

advice to Congress is occurring in the Senate. An amendment that would set aside \$1 million for a pilot program in technology assessment, run by the Government Accounting Office, was adopted in July as part of the Legislative Appropriations Act. Senator Jeff Bingaman (D-N.Mex.), the amendment's author, said it wasn't intended to "restart OTA," but to formalize a way to "analyze current science and

technology issues affecting our Congress." He said he eventually would like to see the program expanded and transferred to the Congressional Research Service. While that isn't as substantial as Holt's re-created OTA, it is attracting support as being more politically realistic. Bingaman's million-dollar program must survive conference committee budget negotiations, which is far from a sure thing.

With the severe budget squeeze facing Congress, Holt admits it will be difficult to pass an OTA bill that calls for expanding government with a revived, \$20 million-per-year agency. "I think a case can be made that a lot of efficiency will come from a new OTA," Holt said. "In retrospect, the decision to get rid of the ice buckets was a good one, but the decision to get rid of OTA wasn't." **JIM DAWSON**

Bell Labs Research Regroups as Parent Lucent Shrinks

It's no secret that the past year has been a rocky one for Lucent Technologies. In synch with the rest of the telecommunications industry, its stock has tumbled. By next spring, the company plans to scale back its global workforce to 60 000, or about 50% of its peak two years ago. Bell Labs, Lucent's research arm, has lost funding and people because of the company's financial woes, and because of the spinning off of its microelectronics business. What's the toll on Bell?

The transistor, Big Bang background radiation, the laser, laser cooling of atoms, the fractional quantum Hall effect, solitons, and functional magnetic resonance imaging are among the many discoveries that have come out of Bell Labs, and its scientists have garnered six Nobel Prizes.

But like the rest of Lucent, Bell Labs is contracting. The total number of researchers is now about 600, half of what it was in 1999. The number of people doing basic research in the physical sciences is down to about 60, from 110 or so a few years ago. Going back further to the late 1970s before the government split up parent company AT&T, the physical sciences research team was 300 to 400 strong. AT&T—which as a monopoly could afford to invest in long-term research—was broken up in 1984, and thinning occurred in the early 1990s in a market pinch. More people left when Lucent was founded in 1996, but physical sciences research at Bell Labs later made a comeback.

The spin-off this year of Agere Systems was intended to get Lucent out of making and selling optoelectronic components and integrated circuits and open the door for the new company to sell more freely to Lucent's competitors. But the spin-off, first announced in July 2000 and started in March of this year, has been thwarted by Lucent's financial slump; the plan now is to complete it in the coming months.

In the meantime, many Agere researchers work at Lucent headquarters in Murray Hill, New Jersey. The

With Lucent Technologies in meltdown, many researchers mournfully predict the demise of Bell Labs. Lab leaders, however, maintain they will stay at the forefront of research.

fledgling company is taking its share of the blows: Among other austerity measures, Agere has laid off about a third of its workforce—including many of the 275 former Bell Labs scientists working in silicon and optical component technology.

The Agere spin-off "is the last straw," says one long-time Bell Labs physicist. "The perception of some of us is that it narrows research and limits the potential for collaboration and synergies. The financial imperatives have become so strong, one is not being given time to do things with much more than a five-minute hori-

zon. Bell Labs will never be the same."

Breaking noodles

That refrain has been heard every time the company has splintered, and the worry about research becoming increasingly business-driven extends to all industry-based labs. This time, though, many industry watchers say Bell Labs is more at risk than ever of losing the breadth and freedom of research that have made it a magnet for top scientists.

"Pulling labs apart is like pulling apart spaghetti—you can't do it without breaking some of the noodles," says Stan Williams, a one-time Bell Labs researcher now at Hewlett-Packard Co, where, in 1999, he saw up close the splitting off of Agilent Technologies. "A research enterprise depends on its past integral. Research has an esprit, tradition, and a corporate memory of its own. Once segmented, it's extraordinarily difficult to weld together."

"Any time you get smaller, there is less buttressing from fluctuations of the market," adds David Nelson, a physicist at Harvard University who has consulted for Bell Labs for 25 years. "As outside financial pressures strip layers of insulation off, it's going to be harder to keep the diversity. Where is the next generation of exciting new ideas for hardware going to come from if they're so focused on the bottom line? If you aren't letting 1000 flowers bloom, you lose the capacity to respond to new challenges. You need lots of genetic diversity. This is a concern in the context of Lucent and other companies."

Physical sciences research at Bell Labs "was interdisciplinary. There was a big sea that we fed off of and into," says Philip Platzman, a theoretical physicist who has been at Bell Labs for 41 years. "Now it's small, it's good, and, most important, it's still there. But the atmosphere has changed. The rest of Bell Labs is severely weakened. The Agere spin-off takes away everything connected with components—silicon,



LUCENT TECHNOLOGIES headquarters in Murray Hill, New Jersey. The company is halving its workforce and closing offices left and right. Some of those still there say they are paying closer attention to Lucent's budget than to the US government's.

III-V semiconductors. . . . A third of the physics group went. And [Lucent] recently sold fiber optics. That's another 50 people. What do I do now when I get a nice idea about fiber optics? There's practically no one down the hall to talk to. I have to make arrangements with another company—that's a barrier."

Waving the Bell Labs flag

"Look, I want the company to recover," says William Brinkman, Bell Labs vice president of research. "We have gone through one of the worst periods a company can go through. We have survived. People are ignoring the fact that we had revenues of \$6 billion last quarter when everyone else tanked. That's a major accomplishment." Lucent will keep investing 12–13% of its revenues in R&D, he says, though the "R" part is down a bit, and the company's total revenues are way down.

It's hard to deny that synergy is reduced, says Brinkman. Will university physics faculties still be peppered with Bell Labs alumni in 20 years? "Probably not," he says. "The number of physicists here is not as big as it used to be. But I think we still have a broad spectrum of research in optical and wireless communications. In my own view, some of the stuff, say in organics, is still of Nobel Prize caliber. We think we can still create an environment to attract young people here to make a name for themselves."

"It's a different world, but it's not necessarily worse or better. It's at least as exciting," says Federico Capasso, a 25-year Bell Labs veteran and vice president of physical research. "I actually view [the Agere spin-off] paradoxically as a terrific opportunity. It gives a chance to physicists [at Bell Labs] to see some of their inventions immediately have an impact. That is energizing. We are doing research both to impact the business on some timescale and also to continue to wave the Bell Labs flag. We are still the world's strongest industrial lab."

"I still love it here," adds John Rogers, who came to Bell Labs nearly four years ago after a postdoc and now heads nanotechnology research. He ticks off a list of work in his department: single-crystal organic semiconductors, electrically pumped organic lasers, superconducting switches, electronic paper, biological microlenses.

"Bell Labs has been evolving its research program for nearly all of its 76 years. I think we'll survive the latest tweak," says press office director Michael Jacobs. Not surprisingly, sci-



LUCENT STOCK started to dive in early 2000. (Source: <http://www.prophetfinance.com>.)

entists and managers speaking, per company policy, in the presence of a press officer painted a rosier picture than those speaking on their own, mostly anonymously.

Research for business

The trend in industrial labs to increasingly couple research to business is neither new nor limited to Bell Labs. Observers point to IBM Corp, which cut back fundamental physics research some years ago, and to Xerox Corp, General Electric Co, and other shrinking industrial labs.

Says Platzman, "I think Bell Labs is the most fantastic place that ever existed. I am very distressed that it's

not what it was. People are leaving. They have offers at other places where they think they can have much better careers. I don't know who has left in the week I've been away. And I worry that people will not continue to flock to Bell Labs. That would be a loss for the country, and for the world."

Many physicists wonder if the breadth, vitality, and synergy that made Bell Labs the crown jewel of research labs can be re-created elsewhere. Universities should take over, says Bob Dynes, chancellor of the University of California, San Diego, who spent 23 years at Bell Labs. "But they don't have their ducks lined up."

Even Bell researchers and outside observers who are dismayed about the prospect of Bell Labs losing its place at the pinnacle of research concede that Lucent's strategy of shedding divisions and focusing on Internet infrastructure may be the best bet for staying in business. "The crucial thing is how Lucent fares financially. They still have extraordinary people and extraordinary leadership. If the business is successful, it can afford to invest in research—which itself is necessary for the business to be successful in the longer term," says Charles Shank, formerly of Bell Labs and now director of Lawrence Berkeley National Laboratory. "And anybody who looks at telecommunications knows it has a very bright future."

TONI FEDER

Cost Cuts Kill Climate Satellite

Deep cuts in NASA's Earth science budget for 2002 have claimed a second casualty. Having mothballed the Triana satellite, which would have provided data on ozone and climate change (see *PHYSICS TODAY*, August 2001, page 23), NASA now plans to switch off another Earth-observing satellite, the Upper Atmosphere Research Satellite (UARS). At press time, UARS was scheduled to be turned off on 30 September, despite calls by scientists to keep its \$10 million-per-year budget going. They argue, among other things, that NASA is mandated to continually study the ozone layer under the 1976 NASA Authorization Act and the 1990 Clean Air Act.

UARS is one of the oldest Earth-observing satellites still in orbit, and has been at risk since August 2000, when NASA decided to exclude it from its budget proposal for 2002. Indeed, this year, an 11.7% cut is anticipated in the Earth science budget (see



QUENCHING UARS will create a gap in climate data.

PHYSICS TODAY, June 2001, page 24). Mission delays and cost overruns could lead to early termination of four additional missions, according to some NASA employees.