Military Labs Hit by Funding Retreat

Base closures, along with a planned reorganization of R&D, herald a major shrinking of defense research facilities

A HANDFUL OF MILITARY RESEARCH LABS received a death sentence last week when they appeared on a list of military facilities slated for the ax. Several hundred scientists and engineers could be affected, but this is only the beginning of a sea change threatening military research. The impending demise of these labs marks the first stage of a major reorganization of the military's in-house R&D establishment—a sprawling 76-laboratory research network costing more than $6 billion a year and employing tens of thousands of scientists and engineers—which the secretary of Defense is trying to streamline without the enthusiastic support of the services themselves. According to Michael Davey of the Congressional Research Service, declining budgets and future reorganization efforts will lead in the next 5 to 7 years to the closing of about "one-third of all the laboratories" in the Pentagon system, along with the termination of 12,000 to 15,000 research jobs.

The changes are taking place because Congress has decided it is time to cut the defense budget, now that the Cold War seems to be over and the federal deficit is still threatening to run out of control. Congress has given the task of picking the facilities to be closed to a special execution squad—the Base Closure and Realignment Commission. One of its roles is to absorb political heat from constituents lobbying to prolong the lives of bases, often the lifeblood of small communities. For starters, the commission has chosen 35 bases, ranging from typical Army barracks to specialized R&D facilities, for shutdown and 43 for "realignment" under new management this year. Over the next 4 years, it will come back with additional recommendations aimed at cutting the defense budget by 25%.

The first targets, announced on 1 July and sent to the White House for approval, include nearly a dozen Army and Navy research centers. Air Force science slipped through essentially unscathed—although some Air Force bases were closed—in part because that service owns fewer labs than the others (14, as compared to 38 belonging to the Army and 24 to the Navy). In addition, the Air Force earned brownie points by putting its own R&D reforms into effect last winter. It consolidated its 14 smaller centers into four "super labs," specializing in space research (Kirtland AFB in New Mexico), "human systems" studies (Brooks AFB in Texas), advanced electronics and command and control technologies (Griffiss AFB in New York), and aircraft technology (Wright-Patterson AFB in Ohio). It also merged two supervisory functions for R&D under a single new material command, based at Wright-Patterson, to take effect in October. However, non-Air Force observers say this represents a paper shuffle more than a substantive change in management.

The Army and Navy, meanwhile, have been scrambling to come up with their own reorganization plans, not only to meet budget-cutting requirements, but to comply with a mandate from Defense Secretary Richard Cheney to streamline, consolidate, and assert more discipline over their ranks of researchers. They revealed tentative agendas to the base closure commission in April, and the cutbacks announced by the commission last week were designed to fit into those long-range plans. Among the R&D centers marked for dissolution on 1 July were the Army's Material Technology Laboratory in Watertown, Massachusetts, and Harry Diamond Laboratories in Woodbridge, Virginia. The 500 researchers at Watertown study the fundamental properties of ceramics, metals, and polymers; they and most of the researchers in Woodbridge, perhaps best known for its research on electromagnetic pulse (EMP) effects, will be sent packing to other labs in Adelphi, Maryland, and Langley, Virginia. The old facilities will be abandoned.

This comes as no surprise. The Army had already tagged these centers for retirement, and they had been struggling along in a kind of half-life for several years. What is new, according to Davey, is the Army's plan to create within the next 5 to 7 years one large "corporate" lab like the Naval Research Laboratory and close down 12 lesser facilities. Among those being considered for termination are the Electronic Technology Devices center at Ft. Monmouth, New Jersey, an aviation research center in St. Louis, Missouri, a center for signal warfare in Stanton, Virginia, and three biomedical labs. These changes could eliminate 4000 to 6000 positions.

The Navy, with the largest R&D staff of the three services (more than 32,000), also has elaborate plans for reorganization—on paper, at least. It intends to leave its flagship Naval Research Lab in Washington, D.C., and the Oceanographic and Atmospheric Lab based in Bay St. Louis, Mississippi, essentially unchanged. In fact, the new management scenario under consideration, says Davey, seems to give these two even more independence. However, many other research centers will be consolidated and brought under the direction of four major groups: an air warfare center, a surface warfare center, an undersea warfare center, and a command and surveillance center. The exact plans are still a bit vague and now call for each of these "centers" to be split among two or more geographical sites. However, the base closure commission took these plans at face value, recommending the closure of seven and the realignment of 16 existing Navy labs or test facilities.

The base closure commission's recom-

Defense Laboratories Slated for Closure

ARMY	
Material Technology Laboratory	Watertown, MA
Harry Diamond Laboratory	Woodbridge, VA
NAVY	
Integrated Combat Systems Test Facility	San Diego, CA
Electronics Systems Engineering Center	San Diego, CA
Electronics Systems Engineering Center	Vallejo, CA
Mine Warfare Engineering Activity	Yorktown, VA
Space Systems Activity	Los Angeles, CA
Ocean Systems Center Detachment	Kaneohe, HI
Weapons Evaluation Facility	Albuquerque, NM

The Military R&D Empire

	Number of labs	In-house RDT&E	External RDT&E	Total RDT&E	Total staff military & civilian
		($ millions)			
Air Force	14	389	1588	1977	7451
Army	38	885	1306	2191	20,890
Navy	24	1247	935	2182	32,325
Total	76	2521	3829	6350	60,666

Source: Congressional Research Service (Michael Davey) FY 1987 data

mendations on the service labs will now be reviewed by a separate group established by Congress, called the Advisory Commission on Laboratory Consolidation and Conversion. Peopled with civilian and military leaders, it is run by the Pentagon's chief technical officer, the (acting) director of defense research and engineering, Charles Adolph. This commission has been at work since last year and is due to make its own recommendations, which will be incorporated into the base closure commission's future recommendations, to the Pentagon by the end of September. Both Congress and the Administration have agreed to hold off making any final decisions on the Army and Navy lab changes proposed last week until they have had time to review this panel's ideas—sometime after 1 January 1992.

As for the rest of the base closure commission's proposals, the president must approve or reject the package within 2 weeks. If he approves, the cuts become final—that is, unless Congress objects within 45 days, which would then set the whole process back to square one. Congress hatched this complex scheme to carry out the necessary surgery while spreading the blame as widely as possible. The result is that while military leaders have made promises to bring about sweeping changes, everything remains tentative for now. But the government's budget problems are so severe that they're likely to keep the lab consolidation program moving ahead, however slow its pace. ■ ELIOT MARSHALL

A Tangle of Superconductor Patent Disputes

When products made from high-temperature superconductors finally find their way to market, who will earn royalties on the patent rights? That question just got considerably murkier. Rights to the Y-Ba-Cu-O compounds, one of the three families of high-temperature superconductors, have been mired in a formal patent dispute known as an interference since early 1989. Now the U.S. Patent and Trademark Office (PTO) has declared a second interference, this one regarding priority for the bismuth-based superconductors—materials with the general formula Bi-Sr-Ca-Cu-O, seen as strong candidates for the potentially huge market for superconducting electric cables and storage devices.

The PTO will now be starting an in-house trial to resolve priority. Any patent procedure can be cumbersome (see *Science*, 5 July, p. 20), and this one may be exceptionally so. No fewer than five parties are claiming priority for the bismuth compounds: Du Pont, the University of Houston, the New Zealand Department of Scientific and Industrial Research, Japan's National Research Institute for Metals (NRIM), and Germany's Hoechst.

It is not clear whether the dispute will slow commercialization of the bismuth-based compounds, which wire producers are focusing on because of their comparatively high current-carrying capacity. Several companies have already spun the compounds into experimental filaments tens of meters long. Parties to the dispute may decide to delay or withhold funds for further development until the dispute is settled, according to a patent attorney knowledgeable about the interference. But other companies working with the compounds are not likely to change their plans, according to Peter Loconto, president of Ceramic Process Systems Corp. in Milford, Massachusetts.

The patent office declares a new interference.

The interference caps a record of conflict that began with the first announcements of the bismuth compound, made in January 1988 by Hiroshi Maeda and his group at the NRIM. Paul Chu and his group at the University of Houston announced a parallel discovery just a few days later, and Du Pont filed a patent application in February, according to Edward Mead, then director of the company's superconductivity efforts. In April, though, Hoechst revealed that it had quietly filed for patent rights the previous November. Meanwhile, Jeff Tallon of the New Zealand group says he and his colleagues can establish their priority based on disclosures made in March 1988. Each group described superconducting compounds that contain bismuth in place of the rare-earth element yttrium and have two crystal phases that became superconducting at temperatures of 107 K and 85 K, respectively.

What happens next? To get things started in an interference proceeding, the PTO adopts the claim of one of the parties as a standard—what is known as the count. The count is meant to be a fair statement of the innovation, and according to the patent attorney it is "the rabbit the hounds chase." Each of the claimants tries to prove it was the first to conceive the invention described in the count. The patent office also names a senior party—the party whose claim the junior parties must best. In the bismuth interference the Maeda group holds this pole position.

Once the PTO adopts a count in the bismuth dispute, several of the claimants might find themselves out of the running, if their original patent applications differ from the count. In the Y-Ba-Cu-O interference, for example, a claim advanced by Chu and his colleagues fell by the wayside early on because the count—the claim of AT&T Bell Laboratories, the senior party—described a material with a single crystal phase, whereas the Chu group had described a multiphase compound in their earliest application. That left Bell Labs, IBM, and the Naval Research Laboratory slugging it out.

Each of the claimants surviving this early winnowing will then present evidence supporting its claim to priority. The rules of this phase of the process will give Du Pont and the University of Houston, the two U.S. contenders, a distinct advantage. Under the U.S. patent system, American companies can introduce a wide variety of new evidence—experimental results, laboratory notebooks, corroborating witnesses, and sworn affidavits—to prove their case. Foreign applicants, though, are barred from presenting any evidence other than what accompanied their original patent application in their own country, unless they communicated key information to a U.S. party.

After a series of courtroom procedures—motions, cross-examination, briefs, and oral arguments—the PTO renders a decision. And that resolution, which could be years in coming, may be only the beginning in the bismuth-superconductor dispute. Any party can appeal the decision through the federal court system. According to an official of Japan's Science and Technology Agency, of which the NRIM is part, the Japanese group is prepared to do just that if any part of their claim is rejected. ■ C. DAVID CHAFFEE

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