Bell Labs on the Brink

Changes in funding and mission caused by divestiture raise concern about the future of fundamental research

Bell Laboratories will be the only domestic element of a restructured AT&T allowed to keep the family name after the breakup of the Bell system scheduled for 1 January (see box). More important for AT&T is whether Bell Labs after divestiture can maintain its reputation as the world's premier industrial laboratory.

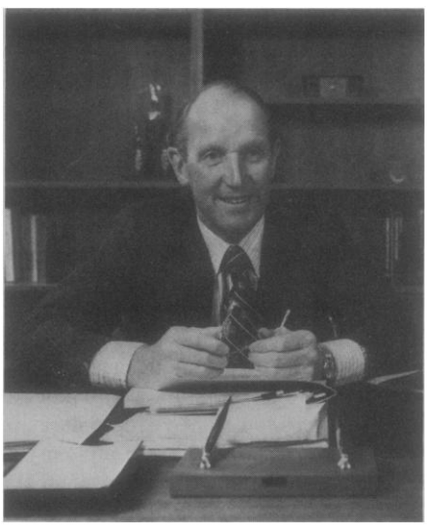
Bell Labs has long served as the wellspring of innovation not only for the Bell system, but for the telecommunications industry at large. Its unusual commitment to fundamental research has been rewarded by Nobel prizes to seven staff members and has been credited with discoveries of keystone technologies including the transistor, the laser, and fiber optics. The obvious question now, however, is whether AT&T as a smaller company with a narrower revenue base operating in an unfamiliarly competitive environment, will be willing and able to make a comparable investment in R & D in the future, particularly in fundamental research.

Officials of Bell Labs and AT&T, for their part, express confidence that Bell Labs will weather the transition and continue to provide the knowledge base and products the company needs. (The labs have provided centralized research, systems engineering, and product design and development for the whole Bell system.) Others see the breakup resulting in a debilitated Bell Labs, leading inevitably to an erosion of the U.S. lead in telecommunications technology internationally.

Divestiture unquestionably will bring radical change in the way Bell Labs operates and relates to the present components of the Bell system. The most conspicuous effect of the reorganization so far has been the shift of 4000 Bell Labs staff (most of them engaged in product design and development) to the new, unregulated subsidiary, AT&T Information Systems (ATTIS). Another 3000 Labs staff are scheduled to depart when divestiture formally occurs at the start of the year. This contingent, mostly systems engineers, will join a new Central Services Laboratory, a cooperative enterprise serving all the operating phone companies, which at that point will have separated from AT&T under the divestiture plan. The transfers will reduce Bell Labs employment to about 18,000.

These transfers underscore Bell Labs' loss of the "end-to-end" responsibility for both technological innovation and network planning which has been cited as a major factor in the Bell systems success at innovation.

During court proceedings prior to the agreement on divestiture, Bell witnesses argued against the breakup of the Bell system and were obviously making the strongest case possible for the status quo. But their dire predictions about the results of divestiture had the ring of conviction. In commenting on the emerging scenario of separation for the operating companies, Bell Labs president Ian Ross, for example, said "such restructuring would significantly limit the scope of Bell Labs mission and reduce its overall funding." Ross said the projected reduction in funding and size "could seriously curtail our research and engineering efforts and jeopardize the critical mass that makes possible all of our contributions to telecommunications and the national interest."



Bell Labs president Ian M. Ross

Research base to be inviolate.

The loss of overall network responsibility would not only bring a reduction in fundamental research, "but would most likely cause the research and development of the new 'AT&T Complex' to be focused—as in many American industries—solely upon market innovations of immediate value to the competitive interests of Western Electric and Long Lines."

Another witness invoked economic theory in a manner that supported Ross's view. William Nordhaus, an economics professor at Yale and president of his own economic research firm, said the breakup of the Bell system would threaten fundamental research at Bell Labs because of what economists call "appropriability"—the ability of an investor to capture the fruits of his investment. Because of the Bell system's monopoly position, it has been able to cover its research costs through user payments and productivity increases gained from innovation. Nordhaus testified that after the breakup, "The Bell remnant will tilt much more toward a conventional equipment manufacturer, and it will therefore have a relatively greater incentive to invest in R & D that will enhance its equipment sales and profits than in systems or non-product embodied R & D."

The argument that AT&T will lose its ability to innovate by a reduction in size was disputed by another witness from academia, Carson Agnew of the Engineering/Economic Systems Department at Stanford. He said the data on firm size and R & D spending indicated, that on balance, it appeared that above a "minimum size" of between $250 million to $500 million in annual sales there is no additional gain in a firm's ability to innovate. The new AT&T would be many times larger than this minimum.

Many of the Bell system's critics and competitors argue that the breakup of the system will, in fact, be good for innovation. Orville Wright, president and chief operating officer of MCI, AT&T's biggest challenger in long distance service, says that "Everybody will be a winner. The country's been a closed market to the general trade companies and foreign manufacturers." Divestiture clears the way for "U.S. electronics firms new to the telecommunications

business to compete," he said. "Independent telephone companies will have a broader source of supply and this will encourage investment in R & D."

Of Bell Labs, Wright says it is "a leading organization in basic research and does fine work." He adds that "You've got to realize it's paid for by the public through local and long-distance charges." Bell has been liberal in licensing its basic research results, says Wright. But he notes again that the obligation to do so was made explicit in the earlier consent decree in return for basic research being paid for by telephone customers.

A distinguishing characteristic of Bell Labs has been its policy on scientific publications and patent licensing. As of last year, the prolific Bell Labs staff had obtained some 31,800 patents since the labs were established in 1925, better than a patent a day. In recent years, staff members have published scientific papers at a rate of 2000 a year. The Labs' policy has been to make research results readily available in the technical literature, including Bell Labs journals, and to offer licenses at a reasonable cost and on a nondiscriminatory basis.

A powerful incentive for the policy was the Bell system option to use its own technology to barter, if necessary, to gain access to technology developed outside the Bell system. AT&T has affirmed its intention to continue the present liberal policy after divestiture. Some Bell Labs executives expect charges for licenses to be increased to help defray the costs of research. Outsiders suggest that AT&T will adopt a more protective attitude toward new technology as the realities of competition are borne in.

The Bell Labs open publication policy is regarded as a significant factor in the Labs' power to attract capable young scientists and engineers interested in research. This raises the matter of the special Bell Labs "culture"—created by factors much less tangible than the level of R & D spending—but to which many observers accord major credit for the success of Bell Labs as a research organization.

For a study on information technology R & D now in progress at the congressional Office of Technology Assessment (OTA), Bell Labs staff members were interviewed for their views on the ingredients of the Bell Labs research atmosphere. The project director, economist Donna Valtri, says that the following points were frequently emphasized. Hiring is done from an impressive pool of applicants by a careful selection process. Along with freedom to publish, employ-

Antitrust and Technology Thrust

The main feature of the court-approved consent decree agreed to by AT&T last year is the divestiture of the 22 local telephone operating companies from AT&T and their organization into seven regional groupings. Remaining under the AT&T aegis with Bell Labs are AT&T Communications (long distance); Western Electric (equipment manufacturing); AT&T International (overseas business); and the new "Baby Bell," AT&T Information Systems (selling equipment and services to business).

Divestiture is the denouement of an antitrust suit filed by the Justice Department in 1974, charging AT&T with a variety of anticompetitive practices. The breakup of the Bell system, however, seems to have been impelled as much by the accelerated advance of telecommunications technology as by the antitrust laws.

In the 1930's and 1940's, it was still possible to distinguish the technologies for radio, telephony, and telegraphy and to regulate the separate industries accordingly. By the 1950's, the growth of new technologies, notably microwave radio transmission, microelectronics, and computers were putting the boundaries under heavy pressure.

For nearly three decades, the structure of the Bell system and the U.S. telecommunications industry has been defined by a 1956 consent decree, also signed by AT&T. The formula adopted then was to allow AT&T to continue as a vertically integrated company with the local Bell phone companies closely linked to the research, long-distance, and manufacturing elements of AT&T. To balance this, AT&T was narrowly restricted to the telephone business. Western Electric, for example, could manufacture equipment only for the regulated functions of the company. Bell Labs fell under similar constraints on the kinds of applied research it could do, but was unrestricted in respect to fundamental research.

Bell Labs researchers, for example, were responsible for much of the early work necessary for satellite communications, but the aerospace industry took over the development and commercialization phases of the technology. On the other hand, Bell Labs continued to be the main source of fundamental research and new technology in telecommunications not only for the Bell system but for its competitors in this country and abroad.

The attempt in the 1956 consent decree to bolster the status quo was almost immediately overtaken by technological change. The Federal Communications Commission (FCC), charged with regulating the telecommunications industry under basic legislation enacted in 1934, became the main arena for efforts to accommodate to this change. Major attempts by Congress in recent years to carry out a comprehensive rewrite of the 1934 law were thwarted by complexity and conflicting interests.

The major underlying problem facing the FCC was caused by the crossing of computers with telecommunications. A principal source of pressure, however, was the persistent effort to force the connection of non-Bell equipment to the telephone network, which the Bell companies doggedly resisted. A significant break occurred in 1968 with the FCC's Carterfone decision, which allowed "foreign" mobile radio units to be interconnected to the phone system. Greater impact was made, however, by the decision to permit private carriers like MCI to connect to local telephone service and provide long distance service via microwave radio transmission.

The FCC's effort to reconcile telecommunications with data processing was carried out in the framework of the so-called First and Second Computer Inquiries (CI I and CI II) during the 1970's. During this period, the commission showed the inclination to allow terminal equipment to be plugged into the telephone network, but also to permit the Bell system wider latitude in competing with unregulated common carriers to provide services based on new technologies.

Creation of AT&T Information Systems as a fully independent AT&T subsidiary free to sell directly to business nationwide is a product of the CI II campaign for competition. The court-ordered breakup of the Bell system in the same cause is expected to transform the telecommunications industry in this country and much of the rest of the world.—**J.W.**

ment at Bell Labs is seen offering job security and stability of funding for research. Evaluations for promotion and salary increases are said to depend heavily on peer opinion. Bell Labs researchers have access to state-of-the-art equipment—although laboratories are not lavishly appointed—and engineers at the labs are adept at building special instrumentation when it is required.

Staff members mentioned freedom from the distractions of teaching and committee work and from the necessity of pursuing grant support which figure prominently in the lives of their university counterparts. They also say they are not expected to justify their work by near-term results like many of their industry colleagues.

The large size of the organization and a tradition of interchange across disciplinary boundaries make it easy for staff members to interact with researchers in other fields. Bell Labs researchers are encouraged to make up shortfalls in their education either by further academic work or training provided within the Labs. And Bell Labs scientists are expected to keep up contacts with researchers outside the organization.

Observers suggest that emergence from the protected world of a regulated enterprise in which the Bell system functioned for most of its first hundred years will force a change in operating style and, inevitably, in the Bell Labs ethos.

One major adjustment will be in the way research is funded. Over the years, the Bell local operating companies have paid a sort of tithe of a small portion of their revenues each year in return for Bell Labs services. The equivalent of 1 percent of their total revenues was allocated to the support of fundamental research. This defrayed about 80 percent of fundamental research costs with most of the rest coming from long lines operations. After divestiture, no funds under the so-called license-contract formula will come from the operating companies, although the local companies will be able to contract with Bell Labs for specific research or systems engineering work.

The burden of the Bell Labs budget shifts to the remaining AT&T subsidiaries. In the past, Western Electric has provided about half the total budget, most of the money going to support development work. Under the new dispensation, AT&T Communications (long distance service) and Western Electric will assume the major funding responsibility for fundamental research with ATTIS and international operations providing relatively small shares, at least in the beginning.

The Bell Labs budget this year is $2.04 billion with fundamental research allocated some $200 million. Next year, the total Bell Labs budget is projected at between $1.8 billion and $1.9 billion, reflecting the transfers of functions and personnel. Fundamental research support, however, is scheduled to remain at the same $200-million level as this year despite the scaling down. AT&T top management has pledged that support of fundamental research activities will be maintained.

Since agreement was reached on the major terms of a consent decree in January 1982, Bell Labs hierarchs have closed ranks and forsworn earlier doubts about the effects of the breakup. In an interview, labs president Ian Ross observed that in its regulated days, Bell Labs saw fundamental research as an "investment in the long-term future, and you protected your research." After 1 January, he says, "The ups and downs of the business cycle and the competition cycle might make more impact on Bell Labs than before divestiture. But you can assume that we're going to continue to protect the research base for the same reasons as before."

The future of Bell Labs comes down to a question of whether AT&T will be able to afford to keep the Labs in the manner to which it is accustomed. Much depends on the performance of the AT&T subsidiary companies in the marketplace. Doubts center not on AT&T's technical resources but on the company's ability to adapt to a tough competitive environment largely new to it.

During the protracted negotiations that eventuated in the consent decree—or modified final judgment, as it is also known—Bell Labs, and particularly its fundamental research program, were treated as matters of concern but were not given top priority. An FCC economist, David Chessler, writing on the future of the telephone industry in the 4 March issue of *Public Utilities Fortnightly*, summed up the governmental negotiators views as follows: "The competitive era in station equipment, interexchange communications, and information services under the consent decree will bring forth a great blossoming of progress in those areas of telephony. It was the thought of the framers of the consent decree that the blossoming will be so great as to more than compensate for the loss of pure research at Bell Telephone Laboratories, and the reduced incentives for innovation at the Bell operating companies."

If U.S. fundamental research and innovation do lag significantly as a result of breakup of the Bell system it will be a notable example of science policy made via the antitrust laws.—**JOHN WALSH**

HHS Preparing to Issue New Baby Doe Rules

Child advocacy groups favor proposed regulations while medical professionals remain firmly opposed

The Department of Health and Human Services (HHS) is grappling with more than 10,000 comments received in response to a second attempt to promulgate its controversial "Baby Doe" regulations.

The purpose of the rules, first issued in March, is to protect the lives of handicapped infants born with life-threatening but correctable conditions, who might otherwise be allowed to die. The mode HHS chose to implement this had the look of a dramatic bid to please the right-to-life community. The regulations required that hospitals prominently post signs reading "Discriminatory failure to feed and care for handicapped infants in this facility is prohibited by federal law"—that is, Section 504 of the Rehabilitation Act, which forbids discrimination against the handicapped. A 24-hour hot line was set up and HHS arranged for "Baby Doe Squads" to be dispatched immediately to the scene wherever a violation was suspected.

The new arrangement resulted in hundreds of nonproductive calls to the hot line. Four calls were followed up and two turned into highly publicized cases where squads swept in to make noctur-