochester Institute of Technology has won a \$164,000 grant from the Andrew W. Mellon Foundation to benchmark and improve the quality of art imaging in American museums. The 15-month project will “document current practices, develop new testing procedures to quantify quality, and increase the scientific level of American museum imaging professionals,” says Roy Berns, the Hunter Professor in the Chester F. Carlson Center for Imaging Science at RIT. The grant period is from June 2003 through September 2004.

“RIT is taking the lead on this,” says Franziska Frey, assistant professor in RIT’s School of Print Media. “No one has comprehensively looked at the quality being produced in the museums.”

Co-investigators Berns and Frey are documenting the workflow museums use to digitally photograph paintings and sculptures.

The workflow is the process that begins with removing an object from an archive and taking it to the photo studios in a museum, lighting the object, shooting a picture, loading the digital image into a computer program, and putting the image into different uses, Frey says.

“We wanted to find out the exact steps that are happening,” she says. “We want to look at it from a technical point of view.”

Frey thinks the time is right for a study of this nature since museums have been using digital imaging for a few years and have established

distinct workflows.

Frey and Berns developed and administered a questionnaire about art-imaging practices to museums to get an overview of current practices. The survey will elicit information about specific hardware and software, calibration, viewing environment, file format, image storage, and other aspects of the process. Five museums will be chosen for in-depth case studies and on-site visits.

“The goal is to improve the quality of the practices in the United States,” Berns says. “I think the whole

test procedures by compiling current standards, test targets and practices, and by soliciting input and feedback from museums, sensor and camera manufacturers, and organizations that develop standards for digital cameras, such as the American National Standards Institute, the International Organization for Standardization and the National Information Standards Organization.

The procedures and targets will be tested at the Munsell Color Science Laboratory (MCSL) using camera systems representative of those used at the museums surveyed.

These cameras are part of another project, also supported by the Mellon Foundation, aimed at building novel spectral-based imaging systems for the National Gallery of Art, Washington, and the Museum of Modern Art, New York.

“We are extremely pleased that the Mellon Foundation continues to look to RIT to provide leadership in color and imaging science of cultural heritage,” Berns says.

Field tests at the museums will provide further information for refining the process. By the end of the project, a series of test procedures and targets will be available to museums.

Working with Berns and Frey are graduate student Erin Murphy and MCSL staff scientists Mitchell Rosen and Lawrence Taplin.

Berns and Frey will publish their findings and hold a workshop at RIT in September 2004 to share their results with participants from the camera manufacture, museum and scientific communities. Learn more at: [www.cis.rit.edu/museumSurvey/](http://www.cis.rit.edu/museumSurvey/)



*The research group includes (from left): Roy Berns, Lawrence Taplin, Erin Murphy, Mitch Rosen, and Franziska Frey.*

idea of documenting cultural heritage is very important, and this will, hopefully, lead to improved practices.”

The transition from film to digital has left the onus on the photographer to get the printing right. With film, Frey explains, an intermediate person handled prepress details, which are now the responsibility of the photographer.

“And if that isn’t done right, later on you don’t have the quality you would need,” Frey says. “In the museum environment money is always a problem. You want to get things done the right way. You don’t want to have to redo them.”

Berns and Frey will develop new

## Real-Time “Movies” will Predict Wildfire Behavior

Someday fire fighters manage wildfires by computer.

RIT recently won a \$300,000 grant from the National Science Foundation to translate remote-sensing data about wildfires into real-time “mini-movies” that fire managers can download on laptop computers at the scene of a blaze. The model and visualization will predict the fire’s behavior for the following hour.

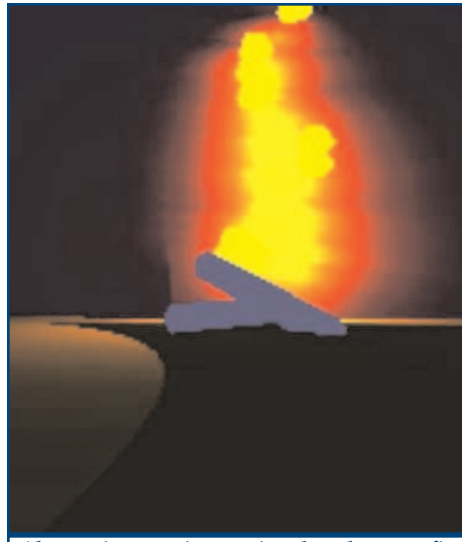
This four-year collaborative project also involves researchers from the National Center for Atmospheric Research (NCAR) in Boulder, Texas A&M, University of Colorado at Denver and University of Kentucky.

Leading RIT’s research effort is Anthony Vodacek, assistant professor in the Chester F. Carlson Center for Imaging Science. Vodacek also heads RIT’s Forest Fire Imaging Experimental System (FIRES), a precursor to the Wildfire Airborne Sensor Program (WASP). Other team members will include CIS senior research scientist Robert Kremens and postdoctoral fellow Ambrose Ononye.

FIRES and WASP research were made possible through the efforts of Congressman Jim Walsh, chair of the House VA/HUD Independent Agencies Appropriations Subcommittee, who has provided nearly \$8 million through the NASA budget over four years to support wild fire-detection research at RIT.

The RIT team has two roles in its new project: One, to collect real-time data about wildfires using the airborne sensor, WASP, and ground-based sensors; and two, to use computer animation to visualize predicted fire behavior.

In between those two steps is a unique fire behavior model that forms the core of the project. Information collected by the RIT team will be fed into the model created by Vodacek’s colleague Janice Coen at NCAR. Based on fire-behavior models in use by the U.S. Forest Service, Coen’s



*Above image is a simulated campfire scene created with DIRSIG (Digital Imaging and Remote Sensing Image Generation Model).*

model will combine RIT’s data with the influence of weather conditions. The model will output a 3-dimensional “movie” about the fire sophisticated enough to predict dangerous fire behavior, such as leaping flames.

Other members of the collaborative team will be in charge of feeding a wide variety of raw data to the model for rapid retrieval at the fire scene.

In order for this relay of information to be successful, Vodacek will need to make the scientific data meaningful to the fire fighters.

“Coen’s model can track smoke and hot gases in the atmosphere,” he says. “We need to translate that into what a fire looks like by using computer animation. It fits very well into what we’ve been doing in the FIRES project.”

Vodacek’s team will create synthetic scenes of fires to visualize live blazes based on Coen’s model, which will tell them where flames will be in any particular situation.

“We would translate it into what a person would see,” Vodacek says. “Essentially, a little movie would be

generated. In the end, the goal is to make it look real to the fire manager.”

The process will work like this: Overhead and ground sensors will collect real-time data about a fire to feed into the model. The data will be transferred to a super computer where the model is run and then sent back to the field. (The fire could be in Montana and the super computer in Georgia, Vodacek notes.) The link is the laptop that the fire manager will use to watch how the fire is predicted to behave for about an hour.

“The idea is that all of this will occur as close as possible to real time,” Vodacek says. “By the time it takes to collect the data, run it through the model and send it back to the field, it may be 15 minutes old. But, still, that gives you a 45-minute outlook, potentially.”

The overall goal of the project is to demonstrate the entire system at the end of four years.

## John Wiley Jones Award

Two imaging science students have been awarded the John Wiley Jones Award for Outstanding Students.

Alvin Spivey and William Pfeister were recognized for their distinguished academic record and notable contributions to the RIT community.

The College of Science presents this award each academic year funded by Jones Chemicals, Inc. to honor the late John Wiley Jones and is a tribute to his career in chemical industry and interest in science education.

William Pfeister received his award in the spring 2003 and Alvin Spivey received his award in the fall 2004.

Each student recipient received a certificate and \$750 cash award.

## CIS Welcomes New Staff Members

CIS welcomed four new staff members in recent months.

**Jason Faulring** is working on two remote sensing projects –the Wildfire Airborne Sensor Program (WASP) and on “ground truthing” instrumentation, which is used to calibrate airborne sensing equipment.



*Jason, working on WASP project.*

Faulring, who last May received his B.S. in computer engineering from RIT, became a full-time member of the staff this fall, but he’s been working at CIS since summer 2002.

He brings years of machine-shop experience to the job. “I’ve spent time with my father in our shop back home since I was knee-high,” says the North Collins, N.Y., native. “That hands-on experience has proven to be invaluable to some of the work I do with WASP and the ground-truthing instrumentation.

“This is exactly the kind of work I’m interested in,” he continues. “I like working on interfacing software and hardware.”

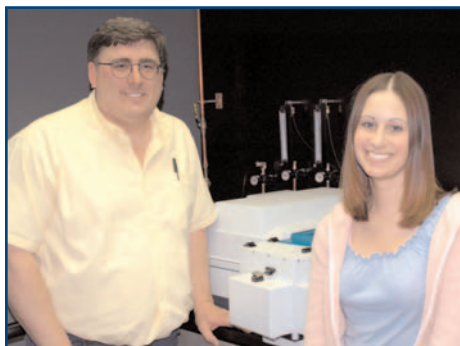
**Lon Smith** joined the Digital Imaging and Remote Sensing Laboratory Center last May. His work centers on the development of infrared optical radiation measurements and standard artifacts to ensure valid field measurements.

“Remote sensing is a science that is quickly evolving and is extremely dependent upon sound ‘ground truth’ and laboratory measurements,” notes Smith.

Smith has always been involved in applied sciences. He spent six years

in the Navy’s nuclear power program, 20 years as an electrical engineer at Eastman Kodak, and was a senior measurement engineer at Corning’s Monroe Photonics Fiber Optics facility. He has a B.S. in electrical engineering technology from RIT and will complete his M.S. in Multidisciplinary Studies (color science and computer integrated manufacturing) by the end of the year.

In addition to his research work, Smith adds, “I work with many of the students who represent the future scientists in the area of remote sensing.”



*Lon (left) stops for a quick picture while working with a student.*

**Joyce French** is not a newcomer to CIS: She worked as a photographic researcher for assistant professor Richard Hailstone from 1998 to 2001. She returned in September to work once again with Hailstone, whose research focuses on the controlling physical properties of the silver halides.



*Joyce working in the laboratory on her project.*

French did similar work as a researcher at Eastman Kodak Co., for 31 years, where she met Hailstone. She’s enjoying her new job.

“RIT is the best place I ever worked,” she says.

**Mark Updegraff** became the center’s building operations technician last November. The job keeps him very busy: He’s responsible for the laser stockroom where students check out equipment used in the seven optical labs; he works with faculty to make sure that needed software and hardware is available and up to date; and he makes sure equipment in the labs is in good working order. In addition, Updegraff is the man to see about building maintenance issues, renovation projects and organizing moves. He also sets up for various meetings.

A native of Williamsport, Pa., Updegraff is a 2002 graduate of RIT’s imaging and photographic technology program. He’s planning to begin a graduate program in either remote sensing or color science.



*Mark in his office.*

He came to RIT, he explains, because “I was looking for a technical school that let me use my creativity, so the tech photo program was perfect for me. No other school offers anything like this.”

## Munsell Color Science Laboratory Dedicates Franc Grum Color Science Learning Center

The grand opening and dedication of the Franc Grum Color Science Learning Center takes place from 6 to 8 p.m. Monday, May 10.

The focal point of the new Color Science Building, the Grum Learning Center, is a combination of a state-of-the-art seminar room and a teaching laboratory for color science concepts and instrumentation. The center will be used for lectures and labs for color science courses, seminars on color science and technology for industry, and research presentations.

The center is a tribute to the memory of Franc Grum, the Munsell Lab's first director and the first R.S. Hunter Professor of Color Science, Appearance, and Technology. Prof. Grum was responsible for founding the lab at RIT, building its initial facilities, and initiating the development of color science educational programs.

"Clearly, the current success of MCSL and its alumni would not have been possible without the vision, determination, and hard work of Franc Grum," says Mark D. Fairchild, Xerox Professor of Color Science and director of the Munsell Color Science Laboratory. "Unfortunately, he was killed by an intoxicated driver in a tragic automobile accident in December 1985. The learning center is a lasting tribute to his mission."

The grand opening event, which is open to the public by invitation, will include presentation of the Franc Grum Memorial Scholarship and the Macbeth-Engle Fellowship in Color Science. In addition to the formal presentations, the open house will feature graduate student research demonstrations and refreshments.

A fund-raising effort, initiated through a grant from the Xerox Foundation, recently raised over \$100,000 to support the Franc Grum Center. While the initial fund-raising



*Franc Grum Color Science Learning Center shown above with more improvements to come in preparation of the Grand Opening and Dedication Ceremony May 10.*

goal was met, additional contributions will be accepted and used to maintain this teaching facility.

In the coming year, color science faculty and staff will begin searching for a donor to name the new Color Science Building by with a significant donation in support of color science teaching and research. More details can be found on the Web site at [www.cis.rit.edu/mcsl](http://www.cis.rit.edu/mcsl).

The Munsell Color Science Laboratory celebrated its 20th anniversary in its new home. The lab settled into the new Color Science Building last fall after a major renovation of the 8,000-square-foot space formerly known as the Link Building (Bldg. 18), which previously housed faculty offices and labs for the information technology department.

"The size and configuration were perfect for us," says Fairchild. "The move allowed us to get a little bit more space and to put all of our labs, grad students, faculty and staff in one contiguous location to provide easier and better interactions."

Fairchild says that the new location makes the Munsell Lab more

connected with the rest of the RIT community. Students, faculty and staff are much more likely to walk through the new building and discover the world of color science.

"Our hope is that this exposure will help generate more interest from RIT undergrads in considering our graduate program," says Fairchild. "At least they will have a better chance of hearing about us. It also provides some new perspective for those of us who have spent 20 years, or more, on the other side of campus. I really like having a tree outside my window," adds Fairchild, whose former office was on the third floor of the Carlson building. The strategy has already paid off with one new grad student for fall of 2004 discovering the program only after seeing the Color Science building.

The Munsell Color Science Laboratory is one of the world's premier academic laboratories dedicated to the science of color. Activities include education and research in areas of color perception, color measurement, color formulation and color reproduction.

## CIS Holds Annual IA Meeting

Imaging science for space exploration and homeland security applications will be among featured highlights of the Chester F. Carlson Center for Imaging Science's annual Industrial Associates Meeting on May 11 and 12 in the Carlson Auditorium.

The event will bring together corporations, educational institutions, and government agencies to talk about innovative research taking place in the field of imaging science.

Joe Pow, associate director of CIS, anticipates a turnout of 100 people, including scientists from British Aerospace Systems, Boeing Co., Ricoh, Eastman Kodak Co., ITT, Markem Corp. and its subsidiary Aellora, Unilever, Fuji Photo Film Co., Lifetouch and Xerox Corp. "This is going to be our largest meeting ever. We've never had two full days of presentations."

The high point of the two-day meeting will be the keynote address by John Stack, president and CEO of Edmund Optics, a leading producer of optical components and imaging systems. He will give his talk, "The Engines of Creativity and Change," at 5 p.m. on May 11.

Other presentations will include student research projects in medical imaging, color science, remote sensing and astronomical imaging. Students will share their research efforts with industry members in formal talks and poster sessions. (See details at: [www.cis.rit.edu/info/IA\\_S2004.html](http://www.cis.rit.edu/info/IA_S2004.html))

In addition, guest speakers will talk about a range of imaging topics such as:

- "Image Analysis via Fuzzy-Reasoning Approach: Prototype Applications at NASA," by Jesus Dominguez, from the NASA Technology Applications Team, at 9 a.m. on May 11.

- "A High School Elective Course in Imaging Science," by Robert Callens, Honeoye Falls-Lima, and Shaun Goodrich, Victor High School, at 11:15 a.m. on May 11.

- "The Shuttle Radar Topography Mission," by Scott Hensley, principal engineer, NASA Jet Propulsion Laboratory at 11:10 a.m. on May 12. "Image Formation through Walls Using a Distributed Radar Sensor Network," Allan Hunt, president of AKELA Inc., at 3:10 p.m. on May 12.

Both days of the event will be webcast live at [www.cis.rit.edu/info/IA\\_S2004.html](http://www.cis.rit.edu/info/IA_S2004.html).

"The webcast will give us an opportunity to quickly and effectively reach out to prospective partners around the world," Pow says.

As part of the meeting, the Munsell Color Science Laboratory will hold a private grand-opening reception for the Franc Grum Color Science Learning Center in the Color

Science Building on May 10 in honor of the founder and first director of MCSL, and the first R.S. Hunter Professor of Color Science, Appearance and Technology.

## H.S. Imaging

*Continued from cover*

"There has been a great deal of interest in this course by our students," Callens says. "We have enough students signed up to have two sections next year."

Goodrich and Callens will share their experiences developing an imaging science curriculum for high school students during the CIS Industrial Associates meeting to be held in May at RIT.

"Their talk will be webcast so that other teachers interested in this will have an opportunity to watch it on the Internet," Pow says. "We hope to attract a nationwide audience."

Visit: [www.cis.rit.edu/info/IA\\_S2004.html](http://www.cis.rit.edu/info/IA_S2004.html).

In addition, Pow would like to offer another round of summer workshops to interested high school teachers. He eventually hopes to export the class to other schools in the area and around the country.

For more information, contact Joe Pow at 585-475-7323 or [pow@cis.rit.edu](mailto:pow@cis.rit.edu).

*Imaging Connection* is produced by a team of dedicated employees who work with CIS faculty, staff, and students to make this publication possible. Please send comments to managing editor, Colleen M. Desimone at: [desimone@cis.rit.edu](mailto:desimone@cis.rit.edu) or call (585)475-6783. **Newsletter Team Members:** Colleen Desimone, Ian Gatley, Joe Pow, Susan Murphy, and Kathy Lindsley. **Electronic Copies can be found at:** [www.cis.rit.edu](http://www.cis.rit.edu)

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