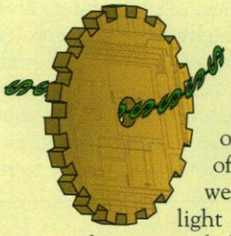
clude public schools, libraries, health care facilities, and "other providers of community services," according to Gibbons' booklet. John Rollwagen, the former Cray Research chief, will help steer this effort as deputy secretary of commerce.

In parallel to this civilian technology push, the Administration plans a military-based initiative at DARPA. Responsibility for this effort falls to William Perry, a former electronics executive and one-time Pentagon official in the Carter Administration, who has been nominated to be deputy secretary of defense. For many years Perry has advocated using the military budget to promote "dual-use" technologies of value both in weapons and commercial products. Perry endorsed a Carnegie Commission report last year recommending that DARPA drop the "D" and become a "dual-use" agency.

Even before Perry's arrival, ARPA had taken the lead in coordinating a five-agency plan to spend $500 billion in 1993 on converting defense industries to civilian goals (*Science*, 19 March, p. 1690). Under Perry, ARPA will continue to lead a government-wide initiative in supercomputers and will also take on a role in expanding the data superhighways. Last year, in a big step in the direction the Clinton Administration is now heading, Congress boosted ARPA's 1993 budget from the Bush Administration's request of $1.3 billion to $2.2 billion, two-thirds of it for "dual-use" technology development. Congressional staffers predict the funding will remain steady at that level.

Elsewhere in the government, agencies are being tapped to take part in a smorgasbord of not-so-clearly defined technology promotion jobs. The NSF will be asked to increase its support of high-performance computing, too, and to contribute to the push for better technical education. The Department of Labor, the National Aeronautics and Space Administration, and the Pentagon will be involved in joint projects aimed at retraining defense industry employees and devising new educational programs for displaced workers who don't have access to college classes. The Gibbons technology plan also promises support for "smart highways," magnetic levitation trains, civil aircraft research, and energy improvements in federal buildings and public housing. The Department of Energy's national laboratories will be asked to set aside "at least 10%-20% of their budgets to R&D partnerships with industry." A new "clean car" task force led by Gibbons will "encourage the development of prototype vehicles" that meet extra-tough antipollution stan-

NIST: Measuring Up to a New Task



For much of its 92-year history, the National Institute of Standards and Technology (NIST) has been best known as a keeper of standards—measuring everything from the weight of pingpong balls to the brightness of light bulbs. But it has recently been assigned a more daunting task: help jump-start the economy and win back U.S. business markets by working with industry to develop innovative technologies. Over the next few years, NIST—a bureau within the Commerce Department—will lavish hundreds of millions of dollars on this task, making it one of the federal government's largest sources of funds for civilian research and development.

NIST's own in-house R&D efforts are slated to double over the next 4 years, but the biggest growth will come in direct support for research performed by industry. At the center of this new thrust is the Advanced Technology Program (ATP). Created by Congress in 1988, ATP currently has a budget of approximately $68 million. But under the Clinton Administration's proposals to shift funds from military to civilian R&D (see p. 1816), the program will be shelling out $750 million each year by fiscal year 1997. Advocates of a more aggressive government role in industrial technology are cheering the prospect, but that kind of growth rate has some critics wondering whether the money can be spent wisely.

ATP hopes to meet its lofty goals by awarding matching grants to companies or joint ventures that agree to share the costs associated with research and development of precompetitive, generic technologies. "Precompetitive means the effort is at an early enough state that it's a high technical risk, but not a high business risk," explains ATP director George Uriano. "Generic means that if you solve technical problems the results will be widely used a number of ways by many companies."

Single-company awards are limited to $2 million to be spent over no more than 3 years. Joint ventures, on the other hand, can win $5 million or more but must put up more than 50% of the matching funds. Uriano says the ATP money is essential to firms trying to develop risky, "breakthrough" technologies. "In this economic climate, few venture capitalists are willing to take such high-stakes gambles. We are willing to fund it up front."

Consider the case of Communication Intelligence Corp. (CIC), a small firm in Redwood Shores, California, specializing in computers that can read handwriting. According to John Ostrem, vice president of research at CIC, Japanese firms are aggressively entering the same market. His $1.2 million ATP grant is to help CIC develop the early phases of a sensor and control system. While the technology could be used in a wide range of laptop and hand-held computers, a breakthrough would "give the U.S. industry a running start in handwriting recognition technology," he says. "The improvements we are making with the grant will give us a 12- to 18-month lead over our nearest competitors," he predicts. "And in the field of computers, that's a lifetime." Ostrem's prediction may seem optimistic, but it's in line with the experience of ATP award-winners so far. A recent study conducted by Solomon Associates concluded that the grants gave companies a 1- to 5-year time savings on accomplishing their research.

CIC

Taking stock. Communications Intelligence Corp.'s writing recognition technology, used in this hand-held computer, received NIST grant.

Like politics, joint ventures seeking ATP funding can produce strange bedfellows. James Hurd is CEO of Planar Systems of Beaverton, Oregon, and a member of an eight-company consortium to develop improved flat-panel displays for computers. Hurd says the $7 million project has "eight competing companies who would rip each other's throats out for market share" cooperating in this research. The firms (which will be joined by other companies in the next few months) already have worked out ways to share technical information and potential royalties. "Our goal is to find ways to inspect and repair the equipment we all make. It will reduce all our products' time to market and

dards. And some broad economic and legal changes have also been proposed to foster civilian technology, such as converting the research and experimentation tax credit to a permanent subsidy, relaxing antitrust laws, and changing the federal advisory committee rules to make it easier for businessmen to advise the government.

While the initial technology package covers a lot of ground, it leaves some key issues unresolved. One is the fate of the big Department of Energy (DOE) laboratories. The Gibbons blueprint says the labs will "continue their key role in basic research," and that "we will develop new missions...to make full use of the talented and experienced men and women" in the labs. Gibbons also said in testimony recently that a special working group is conducting a "survey" of research going on at those labs. His office is also looking into the possibility of setting up peer-review methods to help DOE set funding priorities in places like Livermore and Los Alamos, which now peer review only a small fraction of their work. The goal would be to focus resources more efficiently and see that new projects are aligned with national economic priorities.

DOE's fans on Capitol Hill, meanwhile, have jumped in with their own plan to ensure that the $19 billion agency and its $7 billion labs will be included in the action. Senator Bennett Johnston (D–LA), chairman of the energy appropriations subcommittee, along with two others—Senators Bingaman and Domenici—introduced a bill (S 473) on 2 March designed to make it easier for DOE and laboratory officials to form joint partnerships with industry. It also ensures that these senators and other members of Congress who are patrons of DOE and its projects (including projects in their own states) will be a part of any future negotiations on technology policy. Johnston has already scheduled hearings and hopes to have his bill cleared though his committee and ready for a final vote this spring.

This is the opening bid in what could be an intense season of policy making. The next round will come after the Administration releases its budget next month, when the fine print of its spending plans should become clearer. Each committee on Capitol Hill will be looking to see how its particular stable of programs fares. But for the research community, the big question is how this new-found enthusiasm for technology development will affect the government's traditional support for basic science.

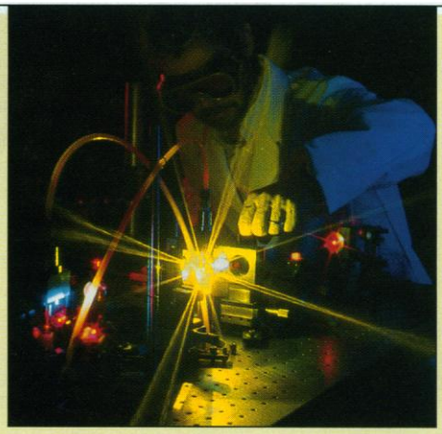
–Eliot Marshall

lower our costs. The consortium works because it meets all our needs," he says.

Before a company or consortium can share Uncle Sam's largess, it first must submit a proposal—they currently cost $20,000 to $30,000 to develop—and endure a grueling three-step evaluation process. First, a group of experts screens the projects for scientific and technical merit. One major question: Is the proposal technically feasible? Second, a group of venture capitalists and business experts ask whether the plan can make it out of the lab and into production. Are there broad benefits for companies in the United States? Is the company strong enough to carry the process from proposal to product application? Finally, those proposals with the highest marks get tagged as "semifinalists." In what one participant characterized as "the most intense grilling since my Ph.D. thesis," company representatives are questioned by a committee about any problems with the proposal. All the semifinalists are ranked in order and grants are made down the list until cash runs out. About one of every three semi-finalists is actually funded. ATP spokesmen stress that special care is taken to spread the grants through a wide range of technologies and applicants.

After several rounds of competition, ATP spokesmen say it's easy to envision spending $750 million per year productively. But does it work? So far ATP has handed out 60 grants totaling more than $400 million in federal and company money. Development is nearly completed on technology ranging from high-intensity data recording heads capable of writing and reading 10 gigabits per square inch to techniques for making materials needed in ceramics, robots, and pharmaceuticals. Uriano says the flat-panel display consortium already has found a way to put circuits directly on glass computer panels. "This advance may hit the market as early as 1994," he adds. Several other companies are using the early benefits of the research to restructure their manufacturing processes.

That's exactly the kind of achievement ATP's supporters in Congress, such as science committee chairman George Brown (D–CA), expected. But critics warn that this large-scale venture into industrial research and development by government could ultimately turn out to be a waste of money. Claude Barfield, resident scholar at the American Enterprise Institute, supports NIST's traditional role as an agency devoted to measurements and technology. But, he says, "Congress likes things it can touch and see. This will put pressure on ATP to fund product development—something that companies and stockholders rather than taxpayers should subsidize." Conservative economist Murray Weidenbaum warns that ATP will be hard to isolate from political pressure for pork projects. "You've got to watch out that all the grants don't go to West Virginia," he cautions, referring to a state that has recently been blessed with an abundance of federal moneys as the result of lobbying from the state's powerful Senator Robert Byrd. And Jerry Jasinowski, president of the National Association of Manufacturers, warns that "people in government are generally naive about how quickly they can gear up and spend money wisely."



NIST

Focal point. NIST's in-house R&D, like this research on optoelectronics, will be doubled in 4 years under the Clinton plan.

Certainly, any agency that suddenly finds itself with $750 million a year to hand out will face a wide range of outstretched palms. And Uriano says that if the big funding increase does come his way, the agency will have to modify its approach. Aside from increasing the number of competitions from one to three or four per year, staff and consultants will look for "trends," Uriano says. Based on previous competitions, the ATP staff will try to spot sectors where ATP grants are most in demand and hold special competitions stressing one type of technology. These will be in addition to the open competitions. The program may also try to cuu down on paperwork by having companies submit just a brief initial proposal. And Uriano says ATP might consider one or two "supergrants" to be divvied out to consortiums seeking perhaps $100 million each year. "If Congress wants to raise a massive effort in just one field, we would have the funding to accomplish that end," he says.

–Jerome Cramer

Jerome Cramer is a science writer based in Washington, D.C.