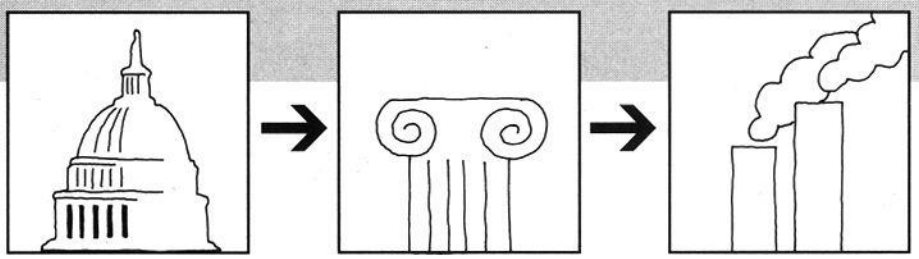

U.S. Technology Transfer: Are the Expectations Too Great?

BY SUSAN M. REISS

When you hear the words "technology transfer" what comes to mind? The national labs, a boost for the economy, improving U.S. competitiveness worldwide? As a "buzz word," technology transfer has earned a favored position in congressional rhetoric. As a process, technology transfer suffers the burden of great expectations.

Although technology transfer has always existed in the form of person-to-person communication, student matriculation, and publishing in professional journals, the process hit the national scene in the 1980s when congressional legislators sought out new ways to stop the perceived U.S. tumble in global competitiveness. Congress put technology transfer on the federal agenda with a series of laws aimed at attracting industry to joint partnerships with the federal laboratories (see box, page 14).

In a post-Cold War era, government officials have latched onto technology transfer as a way to validate the need for national laboratories. By leveraging laboratories' resources, federal officials hope they can keep the labs open. Politicians hope so, too. Closed laboratories mean lost jobs and lost votes.

Yet critics of federal technology transfer argue that the government is ill-equipped to move technology to the marketplace and should not engage in the activity. "The government labs should get out of what naturally should be done by universities and industry," contends John Moll, a member of the technical staff at Hewlett-Packard. "If that means reducing their size, then they should do so."

While critics debate whether the government is capable of transferring technology, those involved in the process say that with the federal government on the technology transfer bandwagon, their jobs are easier. "Having the government say technology transfer is a good and noble thing helps," explains John Preston, director of the Technology Licensing Office at the Massachusetts Institute of Technology (MIT). "Before, people worried about interacting with industry."

Expectation 1: Federal Technology Transfer Works

In the "old days," as one government scientist describes, "once you finished with a technology, you'd put it on the table and wait to see if industry came to pick it up." The result: little technology was transferred from the federal establishment. And as Nick Montanarelli, deputy director of the Strategic Defense Initiative's Office of Technology Applications, explains, "Twenty years ago, technology transfer was a bad word because people thought the government was giving away the store."

In the 1990s, federal agencies involved in scientific and engineering pursuits are required by law to have offices of technology utilization—offices in which specialists match federal research with industrial clients. The manner in which each agency alerts industry to its technology ranges from newsletters to demonstration programs to telephone hotlines. But industry complains that the federal technology transfer process is still too cumbersome to use.

In an effort to quell that complaint, federal officials launched the National Technology Initiative (NTI), a joint effort by federal agencies to showcase government technology and services. The NTI also gives industry leaders a chance to tell the government how it can improve its mechanisms for transferring technology.

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Legalizing Technology Transfer

Congress got on the technology transfer bandwagon in the 1980s and passed legislation making it easier to commercialize inventions. Selected pieces of legislation are listed.[1]

☆ **1980** ☆

Stevenson-Wydler Technology Innovation Act—Makes technology transfer a mission of the federal laboratories and requires all federal labs to staff technology transfer offices. The Act also established the National Medal of Technology.

Government Patent Policy Act—Allows government-owned, government-operated labs to grant exclusive licenses to patents.

Bayh-Dole Act—Allows certain nonprofit and small-business government contractors to retain title to and royalties from most government funded inventions.

☆ **1986** ☆

Federal Technology Transfer Act—Permits government-operated labs to enter directly into cooperative agreements with industry; allows them to license patents to partners in such agreements; requires that government inventors share in royalties from patent licenses.

☆ **1988** ☆

Omnibus Trade and Competitiveness Act—Amends U.S. trade laws with respect to protection of intellectual property rights, export promotion, and education and training programs to increase U.S. industrial competitiveness. Changes the National Bureau of Standards to the National Institute of Standards and Technology; expands its mission to include technology transfer activities.

☆ **1989** ☆

National Institute of Standards and Technology Authorization Act—Amends Stevenson-Wydler to establish Technology Administration within the Department of Commerce, headed by new Under Secretary for Technology. Consolidates into Technology Administration: Office of Technology Policy, NIST, National Telecommunications and Information Administration, and National Technical Information Service.

National Competitiveness Technology Transfer Act—Extends technology transfer mission to Department of Energy defense laboratories and allows these facilities to enter into Cooperative Research and Development Agreements.

☆ **1991** ☆

Defense Authorization Act—Allows federal laboratories to enter into memorandum of understandings with intermediaries to promote cooperative work with small businesses; establishes model programs for national defense laboratories to demonstrate successful relationships between federal, state, and local governments, and small businesses.

☆ **1992** ☆

American Technology Preeminence Act—Amends Stevenson-Wydler to extend the federal laboratory consortium mandate through 1996; allows sharing of intellectual property as a contribution to a CRADA; and allows laboratory directors to make gifts of excess laboratory equipment to schools and nonprofit organizations.

[1]Information from the National Academy of Sciences report, *The Government Role in Civilian Technology: Building a New Alliance*, 1992.

Federal officials are also hoping businesses interested in one-stop technology shopping will take advantage of the National Technology Transfer Center established by Congress in 1989. Located in Wheeling, W.V., the center officially got underway this October. By dialing the Center's toll-free telephone number (1-800-678-NTTC), technology users can access an index to all federal technology databases. The Center is also working with Wheeling Jesuit College to develop undergraduate and M.B.A. curricula for technology transfer and innovation management. Other education and training programs involve conducting seminars and conferences for technology transfer professionals and developing working relationships and agreements with trade and professional associations.

The Department of Energy (DOE)—shepherd to such national laboratories as Lawrence Livermore, Sandia, Lawrence Berkeley Laboratory, Los Alamos, Argonne, and Brookhaven—seeks a balanced approach to technology transfer. In place just two years, DOE's technology transfer program has negotiated nearly 200 cooperative research and development agreements (CRADAs).

These agreements, touted by federal technology transfer officials as "turning technology transfer around," enable the laboratories and industry to cooperate on an extended basis to move technology to the private sector. CRADAs limit the amount of time the government and industry can negotiate terms of the joint venture. Before CRADAs were introduced, negotiations could take as long as two years. The CRADA's limit preliminary negotiations to 90 days. They also enable companies to negotiate exclusive rights for up to five years on the intellectual property involved. Industry and federal research arms have entered into 1100 CRADAs since 1989. Traditional patents and procurement documents round out the federal technology transfer toolbox.

In addition to CRADAs, DOE stresses educating laboratory scientists on dealing with industry and ensuring that laboratory personnel are able to disseminate their findings to the widest possible audience. Cherri Langenfeld, director of DOE's Office of Technology Utilization, notes that DOE still has a way to go on the technology transfer learning curve, but she is confident that as time goes by the agency will "get smarter with the types of tools it uses to transfer technology."

Light Movers: Center for Electronic Imaging and the Alliance for Photonic Technology

Considered crucial technologies for U.S. competitiveness, optics and photonics share the technology transfer spotlight. The Rochester-based Center for Electronic Imaging and the Albuquerque-based Alliance for Photonics Technology are two examples of efforts aimed at transferring optics and photonics technology to industry.

The Center for Electronic Imaging is a partnership between the University of Rochester, the Rochester Institute of Technology, and its corporate sponsors—Xerox, Eastman Kodak, Harris, 3M, the Army Research Office, Photographic Sciences, CIDTEC, Chapman Instruments, and Lucid Technologies. The Center's goal is to promote pre-competitive research and achieve technology transfer by teaming corporate engineers with university faculty and postdoctoral fellows at the university. Nicholas George, the Center's co-director, says the teams or "research triplets" are critical to successful technology transfer. The triplet decides on a research topic and then meets regularly to review progress on the project, trade ideas, and define goals as the project moves toward completion. Research areas include pattern recognition, remote sensing, digital image processing, image quality, and color science.

Decentralizing the technology transfer process and making faculty members responsible for transferring technology eliminates bottleneck that used to occur when laboratory directors were charged with transferring technology, George says. If, for example, a research triplet comes up with an idea they think worthy to patent, they must arrange for a patent attorney. To solve disputes that may arise over where an idea originated, the Center established the University Policy Committee. But George points out, "We have faith people will do what's right."

Now a year-old, the Alliance for Photonics Technology encourages connections between industry clients and. Sandia National Laboratories, Los Alamos National Laboratory, the Air Force's Phillips Laboratory, and the University of New Mexico's Center for High Technology Materials.

To achieve effective technology transfer, APT Director William Latham says, "cooperation is really important." APT offers clients specific contacts within the laboratories in the areas of semiconductor-diode based visible lasers, high power diode lasers, multi-dimensional optical interconnects, high-speed optoelectronics, and optical sensors. In addition, the staff can cut through the cumbersome bureaucracy indigenous to the federal government.

Those interested in learning more about the Center for Electronic Imaging can contact Nicholas George, University of Rochester, The Institute of Optics, Rochester, N.Y. 14627; 716/275-2417.

To learn more about the APT, contact Pete Latham, APT, 851 University Blvd., S.E. Albuquerque, N.M. 87106; 505/272-7001.

Despite strides, technology transfer experts still wonder if the government should be in the business of licensing technology. "The laboratories are not a tarpaulin covering magical technologies that will save U.S. business," argues Travis Walton, director of the Technology Extension Service at the University of Maryland. "Even when the labs have good information to offer, it's not written up in an interesting manner for the user."

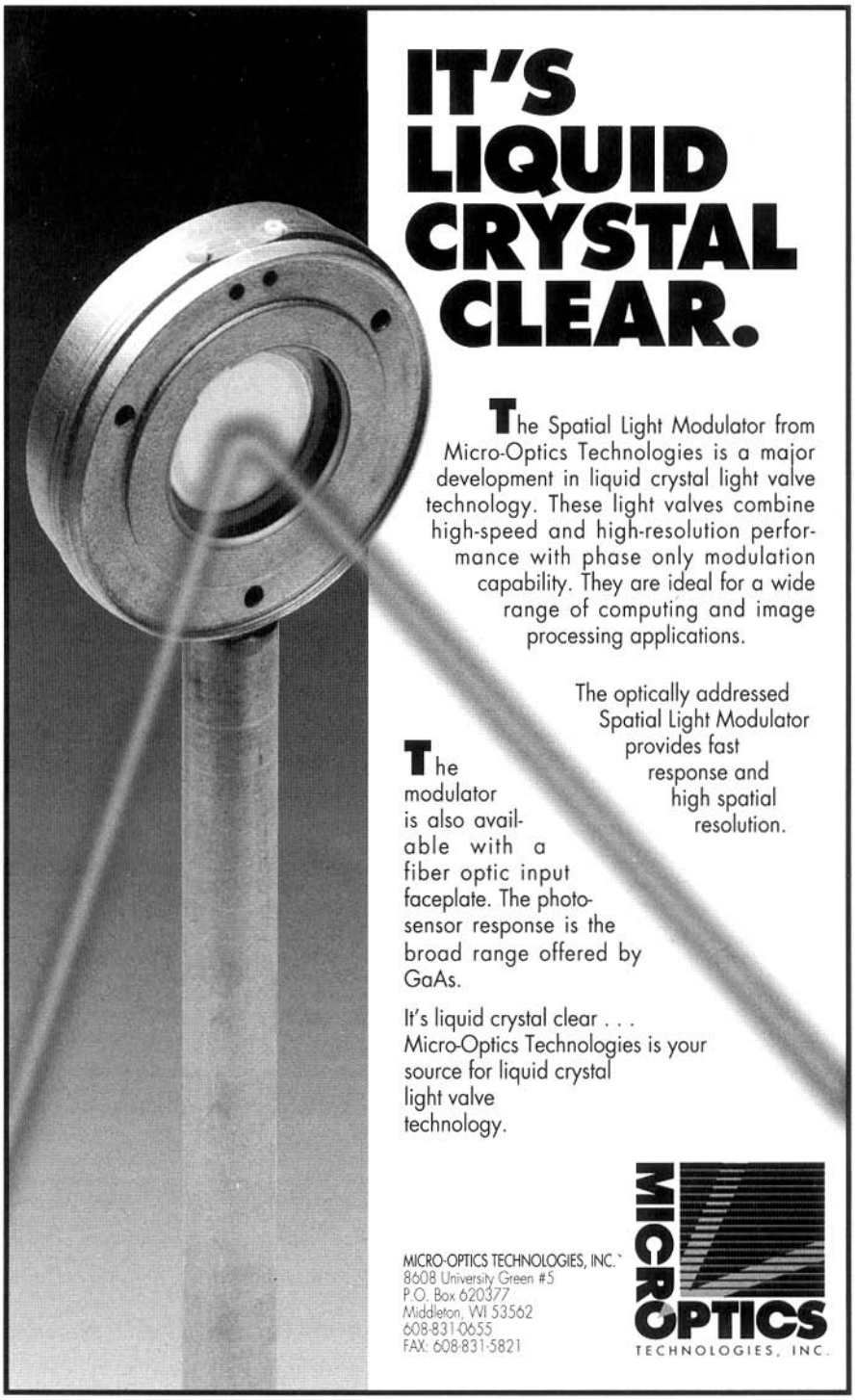
But as DOE's Langenfeld stresses, "We've got too much invested in the national labs not to try and leverage our resources."

Expectation 2: Universities as Tech Transfer Utopias

While the government sorts out the best way to transfer technology, universities beckon industry to their vast stores of research. As Jon Paugh, director of the Department of Commerce's Office of Technology Commercialization, points out, top universities receive bigger royalty checks than the federal government. Industry finds academia attractive because of its ability to pursue high-risk research.

Universities, however, are not technology transfer utopias. Academia may have more latitude than the federal government when it comes to negotiating licenses with industry, but several obstacles can hamper the movement of information from an institution to a business. Conflict of interest heads the list and will be center stage in the coming months as a congressional committee begins a nationwide investigation of top research institutions.

According to the University of Maryland's Walton, in the past, faculty worked on new technologies in a semi-clandestine way. They hesitated to disclose what they were working on because they did not want to give up their full-time status as both a faculty member and an entrepreneur. Changes in Maryland's conflict-of-interest law now



enable the university to assess the activities of faculty members on a case-by-case basis.

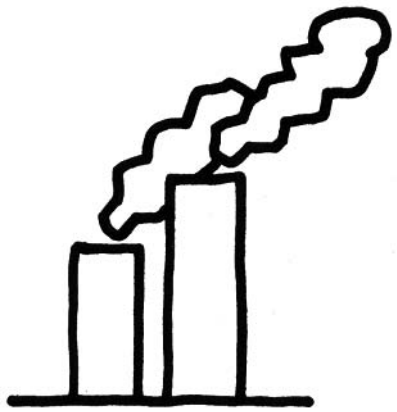
MIT's Preston argues that it kills technology transfer if financial rewards are denied to a scientist who develops an innovative idea worthy of commercialization. "At MIT, we assume that financial reward to the scientist is beneficial as long as it does not significantly bias behavior," says Preston. But he acknowledges that scientists with a financial interest in a company developing their technology may run into the following difficulties:

- abusing students by using them as cheap labor;
- funneling information to the company and not disseminating research to the widest possible audience;
- aligning on-campus research to support the company's product development efforts;
- spending more than the allotted consulting time at the company; and
- taking more than an advisory role at the company.

Universities can also fall prey to abuse in the technology transfer arena. Preston explains that if the university either owns equity or has a royalty interest in a company, it may funnel future inventions to the company rather than make them available to any company, or it might bias promotions in favor of scientists who have brought money to the university.

To counter conflict of interest, yet maintain an environment that promotes technology transfer, MIT established a list of guidelines for the university and its researchers to follow. Each inventor also signs a "Conflict Avoidance Statement" that provides information on how to avoid conflict. Further, MIT employees fill out an annual statement of outside professional activities.

Next to developing conflict-of-interest policies, technology transfer specialists spend much of their time educating faculty on the ways of the marketplace. One university technology transfer officer, who asked not to be identified, says faculty should realize industry is "not an open checkbook." Faculty need to consider if their invention truly fits a need or solves a problem. If not, don't expect companies to race to the laboratory door and start negotiations, the experts say.



Expectation 3: Private Firms Broker Technology

Private technology brokers are another way to move technology from universities to industry. While some—such as Research Corporation Technologies (RCT), a technology transfer organization in Tucson, Ariz., and Teknekron, based in Menlo Park, Calif.—succeed, most fail, says the University of Maryland's Walton. "They have to really understand what the client wants and what technology is available."

RCT President Gary Munsinger says technology transfer from universities is picking up because university investigators are more aware of the potential importance of disclosing their inventions. "Interest in U.S. technology worldwide is greater today than it's ever been," explains Munsinger.

RCT works with faculty, staff, student inventors, and research administrators to determine what research has a shot at commercialization. The firm reviews invention disclosures, files patent applications, markets the invention to interested businesses, and negotiates licenses.

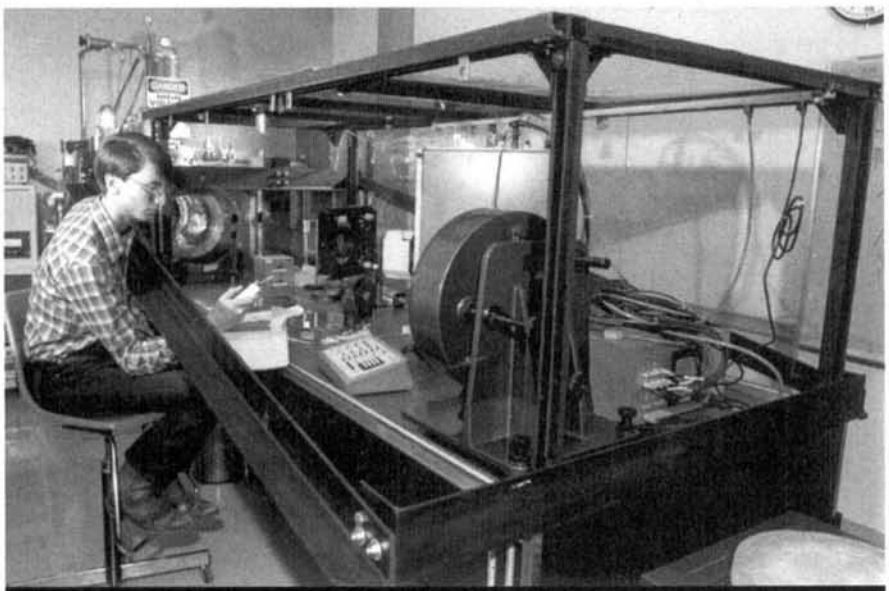
The firm also markets inventions worldwide. Munsinger says the biggest barriers to doing business with a foreign firm are communication, distance, and time differences. He adds that as competition for markets reaches across the globe, companies will be forced to take a less parochial view of how to do technology. "We'll see more companies working together," predicts Munsinger. "Increasingly, technology will not have a nationality."

Specializing in both life science and physical science technology, RCT has a license review team devoted to optics. But "entertaining the ear" of would-be optics users is difficult because people want to develop this technology in-house," says RCT optics specialist Eugene Cochran.

But persistence pays. RCT recently negotiated an agreement with Gaertner Scientific of Chicago so the ellipsometer manufacturer could acquire rights to the StokesMeter developed by Rasheed Azzam of the University of New Orleans.

"The Azzam patent is unique in that it eliminates moving parts to measure polarized light," says Gaertner's Rusty Kutko. "With modification, the Stokesmeter has the potential to take one measurement per microsecond." Current instruments use rotating analyzers and operate at one measurement per second. Kutko adds that, for small companies with limited resources, technology brokers offer an important link to new technology.

Teknekron, which nurtures technical entrepreneurs who want to establish start-up companies, prefers to hunt out inventors rather than inventions. This entails identifying problems that need solutions and searching university labs for researchers who can supply the answers. "We seek out intellect rather than intellectual property," says Vice President George Turin. "A patent has no value unless the intellect comes with it." For this reason, Teknekron usually bypasses university licensing offices. Courting the inventor rather than the invention puts Teknekron in a stronger position because the inventor is able to modify his idea; the patent remains stagnant with little hope of embellishment. The firm has grown an average of 40% each year since 1968. Combined sales totalled $225 million in 1991.



SCOTT WILSON, RESEARCH ENGINEER AT THE CENTER FOR HIGH TECHNOLOGY MATERIALS, ADJUSTING ALIGNMENT OF INTERFEROMETER USED AS ION BEAM MILLING FOR OPTICAL FIGURING OF COMPONENTS. (PHOTO COURTESY OF THE CENTER FOR HIGH TECHNOLOGY MATERIALS, UNIVERSITY OF NEW MEXICO, ALBUQUERQUE.)

EXPECTATION 4: TECHNOLOGY SOLVES SMALL BUSINESS PROBLEMS

Universities and private firms such as RCT and Teknekron provide easy access to technology for small businesses. Their information network and, in the case of private firms, financial resources enable small businesses to concentrate their own resources on securing technology. But the University of Maryland's Walton cautions that many small businesses incorrectly assume the technology they license will solve their problems immediately. "Unsophisticated small businesses think we have a bunch of plums ready to pick," Walton explains. "The technology usually has to be modified before they can use it."

Businesses should also carefully craft management and financial plans, which Walton says are more important to growth than securing technology. "You can't turn a corporation around with technology if it doesn't know where it's going."

Litigation is fast becoming a competitive tool for both large and small businesses that want to get ahead in the marketplace. "Patent litigation is on the rise," says Paul Davis, vice president and general counsel for Laserscope, a manufacturer of surgical lasers in San Jose, Calif. Young companies and those fighting to survive may use litigation to enhance their market position, but Davis warns they need a strong claim to overcome established firms. A start-up company must also consider if the financial and time commitment involved are worth the fight. Litigation is most beneficial for established companies that clearly stand to gain financially.

Davis also notes that the courts are now more likely to uphold a patent as valid than they were a decade ago. Why the switch? The judicial system created an appellate court designed specifically to hear patent cases overturned by the regular court of appeals.

"In the future, we'll see the patent used as a strategic weapon to gain access to technology," Davis concludes. "It's the sword that can take your competitors out of the market. Without a patent, you're at the mercy of your competitors."

FUTURE EXPECTATIONS

If technology transfer is the wave of the future, as NTTC Executive Director Lee Rivers predicts, the U.S. needs to shore up its approach. Successful technology transfer requires increased communication and cooperation between all parties involved in the process, note the experts. They also suggest that Congress address the issue of investment tax policy, rather than focusing on the high profile rhetoric of technology transfer.

A key player in promoting communication is the professional society. "OSA plays a tremendous role in technology transfer," contends Thomas Baer, a senior research fellow at Spectra-Physics. Conferences, professional journals, and personal interaction all foster movement of technical ideas. Trade associations also help federal officials identify where generic research is being performed so they can target potential users of technology created at the federal laboratories.

"Technology transfer doesn't fail," concludes the University of Maryland's Walton. "It just doesn't meet expectations."

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