Bromley Targets Superconductors

D. Allan Bromley, President Bush's science adviser and director of the Office of Science and Technology Policy, is preparing to sharpen the focus of the federal government's research effort to develop low- and high-temperature superconducting materials. On 31 October, he is expected to outline a 5-year plan aimed at providing better coordination of research on superconductivity and encouraging greater industrial investment in developing the technology.

Bromley also is expected to recommend increased funding for research at government laboratories and at federally supported universities over the next 5 years. A draft copy of Bromley's plan, obtained by *Science*, suggests that, on average, federal agency budgets for fiscal year 1994 could be 50% higher than in 1989. Total federal support for all superconductivity research was $187 million in fiscal year 1989, with high-temperature work receiving $129 million.

The report says there is an urgent need to identify weaknesses in the U.S. research effort and to utilize research funds more effectively to transform scientific knowledge into useful technologies. It also cites a need to consider the national security issues that might arise as the technology is developed and applied.

The 600-page draft, which is being revised, recommends that the Department of Defense (DOD) "be given primary responsibility for promoting advancements in [certain thin-film superconducting] technologies because of the many potential applications in defense systems." In particular, the Administration seems concerned about thin-film devices for earth observation and space communications applications that are being developed by the National Aeronautics and Space Administration.

The Superconductivity Action Plan, which is to be examined in a hearing by the House Subcommittee on Transportation, Aviation, and Materials at the end of the month, was mandated by Congress in 1988. But the undertaking languished in the last months of the Reagan Administration because of inadequate funding for the National Commission on Superconductivity and its parent organization, the National Critical Materials Council.

"Right now, there is really no . . . national focus or guiding direction" for the U.S. research effort, says Carl Rosner, president of Intermagnetics General Corporation. But Rosner, who also represents the Council for Superconductivity for American Competitiveness, says he has "high hopes" that this will change since Bromley appears ready to crown himself the czar of superconductivity R&D. The draft plan would give OSTP a much stronger role in shaping the superconductivity research agenda. It would conduct a continuing review of government efforts, with advice from industry and nongovernment experts.

One request of industry officials like Rosner is that the Administration try to bring a better focus to research efforts in the civilian sector. "DOD may be the only agency that knows where it's going," says Rosner, citing the lack of a lead federal agency in superconductivity in the civilian side of government. But if DOD is the dominant research agency, as Bromley's draft plan suggests, Rosner fears that the development of a strong, industrially oriented R&D effort could be stifled.

Bill Gallagher, a researcher at IBM's research center in Yorktown Heights, New York, says DOD's support in superconductivity is valuable, but he shares Rosner's concern. DOD's R&D "tends not to spill over into the commercial sector where manufacturing cost is a primary concern," he says.

Bromley's plan is certain to undergo change. Aides say that the next year will be spent studying basic and applied research needs in greater depth. Also to be examined are the creation of special R&D tax credits, health and environmental safety issues related to superconductor materials, and ways to expand American researchers' working relationships with their counterparts in Japan and Europe. ■ **MARK CRAWFORD**

Landsat: Cliff-Hanging, Again

The Landsat program, while making a unique photographic survey of the earth from space, has also staged one of the longest running soap operas in the federal science budget. This fall it seems headed for yet another life-or-death drama.

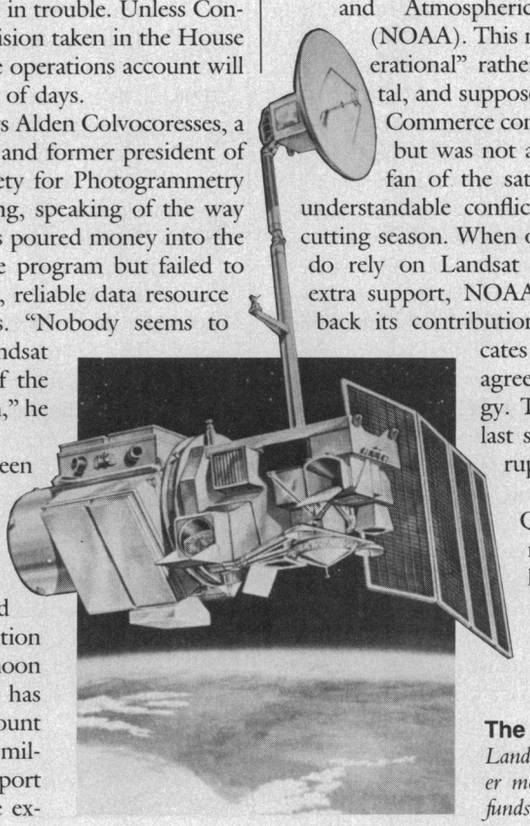
The Landsats have dangled on the brink of oblivion for several years, and despite a celebrated rescue by Vice President Dan Quayle last spring (*Science*, 17 March, p. 1429), they are still in trouble. Unless Congress reverses a decision taken in the House earlier this year, the operations account will run dry in a matter of days.

"It's a crime," says Alden Colvocoresses, a federal map maker and former president of the American Society for Photogrammetry and Remote Sensing, speaking of the way the bureaucracy has poured money into the management of the program but failed to provide an efficient, reliable data resource for earth scientists. "Nobody seems to recognize that Landsat is a key element of the U.S. space program," he says.

Instead, it has been treated as an orphan. In recent times, while billions of dollars have been promised for the space station and trips to the moon and Mars, Landsat has not been able to count on as little as $19 million in federal support needed to keep the existing satellites running for a year. Researchers who use it have had to beg repeatedly for emergency help from Congress and the White House.

Landsat's troubles arose from a decision by the Carter Administration to "commercialize" the program and shift it out of the category of space research at the National Aeronautics and Space Administration into Commerce under the National Oceanic and Atmospheric Administration (NOAA). This made Landsat "operational" rather than experimental, and supposedly self-financing. Commerce controlled the budget but was not a big user or great fan of the satellite. This led to understandable conflicts in the budget-cutting season. When other agencies that do rely on Landsat failed to chip in extra support, NOAA began trimming back its contribution. NOAA's advocates in Congress agreed with this strategy. This led to a crisis last spring when bankruptcy loomed.

Vice President Quayle, in his first major action as head of the newly created National Space Council, rode to the res-



The edge of night? *Landsat, poised for another melodramatic rescue as funds run out.*

cue. The President pledged to ensure the "continuity of the collection of Landsat-type data" and sent an amendment to Capitol Hill in July seeking full-year funding for Landsat in 1990. Quayle put together a task force to study the problem and resolve the interdepartmental squabble. The aim was to decide who would build and manage the next machine (Landsat 7) and determine how its costs and benefits should be allocated. The report was meant to be done by the end of summer, but has been delayed.

Meanwhile, Landsat's immediate prospects grew dim. The 1989 fiscal year has ended, and the program is technically out of money. It is alive only by grace of the congressional continuing resolution, which keeps all federal programs going while decisions are made on the 1990 appropriations bill. The House and Senate are about to begin talks to resolve their differences on the bill, but even the best outcome may not be great for Landsat.

The House has offered to spend no money at all on the Landsats now in orbit (the aging editions 4 and 5). And it has slashed the Administration's proposal for completing the partially built successor, Landsat 6, from $36.9 million to $20.4 million. The Senate's offer was a little better: it proposed half a year's funding for the old satellites ($9.5 million) and almost full funding ($34.9 million) for Landsat 6. Says Thomas Pyke, NOAA associate administrator who heads the program: "We are hopeful that the House-Senate conference will resolve it in our favor."

In the halls of Congress, Landsat fans have been sending notes to Representative Neal Smith (D–IA), chairman of the appropriations subcommittee for NOAA and leader of the House negotiating team in the conference. Five members of the Science, Space and Technology Committee, including chairman Robert Roe (D–NJ), wrote to Smith on 2 October recommending that he seek full support for all the Landsats. Smith, according to one Hill staffer, believes firmly that users of government services should pay for them, a rule he wants to apply to Landsat's biggest user, the Pentagon.

But Pentagon chiefs do not want to increase their support for Landsat without gaining more control. Yet at the same time, according to congressional aides, they object to other cost-sharing ideas such as NOAA's proposal earlier this year to form a joint venture with France, which runs the highly successful SPOT satellite. On this controversy, the National Space Council has no comment. Spokesperson Elizabeth Prestridge says simply that policies on the future of Landsat are "still under review."

■ ELIOT MARSHALL

B-2 Comes Up Short

A leak of classified information about the comparative ranges of the Air Force's newest strategic bombers suggests that the B-2 "flying wing" may come up short against the more conventional B-1.

The range data, which were leaked to *The Washington Post* by an unnamed source, indicate that the current estimate of the B-2's unrefueled range is 6000 miles, while the B-1's stands at 6400 miles. "I'm surprised at that," said House Armed Services Committee chairman Les Aspin, who has been privy to the supersecret B-2 for most of its development period. "They've been advertising the B-2 as having better range."

But it is no surprise to Joseph V. Foa, an emeritus professor of engineering at George Washington University. Last spring, Foa warned in a memorandum circulated among scientific organizations and members of Congress that the B-2 would inevitably prove to have a range inferior to traditional wing-fuselage aircraft such as the B-1 (*Science*, 12 May, p. 650).

In the 1940s, Foa had uncovered an embarrassing error in research performed for a secret Air Force study by William R. Sears, then Northrop's chief aerodynamicist. During those years when Northrop was building the experimental XB-35 and YB-49 all-wing strategic bombers, Sears had claimed to prove mathematically that the exotic shape imparted maximum range to jet-propelled aircraft. But Foa, then engaged in parallel research at the Cornell Aeronautical Laboratory, had found that Sears' formulas instead showed the exact opposite—the flying wing configuration would produce minimal range. After the YB-49 program was scotched in 1949, the Air Force told Congress that the plane's range was indeed deficient. Sears acknowledged the old mistake, but never agreed with Foa's disparagement of flying wings, declaring that modern versions would demonstrate clear advantages.

"I find it kind of hard to believe," Sears told *Science* after the latest revelation about the B-2's range. "I am surprised."

"It would be interesting to know if the figures are for similar payloads and flight paths," said Foa of the leaked data, "not only because this might confirm the analytical prediction. If the B-2's range is even just somewhat lower than the B-1's under similar conditions, then flight tests are going to reveal more significant deficiencies in cruising speed."

Unfortunately, the new information reveals nothing about such mission factors as payload, flight path, or speed. According to a long-time Aspin aide, the B-1 and B-2 range figures were contained in two separate reports submitted to Congress by the Air Force. "It's not clear whether they are oranges-oranges comparisons," he said, pointing out that the B-1's typical attack profile has been changing to include more and more low-level flight, which would drastically cut the bomber's range. The stealthy B-2, on the other hand, would most likely attack at high altitudes, not needing to duck under the sweep of enemy radars. "The real surprise may be that the B-1's range is so low, not that the B-2's isn't as high as we thought."

Some light was shed on the mission picture last March, when the Strategic Air Command replied to questions posed by Senator J. James Exon (D–NE). According to SAC, the B-2's unrefueled range varies from 4250 miles to 7500 miles, with a payload between 40,000 pounds and 75,000 pounds. SAC reported that although the B-2 carries less fuel than the B-1, it has "an equivalent unrefueled range" because of its low wing-loading and high-altitude subsonic cruising speed. General Bernard Randolph of Air Force Systems Command said later that the B-2 could carry a 50,000-pound payload for 6000 miles without refueling, a range that corresponds to the recently leaked figure.

The 6400-mile figure for the B-1 would be about 1000 miles less than the "maximum unrefueled range" of 7455 miles listed for the past several years in *Jane's All the World's Aircraft*, a standard reference.

Though of crucial interest to technically minded observers, all these numbers are evidently irrelevant to the lawmakers now trying to decide whether to buy the B-2. "The debate so far hasn't been about capabilities, but about bucks," Aspin's aide said with a shrug. "Besides, B-2 capabilities are still on paper. Next year we'll start talking capabilities."

■ WAYNE BIDDLE

Wayne Biddle is a journalist who is writing a book about the aerospace weapons industry.