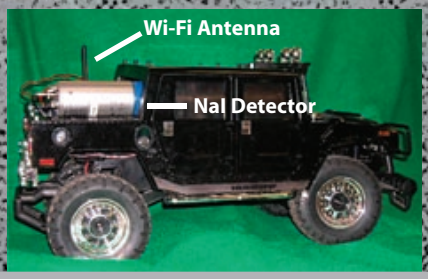


RaDRobot is a WiFi-controlled, self-propelled, semi-autonomous radiation sensor that uses a low cost, commercially available toy truck base.

A central server can control a squadron of RaDRobots, directing radiological searches, developing radiological contour maps and triangulating sources.

RaDRobot's radiation detection software can detect, identify, and quantify radiation from various radioisotopes, and can detect shielded sources.

A WIRELESS WAR ON TERRORISM

BY BOB SKIPPER

Photos courtesy of Phillip Womble

DR. PHIL WOMBLE, DIRECTOR OF THE APPLIED PHYSICS INSTITUTE (API) AT WESTERN KENTUCKY UNIVERSITY, IS USING WIRELESS AND INTERNET INFRASTRUCTURE TO DEVELOP A NEW GENERATION OF DEVICES FOR USE IN HOMELAND SECURITY. SOME OF THE GADGETS, WHICH ARE USED TO DETECT RADIOLOGICAL, CHEMICAL, AND BIOLOGICAL HAZARDS, ARE REMINISCENT OF A JAMES BOND MOVIE.

Photos of various instruments line the walls throughout the API's offices in the Center for Research and Development. The devices include the results of the Institute's earlier work with neutrons as well as the current research in wireless scanners and tracking devices.

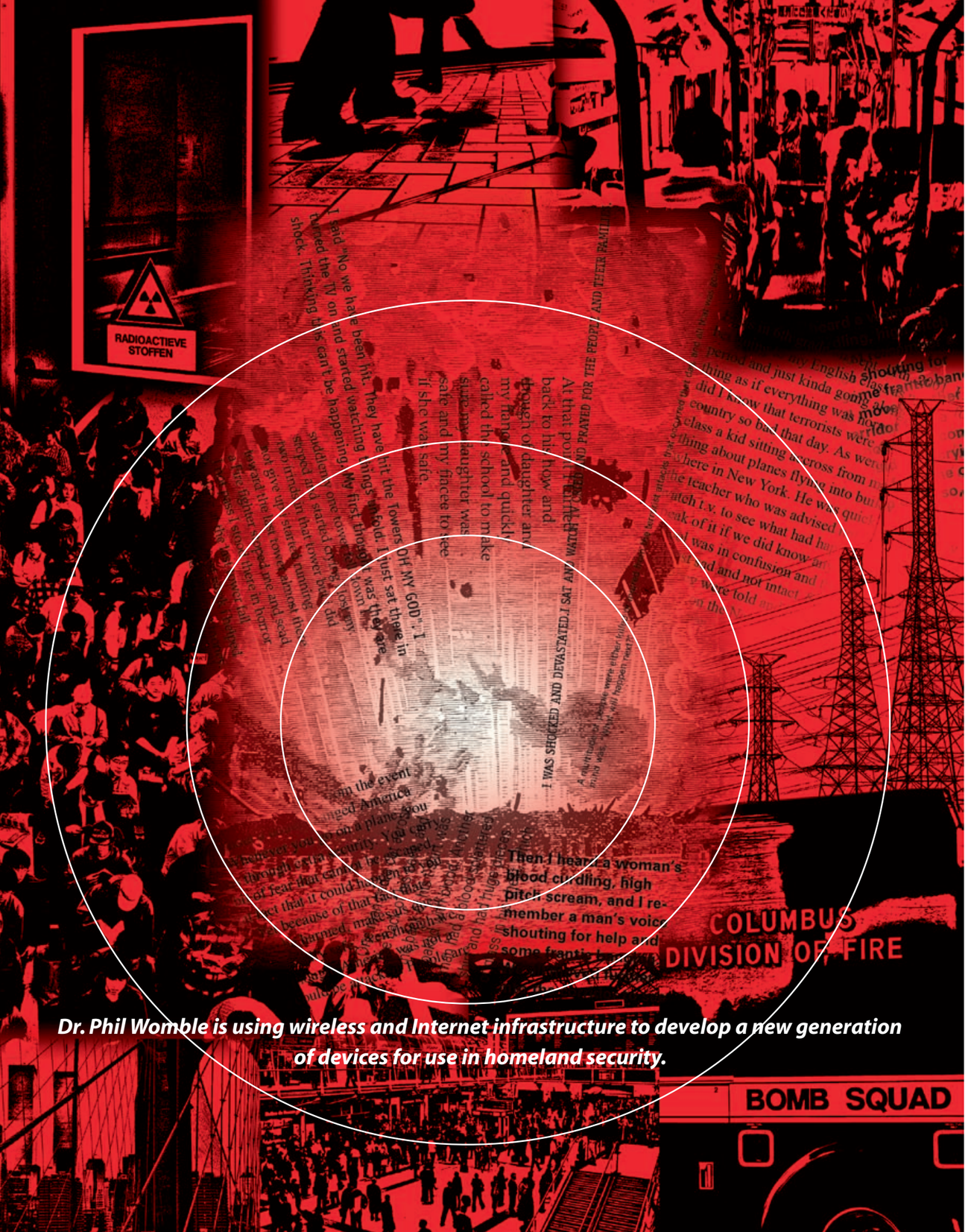
In the back, antenna in series are used to track electronic sensors that could be carried by emergency personnel. Upstairs, co-researcher Alexander Barzilov shows off a cell phone that has been modified to become a scanner that can transmit readings to a central location for analysis. And across the room, the parts of a battery-powered toy truck are scattered about as researchers modify it to carry a camera and sensors with wireless operation.

And now the staff is working to secure a $1 million, 2.5 million volt particle accelerator from the U.S. Army to begin a new generation of research. "If you took a look at us four or five years ago, we were doing neutron this and neutron that," Womble said. "Today we're thinking a lot about wireless, but with things like the accelerator, we're trying to keep our options open."

Dr. Phil Womble

The path to a particular project is often not linear, but more like the branches of a tree, Dr. Womble explained. In 2003, someone asked him to make a wireless device to do a certain task, which was the first stage of an electric meter that can be read wirelessly from a distance. "I said 'sure that's easy' and we did it. Then I said, 'gosh, this wireless stuff is kind of cool; what else can it do?'" Womble continued.

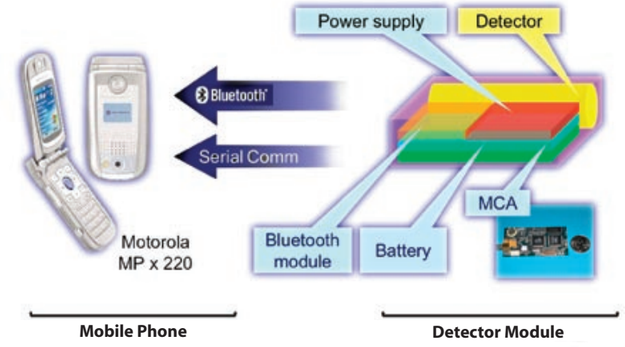
The next branch is growing toward medical applications. "If you had told me a year and a half ago that I would be developing medical sensors, I would have laughed at you," Dr. Womble said.



Dr. Phil Womble is using wireless and Internet infrastructure to develop a new generation of devices for use in homeland security.

Illustration by Tom Meacham

Diagrams courtesy of Alexander Barzilov, Phillip C. Womble, Jon Paschal, Abe Music, and Britton Wallace



RadPhone is a portable gamma-ray spectrometer that uses mobile phone technology to analyze the composition and source strength of a detected radiation source, and to distribute the results to security personnel.

RadPhone consists of a detector module and a mobile phone/data acquisition computer with wireless communication. It is programmed to mitigate or eliminate false alarms from medical isotopes and naturally occurring radioactive sources, and can be "trained" to recognize specific signatures of radiation.

Analysis results can be transmitted to a remote computer database through email or SMS messaging along with picture file of the object under scrutiny, to be analyzed by a remote expert.

"Now I have an interest in it because I've done all these other projects and I'm thinking 'wow this should be easy based on what we've learned.' That's typical for the Institute."

Dr. Womble and his API team are eager to find the right application for the commercial market. "That's the hardest part. You come up with an idea and try to sell it," he said. "At this institute we do more applied research. We ask a question that you typically don't get asked in university life — is what we're doing commercially viable? Can it be marketed?"

That commercialization puts the API at odds with some who say that's not true research. "But the problem is, once you say there's a viable market, we find out there's a whole load of basic research problems that must be solved before you get to the applied part," Womble said. "Usually a person involved in basic research solves one problem in a particular discipline and then goes on to the next problem. I may have to simultaneously solve three or four problems in various disciplines."

Dr. Womble uses the cell phone scanner as an example. The team used an ordinary cell phone; designed new circuitry to fit inside; wrote programs to work with the cell phone's Bluetooth technology; and came up with a small scanner that can be used to search for radiological, chemical, or biological hazards. The phone can send the information to what Dr. Barzilov calls a "center of excellence" for interpretation, and can still be used as a phone or a camera.

"So there will be all these problems and they won't all be in one area of physics," Dr. Womble said. "It will be across a whole bunch of disciplines that you'll have to know." These experiences have led to "a large knowledge base," he said.

Dr. Womble sees the particle accelerator as the future of the API. It will be used for a variety of studies from understanding the composition of surfaces to materials characterization down to parts per billion. It could lead to "some exciting stuff by building new materials or new integrated electronic components," he said.

"I hope this will be the future of the API from the standpoint that we have a new strength to build on," said Womble. "It will build research for the University, but it will also be a commercial tool for the local high-tech industry where they will be able to come in and use something like this."

No matter where the research leads, one thing will remain constant — the involvement of students in the API. In the spring of 2005, eight undergraduate students were working at the institute, assisting with the research and gaining valuable practical experience as well as classroom knowledge.

"From a teaching standpoint, this is the best sort of teaching because it's one-on-one with the students," Dr. Womble said. "It gives them extra experience outside of the classroom that reinforces what's taught in the classroom. What this center provides the University is a place for the students to learn more about how to become scientists and engineers."

The university has to have that experience for its students, Womble said. "It used to be a good thing for a university to say 'here's a diploma, see you later.' Now a university has to do much more than that. It has to respond to the community and offer training so that folks can go out and get careers and be successful."