A New Kind of Rescue Hero

It's not a toy fireman—or even a real one. It's a death's head cockroach, and Ben Epstein '78 is outfitting it to save lives.

By Karen McCally '02 (PhD)

IT'S A WEDNESDAY MORNING IN MAY IN A lab at Texas A&M University, and **Ben Epstein** '78 is filming as a technician removes a two-inch long cockroach from a plastic box, rubs it with a cotton cloth, and dabs a splotch of adhesive on its back.

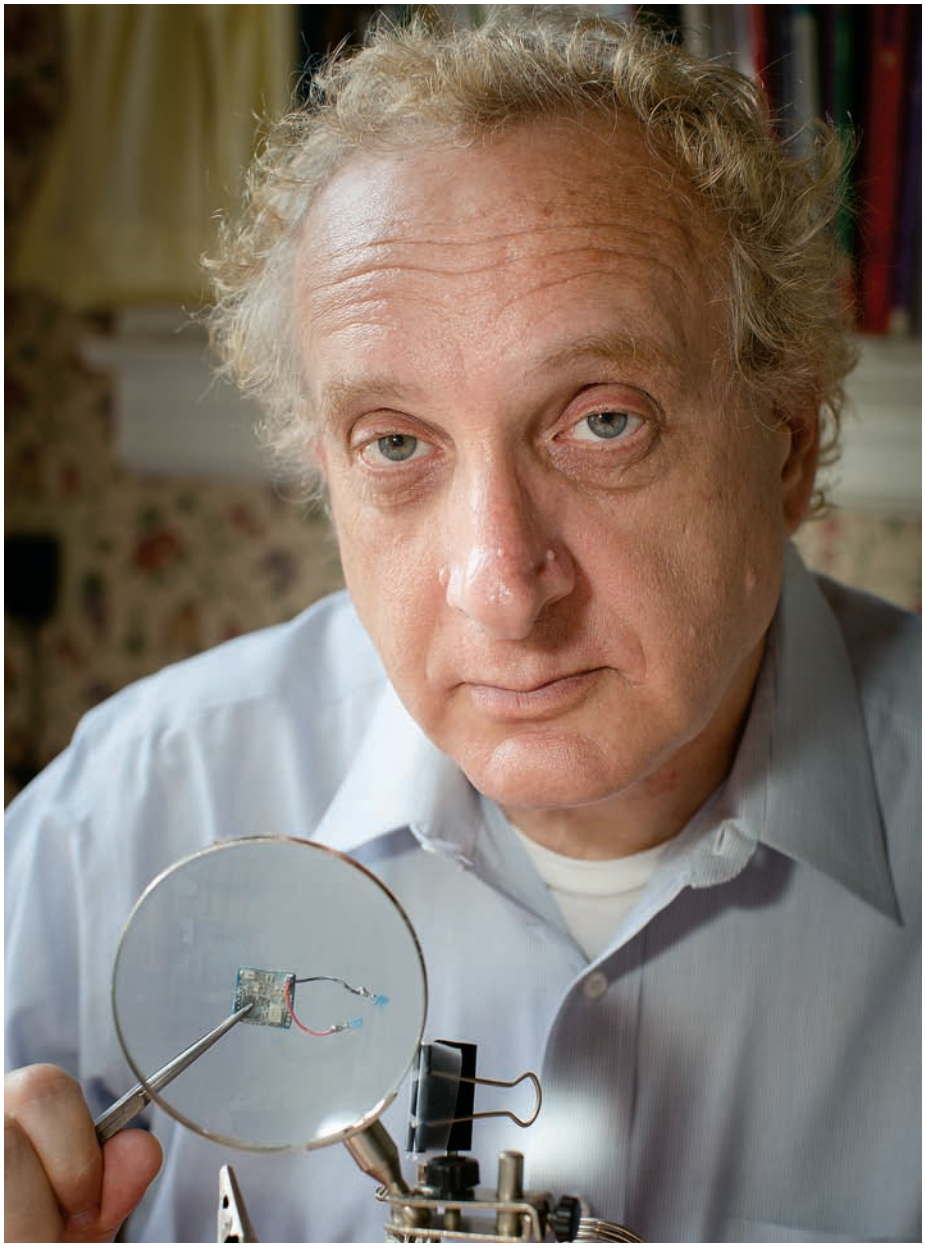
Next, the technician presses a small circuit board to the adhesive, connecting a tiny radio, microphone, and battery. The whole package fits on the roach like a backpack, and in a few minutes, the roach and several others like it will be released onto the cement floor of a large shed, where they will scurry away like grade schoolers dashing to the bus stop.

It's all part of the field test for the OrthopterNets program, a project of OpCoast, a two-person New Jersey tech company specializing in networking and wireless systems. Epstein and the company's other half, David Rhodes, are both electrical engineers with doctorates, a long line of published articles, and about three decades of experience in the field.

"If you have enough insects with these radios, they can form what's called an ad-hoc radio communications network," Epstein says, explaining the OrthopterNets project. The release of hundreds of outfitted cockroaches could form a network allowing search officers, stationed at receivers, to communicate with people trapped in mines, buildings, or caves. The project could make this particular species of cockroach—the supersized death's head cockroach, which likes nothing more than to wander in dark spaces—an unwitting search and rescue hero.

OrthopterNets is funded by the Defense Department's Army Research Office. The Defense Department has funded research that's had significant commercial applications, and Epstein hopes that OrthopterNets is no exception. He predicts, however, that it will draw interest mostly from public and private entities that carry out search and rescue missions.

"I don't see people buying these things on Amazon," he jokes.



▲ **LOW-TECH HIGH-TECH: Cockroaches outfitted with tiny electronic equipment form wireless communications networks in a Defense Department–funded project led by Epstein.**

That said, the death's head cockroach is, in fact, a bargain. The low-tech facilitator of high-tech operations comes at a pittance. "It barely even appears in our budget," says Epstein of the cost of the roaches, which he obtains from a local supplier. Not even the circuitry itself is expensive, he adds. For commercial users, "most of the cost would be in mounting the circuits—the manual labor involved."

The project is in the prototype phase and Epstein estimates that it will take another

JOHN MINCHILLO/AP IMAGES FOR *ROCHESTER REVIEW*

year to make OrthopterNets operational. Part of the challenge is making the equipment as small, light, and powerful as possible. On the one hand, the death's head cockroach is a hearty creature. During the May field experiment, roaches were carrying two grams of equipment—about half their total weight. And, Epstein noted, "They don't seem to mind."

Nonetheless, about four minutes into the field experiment, at least one of the roaches slowed considerably, as first the battery, and then the circuit board, slipped from its back. "Batteries are the biggest limitation," says Epstein, who says that's why the team is focused on developing the circuit board to consume less power.

The OrthopterNets project is one of many that the Defense Department has sponsored that harness "cyborgs"—short for cybernetic organisms—for military purposes. Several years ago, the department's Defense Advanced Research Projects Agency, or DARPA, funded a program called HI-MEMS, or Hybrid Insect Micro Electromechanical Systems, to develop technology to control insect locomotion. Epstein attended a HI-MEMS briefing. "I was very impressed with the work that I saw," he recalls. Noting that HI-MEMS focused on insect movement, "I thought why not do something involving communication with insects?""

He constructed a team of experts on everything from insects to integrated circuits. His partners—Hong Liang of Texas A&M's mechanical engineering department along with Byunghoo Jung and Harry Diamond of Purdue University's School of Electrical and Computer Engineering—describe Epstein as "highly creative." "I've always enjoyed our collaborations with Ben," adds Diamond, who worked with Epstein on the development of a digital array radar for the U.S. Army.

A tinkerer by nature, Epstein says his childhood bedroom in Cherry Hill, N.J., was littered with deconstructed gadgets. At Rochester, he had less time for informal experimentation. "To be quite honest," he confesses, "I was just studying so much."

There were exceptions. Just for fun, he helped a professor test the theory that flatworms, or plenarians, emitted electrical fields. If the fields could be manipulated, Epstein says, "you could make plenarians grow two heads."

Alas. "We never got that far," he concedes. ®

In the News

GAME CHANGER: Ayub founded the Afghan Youth Sports Exchange.

ALUMNA ONE OF 33 WOMEN FEATURED IN *ESPN MAGAZINE*'S 'BEYOND IX'

ESPN Magazine named **Awista Ayub** '01 one of "33 women who will change the way sports are played" in an article, "Beyond IX," in its June 11, 2012, issue commemorating the 40th anniversary of the passage of Title IX. A section of a larger education bill, Title IX prohibited discrimination in any federally subsidized educational program on the basis of sex, and led to major improvements in athletic programs for women and girls. In 2003, Ayub founded the Afghan Youth Sports Exchange to use athletic competition to teach leadership and conflict resolution. The exchange brought Afghan girls to the United States to play soccer and to return to Afghanistan as ambassadors for the sport. The program eventually resulted in a league of 15 girls soccer teams in Afghanistan (See "Supporting a 'Home' Team," *Rochester Review*, November–December 2009). Ayub is now helping to bring basketball and tennis, as well as soccer, to war-torn regions as director of South Asia programs for the nonprofit Seeds of Peace.

VITTORIO GRILLI '86 (PHD) NAMED ITALY'S MINISTER OF FINANCE

In July, Italian Prime Minister Mario Monti appointed **Vittorio Grilli** '86 (PhD) as minister of finance. A native of Milan, Grilli had previously served as deputy minister of Italy's Ministry of Economy and Finance, and before that, in Italy's treasury. Grilli also worked in the private sector as managing director of the London office of Credit Suisse First Boston. After earning his doctorate in economics at Rochester, Grilli taught economics at Yale and at the University of London.

GRILLI: New Italian finance minister

GRADS NOMINATED BY PRESIDENT OBAMA TO KEY POSTS

President Barack Obama has nominated **Allison Macfarlane** '87 and **Emil Kang** '90 to key administration posts. Macfarlane, a geologist, was tapped to chair the Nuclear Regulatory Commission. A professor of environmental science and policy at George Mason University, she served previously on Obama's White House Blue Ribbon Commission on America's Nuclear Future, which studied nuclear waste disposal. Kang, a musician and the director for the arts at the University of North Carolina at Chapel Hill, was nominated to be a member of the National Council on the Arts. The council advises the chair of the National Endowment for the Arts on issues concerning grants, funding guidelines, and new initiatives.

SCOTT DUNCAN/OTHER FILMS INC. (AYUB); CORBIS (GRILLI)