In Sink-or-Swim Environment, Physicists Retrain to Survive

These are rotten times for physicists. A growing number are competing for a shrinking pool of jobs, according to statistics collected by the American Institute of Physics. In industry, research positions are drying up fast as the Kodaks, IBMs, AT&Ts, and Bellcores of the world kill off basic physics research projects. "We are moving away from learning more about the physical world" and toward a focus on the world of information and computer networks, says Robert Lucky, vice president for applied research at Bellcore, in Red Bank, New Jersey. Things aren't much better in academia, where hundreds of physics Ph.D.s are stuck in a pool of the underemployed—getting by in temporary, low-paying postdoctoral fellowships or low-prestige, part-time research positions. So some industry physicists, with few options open, are shifting their focus to information technology, and Bellcore has a program to help them do it.

Over the past 2 years the company has put more than 400 researchers, mostly Ph.D.-level physicists and electrical engineers, through an intensive 3-week crash course in software and systems engineering. The course, which program initiator Stewart Personick says costs the company about $20,000 a head, is Bellcore's effort to hold on to its top basic researchers even as its research program has shriveled.

Though the Bellcore program is a new and apparently unique development, the forces behind it are shaking the whole telecommunications industry. As these companies look for competitive advantage in systems research—networks, software packages, and the like—traditional skills in basic research are out of favor. "The way telecommunications networks are going, we are moving toward software and away from hardware," says Bellcore's Bill Stephens, a recent graduate of the course. Expertise in networks and software, he adds, is becoming essential not only for survival at Bellcore but for staying in industry research at all.

Bellcore's course originated 3 years ago, says Personick, when "it became incredibly apparent that researchers with degrees in physics and electrical engineering need to get involved with various aspects of computer science." Previous generations of physicists had worked their successors out of jobs in basic research, adds Lucky. "It's really been too good," he says, speaking of the fruits of basic physics, such as the transistor, laser, and fiber-optic cable. With many past advances in basic physics still waiting to be exploited, industry's needs have shifted from researchers who can contribute fundamental advances to people who can do network architecture and information handling.

To Bellcore, a good place to find those people was in the company's existing corps of basic researchers. "Physicists make magnificent systems engineers," explains Bellcore electrical engineer Richard Alloy. "They see the world in a comprehensive way—they look at things in context." For Bellcore, there was the added appeal of holding on to people of known talent and flexibility, rather than risk hiring newcomers. All they lacked was training in computer science. And that's what Personick decided to give them.

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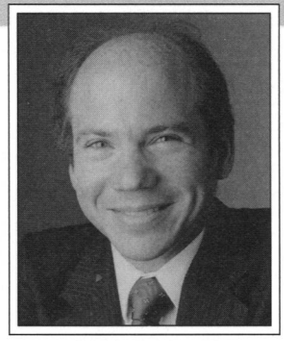
–Stewart Personick



Not an educator himself, Personick realized he would need some professional help in setting up the course. After considering about a dozen institutions, he turned to Carnegie-Mellon University in Pittsburgh, both because of its strength in computer science and because of its track record in working with Bellcore on other technical training and retraining courses. The first group to enroll in the new program spent 2 weeks on the Carnegie-Mellon campus and 5 more 1-week segments back at Bellcore headquarters in New Jersey. Last year, the organizers consolidated the course into a single, intensive, 3-week session on campus.

Three weeks may seem like a short time for physicists to retool their skills, but Personick explains that the idea is to give them the tools to teach themselves. "Since computer science is a rapidly changing field, we need some understanding of the terminology and concepts in order to retrain ourselves and remain current," he says. "We aren't trying to turn electrical engineers and physicists into computer scientists overnight," he says. "This is a basic crash course in the terminology and concepts."

By now four classes of Bellcore researchers, mostly a mix of mid-career Ph.D.-level physicists and engineers, have gone through the course. Personick stresses that enrollment is completely voluntary, and graduates return to their current jobs. But graduate Stephens notes that changes in the nature of those jobs provide a strong incentive. His experience in the course, he says, served him well as the group of researchers he manages changed from mostly electrical engineers working on circuit design to a mixture of electrical engineers and computer scientists.

Stephens' experience of having to cope with change is becoming an increasingly common one for industry researchers. Other major computer and communication companies, such as AT&T and IBM, don't have the equivalent of the Bellcore program, but they, too, are cutting back on basic physics research and putting more emphasis on software. IBM, for example, has whittled its core of physicists from about 330 to 220 over the past 5 years, says Trey Smith, director of physical sciences research.

For researchers and managers at such companies, Carnegie-Mellon has set up the Information Networking Institute, which gives 14-week courses aimed at engineers, marketing specialists, and, increasingly, physicists. Says Alloy, the director of the program, "We looked into the future and saw a need for a unique skill blend not addressed by our educational institutions," combining computer science, electrical engineering, and business skills.

Bowing to necessity isn't always easy for the basic researchers making the shift, however. Bellcore physicist Mark Johnson, who continues doing basic research in memory technology, says he's seen countless fellow researchers come under pressure to do more applied work and subsequently choose to desert the company in favor of positions in academia. Stephens, for his part, says, "I have mixed emotions. I'm hoping I can adapt, but it's a hard row to hoe when you go from something you know and love to something completely new." But for industry researchers, there's probably no going back, says Alloy. "We will see more change in this [telecommunications] industry during the rest of the 1990s than we've ever seen before."

–Faye Flam

For more information on careers in science, see "Careers '93: A Survival Guide," on p. 1765.