DOE Princeton Plasma Physics Laboratory

Vol. 24, No. 7 • May 20, 2003

HOTLINE

The Princeton Plasma Physics Laboratory is a United States Department of Energy Facility

MINDS Demonstrations Underway

At the MINDS demonstration for legislative officials are, from left, PPPL Director Rob Goldston, PPPL's Steve Langish, Jon Gans, legislative assistant for U.S. Representative Rodney Frelinghuysen, PPPL's Ken Silber, Princeton University's Chris Carter, and PPPL's Charles Gentile. Langish is receiving information about material entering PPPL, which is picked up and transmitted from the entrance device to a laptop in the Lobby.

You may have noticed a small, black cylinder stationed below the card reader at PPPL's entrance. As part of the test system for the Miniature Integrated Nuclear Detection System (MINDS), it can be activated to pick up and identify radioactive materials entering the site.

Testing is the latest step in the development of the system, which is being overseen by a team led by PPPL engineer Charles Gentile. The team is also working with the Rutgers University Center for Advanced Information Processing and Picatinny Arsenal to develop MINDS. "The system, which would be used to boost anti-terrorism efforts, includes a lap-top computer that stores databases of radionuclides for comparison, proprietary detection software, and three different radiation detectors, or heads, to cover a whole gamut of nuclear signatures. It would have applications in transportation and site security," said Gentile. (A PPPL Digest about MINDS is on the web at http://www.pppl.gov/publications/pages/publications.html.)

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PPPL Student Named Congressional Science Fellow

Adam Rosenberg, a research assistant at PPPL, has been awarded the American Physical Society (APS) Congressional Science Fellowship. Rosenberg begins the one-year fellowship this September in Washington, D.C. He plans on receiving a Ph.D. from Princeton University's Department of Astrophysical Sciences, Program in Plasma Physics, this summer.

PPPL physicist David Gates, who supervised Rosenberg's second-year theory project, said, "In the course of his work, Adam interacted with many scientists from institutions across the U.S., including the University of Wisconsin and Los Alamos National Laboratory, as well as with those at PPPL. He held his own and is now well established as a serious contributor to an important subfield of fusion plasma physics." Gates went on to describe Rosenberg as a good communicator who is an excellent choice for the APS award.

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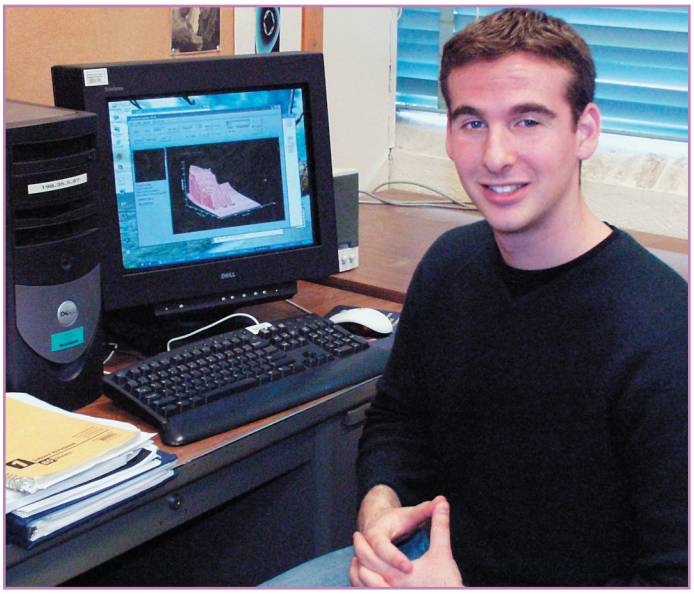

Adam Rosenberg

MINDS

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Proof-of-principle demonstrations in April, attended by representatives of state and local government, industry, and Federal laboratories, have confirmed the system's ability to detect and identify small amounts of nuclear material inside an inter-modal shipping container. Tests on detecting materials in moving vehicles began recently.

Partners in MINDS' Development

MINDS must be programmed to respond only to signatures of threat-specific radionuclides, greatly minimizing false positive alarms, which would result from the transportation of approved radionuclides such as medical and industrial shipments. Furthermore, signal losses due to distance, shielding and other absorbers, as well as noise due to background radiation, complicate material classification. For example, terrorists might attempt to hide weapons materials by shielding them or transporting them with legal radioisotopes. To overcome these difficulties, the PPPL team, in collaboration with the Center for Advanced Information Processing (CIAP) at Rutgers University, is combining a library of specific spectra with CIAP's advanced neural-network-based detection software, known as the Vigilant Decision Machine (VDM).

The VDM software engine has been proven to detect rare events amidst complex signals found in real-world environments. For example, VDM has been used at airports in conjunction with a coherent X-ray scattering technique to successfully screen luggage for plastic explosives. It also has been used in voice and face recognition systems and in defense-related applications.

In MINDS, VDM will be used for pattern recognition. The software is capable of learning the specific signals associated with various radionuclides and distinguishing those signatures from background noise and other interference. CAIP will apply VDM's sophisticated software to the MINDS energy spectra so that they are fine-tuned to the subtle differences between radioactive materials, dangerous and benign. The software will also improve MINDS' ability to detect radionuclides at a distance through walls and other absorbers, and in the presence of electronic noise. PPPL and Rutgers have jointly submitted several funding support proposals for continued development.

Picatinny Arsenal, a U.S. Army facility currently serving as an antiterrorism training center, is providing PPPL with funding for the further development of MINDS. In Fiscal Year 2002, this funding was used to prepare for successful demonstrations of the system's ability to detect nuclear material inside an automobile moving through the PPPL security gate — an analog to the tollbooth application. MINDS detection hardware has been located at the PPPL guard gate with readouts at a remote location in the Lyman Spitzer Building.

During FY 2003, Picatinny funding is supporting the full integration of the PIN diode (and/or Cadmium Zinc Telluride or Cadmium Telluride) and gamma ray detectors into the system, building upon previous work. Work is continuing on the adaptation of CIAP's VDM system for pattern recognition, as well as the development of software for the distinction of X-rays generated by the interaction of nuclear radiation with shielding materials. This could allow MINDS to detect and identify nuclear materials despite shielding. Another area being addressed is the compatibility of outputs from the MINDS system with other nuclear detection systems.

Future Development Efforts

Tasks required for the full development of MINDS include:

- The continued compilation of a database of signal waveforms for nuclear materials.
- The optimization of MINDS' ability to distinguish unauthorized from authorized materials (even when they are mixed together), and at the same time maximizing the ability to detect which unauthorized materials are present.
- Understanding the interplay between the various parameters affecting signal-to-noise ratio (e.g., distance from the sensors, quantity of materials, degree of shielding, absorption from surrounding materials, and external noise) to develop the signal preprocessing that will provide robust performance for a cycle time of less than one second. This will involve the continued work on the adaptation of CIAP's VDM software as necessary to meet speed and recognition accuracy requirements.
- Integration of a neutron detector into the system
- The development of a package for the system that will address portability and environmental issues.
- The field testing of the prototype system in various implementations, configurations, and environments. Authorities have expressed interest in field testing the system at Port Elizabeth and at bridge/tunnel entrances. Such interest has also been expressed by Amtrak police and by Picatinny Arsenal for their homeland defense training facility. Field tests will require installing systems and collecting data over a period of time to determine the background radiation for specific sites in addition to other background signals, so that baselines can be established.

Budding Young Scientists Exhibit Projects

Area students, toting their winning science experiments, came to PPPL on April 25 for the Lab's annual Science Day Fair. The Science Fair honors the winners of PPPL's Corporate Awards, who were chosen among student exhibitors in March at the North Jersey Regional Science Fair at Raritan Valley Community College, and at the Greater Mercer Science and Engineering Fair at Rider University. The young scientists exhibited their work in the Lobby, which included topics such as the effect of temperature on the speed of light, creating static electricity, and robotic surveillance using appearance-based obstacle detection. The day was organized by PPPL's Mary Ann Brown. Above, PPPL physicist Doug Darrow (left) talks to student exhibitor Meghan Kara McNulty about her project, "The Laser: Light, Optics, and Purity."

PPPL physicist and Nobel Laureate Russell Hulse (at right) hears about Kassandra Barone's project, "Bendhams Disks."

Rosenberg

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Rosenberg's interest in science policy — which is driven by a strong desire to make a positive contribution to society — compelled him to apply for the Congressional Fellowship. "I am particularly concerned with the expanding energy needs of the world, as it is clear to me that fossil fuels are in limited supply, detrimental to the environment, and a major source of geopolitical unrest," he said. He sought a doctorate in plasma physics studying nuclear fusion because he believes fusion is an attractive alternative that addresses each of these concerns.

As a Fellow, he looks forward to investigating and guiding policy in various other types of power generation, as well as in other areas of science, in the hope of encouraging options that lead to a cleaner, safer world.

"I'd like to improve our nation's energy independence and security through a variety of means. I really hope I can have a positive impact on science policy," said Rosenberg.

He received a bachelor's degree in applied and engineering physics in 1998 from Cornell University. He came to PPPL as a research assistant and Princeton University as a doctoral candidate in 1998. His thesis investigates radio frequency wave heating of ions in the National Spherical Torus Experiment under advisors Jonathan Menard and J. Randall Wilson. Said Wilson, PPPL's Radio Frequency Technology Head, "It's been refreshing to work with Adam. He brings back that enthusiasm to contribute to society through our physics research that brought us into the field in the first place. This will serve him and all of us well in his job in Washington."

Rosenberg is a coauthor of eight papers and a 1998 recipient of Princeton University's Merit Prize.

The APS Congressional Science Fellowships were created to provide a public service by making available individuals with scientific knowledge and skills to Members of Congress, and, in turn, enabling the scientists to broaden their experience with the legislative and political processes. ●

A Reminder About Outside Consulting

Situation A:
A business asks PPPL employee Jane Doe to consult on an outside project. The scope of the work does not overlap with research the Lab is doing, but it does require skills used at PPPL.

Situation B:
A business asks PPPL employee John Doe to consult on an outside project to develop a new field-line mapping algorithm. John is developing a gyrokinetic code at PPPL — the scope of which overlaps with the consulting work being requested by the outside business.

Situation C:
A business asks PPPL employee Joan Doe to consult on a project that entails applying computer codes she has developed at PPPL for fusion to another area of research — field-reverse configurations. The code enables visualization of the results.

Following the Lab's policy, which, if any, of these situations would allow PPPL staff to accept outside consulting work? Answer: Situation A.

"According to policy, staff members may pursue consulting jobs as long as the work they do for an outside business is on their own time and does not place them in a conflict of interest situation with the Lab," said PPPL Business Operations Head Ed Winkler. He explained that in Situation A, the proposed outside work is not consistent with or complementary to research work being performed at the Lab, so there are no conflict of interest issues.

However, Winkler added, in Situation B, the proposed consulting work overlaps with research being done at PPPL, which creates a conflict of interest. The work should be performed through a "Work for Others" agreement between the Lab and the private company and NOT through a consulting agreement between a staff member and the private company.

Situation C is a little trickier than A and B because it requires a judgment about whether the work under the proposed consulting agreement is consistent with or complementary to the Department of Energy's mission at PPPL. If it is, the work can be performed under a Work for Others contract between the Lab and the private company, but NOT through a consulting agreement between the employee and the private company. "Such an agreement would raise the conflict of interest concerns," Winkler noted.

Below are the guidelines for taking on outside consulting assignments:

- The outside consulting work is done on the staff member's own time (i.e., evenings, weekends and vacation days).
- The work does not present or appear to present a conflict of interest regarding the employee's duties to PPPL and the Lab's mission.
- Prior to accepting the work, the employee must receive approval from the Lab Director. The request should include a description of the work to be performed, the amount of time it will take, and the name of the organization who is hiring the PPPL staff member as a consultant.
- The consulting work should not impair the employee's responsibilities at PPPL.

"The key element is timely and complete disclosure on the part of those individuals wishing to do consulting work for outside parties," said Winkler. When Laboratory management knows the nature of the proposed consulting assignment, the party for whom the work is to be done, and the amount of overall effort involved, then it can make a determination in a thoughtful and disciplined manner. Winkler emphasized that an employee must receive approval from the Laboratory Director PRIOR to accepting outside consulting work.

For more information or guidance, contact Steve Iverson at ext. 2007, Susan Murphy-LaMarche at ext. 2224, or Ed Winkler at ext. 2218. The policy for outside consulting is included in the Employment Section of PPPL's Personnel Practices Manual, P020 Policy for Research Sponsored by Non-Department of Energy Entities. ●

Hotline

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The HOTLINE is issued by the Princeton Plasma Physics Laboratory, a research facility supported by the United States Department of Energy. It is primarily an internal publication. Correspondence and requests to reprint material should be directed to the Editor, PPPL HOTLINE, P.O. Box 451, Princeton, NJ 08543; Interoffice correspondence should be addressed to MS-38, LSB Bldg., C-Site; fax 609-243-2751; telephone 609-243-2757; e-mail pwieser@pppl.gov.