



Transferring APL Technology to Industry

Kristin M. Gray

By all accounts APL has been transferring technology for decades, but it was a 1998 strategic plan that laid the groundwork for a formal program. The Office of Technology Transfer was created in July 1999 to manage APL's portfolio of more than 400 inventions, many of which have emerged from the Laboratory's long history in space science. At a rate of three new inventions per week, APL is well positioned to impact local and national economies. Early successes in licensing and creating start-up companies around select space technologies, among others, signal APL's formal entry into the arena of technology transfer for commercial applications.

BACKGROUND: TECHNOLOGY TRANSFER IN THE UNITED STATES

Although U.S. government agencies have historically funded billions of dollars of research at universities and federal laboratories, less than 5% of the resulting inventions were ever licensed to industry and put into commercial use prior to federal legislation. On 12 December 1980, the Bayh-Dole Act (U.S. Public Law 96-517, *Patent and Trademark Act Amendments of 1980*) was passed to allow universities to retain intellectual property rights to inventions developed under federal funding. As a result, technology transfer activities at universities saw a dramatic upturn.

Under the act, universities are encouraged to collaborate with commercial concerns to promote the utilization of inventions arising from federal funding. Universities are expected to file patents on inventions they elect to own and to give licensing preference to small businesses. The government, however, still retains "march-in" rights and a nonexclusive license to practice (i.e., use) the patent throughout the world.

Prior to passage of the Bayh-Dole Act, fewer than 250 patents had been issued to U.S. universities each year. Recently, however, universities have averaged more than 1500 patents annually. More than 200 universities are now engaged in technology transfer—up from about 25 in 1980. According to the most recent survey by the Association of University Technology Managers (AUTM),¹ this technology transfer activity adds over \$40 billion to the economy and supports 270,000 jobs each year.

TECHNOLOGY TRANSFER AT APL

Pursuant to the Laboratory's 1998 Strategic Plan, an 11-person interdepartmental APL team was formed to develop and execute a strategy for initiating a Technology Transfer Program. The team's research, conclusions, and recommendations were detailed in the *Technology Transfer Summary Report*. In the report, the benefits of a new program were defined as

- Broadening public benefits derived from APL technology
- Impacting the local and national economies, including the creation of new jobs
- Enhancing APL's image as a creative and innovative institution
- Attracting new talent and new, challenging work
- Acquiring unrestricted funds for future scientific research and technology development at APL and within The Johns Hopkins University

In July 1999, APL created the Office of Technology Transfer (OTT) to manage and transfer the Laboratory's portfolio of technologies to industry. To get under way, APL's accumulated portfolio of active inventions was sent to the National Technology Transfer Center² for preliminary assessment, and a national search was conducted to select a director of technology transfer to lead the new effort.

Setting Goals

The mission of the OTT is to *facilitate the transfer of technology to business and industry to benefit the public, foster economic development, and benefit the University*. To achieve this mission, and to achieve a leadership position in technology transfer, it was recognized that APL needed to establish the organization, policies, guidance, and sustained management commitment to six goals.

1. *Empower the process*: More effectively manage the technology transfer process by selecting an experienced leader; empowering the office; streamlining policies, procedures, and processes; and developing a business plan.
2. *"In-reach"*: Encourage APL staff and organizational units to aggressively transfer technology by improving awareness, stimulating individual initiative, fostering entrepreneurship, and encouraging departmental involvement.
3. *"Technology push"*: Advocate protection, assess market potential, establish a selection method, focus and prioritize marketing efforts, and thus ultimately identify marketable technologies and other intellectual property which may be suitable for legal protection and commercialization by APL.
4. *"Market pull"*: Understand and address industry needs and match those needs to APL capabilities.
5. *Manage conflict*: Provide the policy and guidance to resolve organizational conflicts of interest arising from technology transfer, thereby shaping the environment and mitigating risk.
6. *Experiment*: Seek, establish, nurture, and explore opportunities to attract venture capital, establish appropriate industry partnerships, and stimulate entrepreneurial "start-up" affiliates.

Strategic Planning

Upon its inception, the OTT initiated its own strategic planning process to address each goal. The resulting 10-year strategic plan is modeled, appropriately, on the growth phases of a new business start-up. The plan defines growth and milestones in a three-phased approach allowing for start-up, growth, and maturity. To ensure that the OTT is meeting its goals, performance measurements, both qualitative and quantitative, are tracked and reported annually.

Quantitative Measurements

Primary metrics reflect key activities of successful technology transfer. These are compared with APL's past performance, with APL's ranking in the nationally recognized AUTM¹ annual survey that reports results of universities across the country, and with top research institutions of similar stature to JHU. Primary metrics include

- Number of invention disclosures
- Licenses/options executed
- License income received
- Total research funding associated with technology transfer agreements
- Number of start-up companies created

Secondary metrics are also tracked, e.g.,

- Number of new U.S. patent applications filed
- Number of U.S. patents issued

Qualitative Measurements

A comprehensive Technology Transfer Program assessment is based on more than raw numbers and statistics. The qualitative performance of APL's program is also monitored and reviewed. Qualitative performance measures for the OTT have been identified and grouped according to the six main goals of the *APL Technology Transfer Summary Report* as noted earlier.

Examples of qualitative performance metrics include transferring government-sponsored inventions to dual-use and commercial off-the-shelf products, supplementing innovative APL technology with innovative technology transfer initiatives, and improving APL employee retention and satisfaction via positive participation in the technology transfer process.

Although not typically tracked by national technology transfer surveys, it is also important that stakeholders of APL's technology transfer efforts benefit from economic development and serve the public interest throughout the state and nation. Specific advantages include a targeted effort to create start-ups in the region and licensing to local, high-risk small companies.

Assessing Technology Competitiveness

Achieving and maintaining key competitive advantages in technology development and enhancements to meet APL's customer needs is a critical element in the Laboratory's long-term success. Because of its intensive industrial interaction resulting from technology transfer activities, the OTT has a unique opportunity to broaden APL's insight into its technology competitiveness in a variety of ways. For example, knowledge of APL's standing among competitive research institutions enables us to see where and how the Laboratory can meet the technological expectations of federal funding agencies in the future. Such information also provides significant guidance for APL's management concerning future investments of resources.

A detailed analysis of current success in technologies already licensed from APL is another important measure of APL's insight into technology competitiveness. Profiles of licensed APL inventions indicate technical areas that are meeting current customer needs. As more and more technologies are transferred, it is expected that a clear picture of APL's technical strengths and its ability to meet external industry needs will emerge. In addition, a portfolio of diverse, high-tech customers provides a base from which the OTT can apply a variety of instruments to enhance APL's competitive advantage.

Information on APL's technology competitiveness is obtained from a variety of OTT activities, including Web site utilization analysis, interactions with industrial and government technology development sponsors and licensees, and professional interactions with other technology transfer organizations. Also predictive of future activities are surveys of the interests of OTT's industrial customers, which offer a view of technology trends.

THE TECHNOLOGY TRANSFER CYCLE

The management process for a large portfolio of university technologies is often categorized as cyclical. The technology, or intellectual property, is protected, marketed, and licensed to industry. As part of the agreement with an industrial partner, the research institution receives compensation from sales of products or processes generated using the new technology. And, as is prescribed by the Bayh-Dole Act of 1980, this income is distributed back into research and to the researchers who developed the technology. New inventions are developed from this funding, and the cycle starts again. The technology transfer cycle (Fig. 1) illustrates the route typically taken by an APL invention.

Research and Development

As a direct programmatic need, APL research and development is conducted under both sponsored contracts



Figure 1. The technology transfer cycle.

and APL's Independent Research and Development Program. This R&D work is the basis for investigating, testing, and implementing novel technological approaches.

Inventions

When an APL staff member has developed a novel technology or technological solution, the invention is documented and submitted to the Office of Patent Counsel (OPC). The invention is then processed, recorded, assigned a case number, and sent to the OTT. Each invention is assigned to a technology manager to ensure its appropriate intellectual property protection and to take the invention through the marketing and licensing steps of the technology transfer cycle.

Figure 2 shows APL's invention disclosure rate over the years. This year, the Laboratory is on track to disclose more than 150 new technologies, an average of 3 per week.

Assessment

Together, the OPC and OTT work closely with the inventor to do a preliminary technical, intellectual property, and market assessment to determine the invention's protectability and marketability.

In 1999, 235 of APL's existing inventions were evaluated for technical merit and marketability by the National Technology Transfer Center. In addition to the 122 inventions found to be commercially viable, the Laboratory has seen a more than 2-fold increase in invention disclosures submitted since the inception

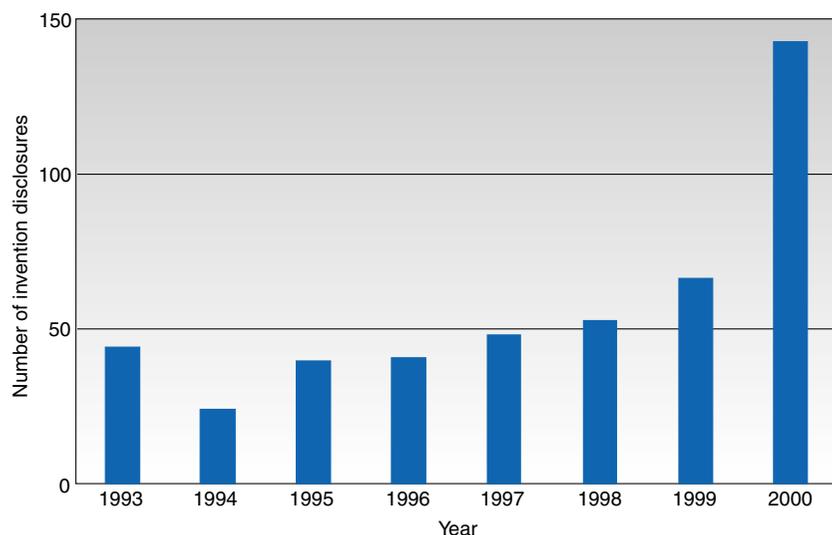


Figure 2. APL invention disclosure rate.

of the Technology Transfer Program. The OTT is beginning a systematic portfolio management approach to marketing and licensing these inventions.

Intellectual Property Protection

If, after a preliminary review, the technology is deemed protectable, some intellectual property protection is usually pursued. In most cases, a 1-year "provisional patent application" is filed in order to secure the date and to determine if there is market potential for the invention. The Laboratory also files U.S. patent applications, foreign patent applications, and in some cases, trademark and copyright registrations. Intellectual property protection is an ongoing process, with major filing decisions frequently relying on market assessment of the technology.

In the last year, APL filed 108 patent applications, including 84 provisional applications. This number is also likely to increase. The Laboratory has been very aggressive and quite successful at filing patent applications. In fact, the average issue rate of all applications filed with the U.S. Patent and Trademark Office is approximately 60%; APL's issue rate is closer to 90%. The Laboratory has a portfolio of more than 200 issued patents, another number that is likely to grow quickly in coming years.

Marketing

The OTT markets APL's 400-plus active inventions both individually and as part of its portfolio through the OTT Web site (<http://www.jhuapl.edu/ott/>), select technology listing services, targeted marketing outlets, regional conferences, advertisements, and publications such as the OTT *Innovations* newsletter. The

OTT also communicates its activities and the breadth and depth of APL technology through a public relations effort with the Laboratory's Office of Communications and Public Affairs.

The inventor is an integral part of the marketing process; more than 70% of successful leads typically come from the inventor through his or her work in the field. In the absence of a clear list of contacts from either the inventor or the technology manager, the OTT employs various internal and external resources to research the appropriate market(s) and key players in those markets. APL's R. E. Gibson Library provides invaluable research in the beginning stages of determining the players. In some cases, the

OTT will contract with outside industry or area experts to evaluate the marketability of a technology and provide points of contact.

Licensing

Once a licensee is identified and qualified, the OTT enters into negotiations for a license agreement. The OTT uses template license and option agreements and has negotiation and signature authority for license agreements, both of which help to expedite the process. License agreement terms vary widely, but common elements include license execution fees, royalties on sales of products, and milestone (or diligence) payments. Agreements with companies may also include provisions for further R&D funding for the Laboratory.

Many factors go into choosing and qualifying a licensee, including the size of the company, its expertise in the product area, its past success in bringing a product to market, and its location in the state of Maryland. It is the policy of the OTT to seek local, qualified licensees whenever possible. If a Maryland licensee cannot be identified or is unsuited to commercialize the technology, the OTT looks outside the state.

Once a potential licensee or licensees have been identified and are ready to license the technology, the OTT enters into license negotiations. Each negotiation process is unique, but the clear goal is to give the technology the best chance of success in the marketplace. Factors considered in the negotiation process are the stage of development of the technology (i.e., how close it is to being a product), whether it will be licensed exclusively or nonexclusively, and what the profit margins are on sales of similar types of products.

Products and Services

When the company takes a license to a technology, it begins the road toward a new or improved product, process, or service. Frequently additional R&D is needed, but once the technology is fully developed, the new product is released and made available to customers.

Royalty and Development Income

When a company uses APL technology in creating or improving a product or process, it pays a royalty, typically based on a percentage of sales, as defined in the license agreement. This income is disseminated back to the inventor, the inventor's laboratory and department, and the Technology Transfer Development Fund according to the Laboratory's Intellectual Property Policy of October 1999.

The unrestricted income generated from a successful trip through the technology transfer cycle is the basis for new research, new developments, and new invention disclosures, and the process begins again.

IN-REACH: PROMOTING APL STAFF INVOLVEMENT

Concurrent with ongoing marketing and licensing activities, several internal mechanisms have been implemented to recognize, reward, and encourage APL researchers' participation in the technology transfer process. These efforts serve to fulfill OTT's in-reach goal noted earlier.

For example, the OPC and OTT team to present "Patents & Pizza" seminars at APL's Kossiakoff Center. These seminars have attracted close to 200 APL staff members wishing to get more information about various aspects of the intellectual property and technology transfer processes. Speakers at these events, such as members of our local legal community, past inventors, and OPC/OTT staff, address topics like software patenting, inventorship, and the technology transfer cycle. At each seminar, inventors who have been issued patents since the last event are presented with a plaque with an image of the front page of their patent. OTT also gives an annual Invention of the Year Award. The first, in June 1999, was given for a molecularly imprinted polymer for detecting food spoilage.

In line with other top-tier research universities and government laboratories, APL's Intellectual Property Policy allows inventors to realize, when appropriate, tangible benefits from inventions and copyrighted materials. This policy also encourages inventors' participation in the process.

Many new technologies benefit from additional resources to help bridge the gap between the laboratory bench and the marketplace. To that end, APL researchers, through the OTT, are eligible for small technology

transfer grants, prototype development grants, and business plan development grants.

HOW ARE WE DOING?

In the first year of APL's Technology Transfer Program alone, Laboratory researchers disclosed 143 new inventions, 108 patent applications were filed, 12 U.S. patents were issued, 12 license agreements were completed with industry, and 4 new companies were formed to commercialize APL's dual-use technology. This work generated \$2 million in license income and \$1.8 million in associated R&D funding. Since then 3 additional agreements have been signed.

One of the first license agreements was based on a novel treatment for age-related macular degeneration, the leading cause of blindness among the world's elderly. An agreement between APL and Akorn, Inc., a specialty pharmaceutical company based in Buffalo Grove, Illinois, gave Akorn exclusive worldwide rights to a patented method for treating the "wet" type of age-related macular degeneration, which was developed by a former APL researcher. Negotiated through the OTT and completed in April 2000, this multimillion dollar agreement included up-front license fees, milestone payments, and royalties on sales of the future product and procedure. The company filed an Investigational New Drug Application with the Food and Drug Administration in June 2000. The system's journey, from preliminary testing to the marketplace, is estimated to take 5 years.

In December 1999, OTT helped to facilitate the Space Department and APL's first spin-off company, Syntonics LLC (see the article by Suter et al., this issue) to commercialize ultrastable quartz oscillators. As part of the licensing arrangement, the University has a minority equity interest in Syntonics, which contracts work back to the Laboratory for continued technology development. Syntonics now has four full-time employees and expanded space in Howard County's NEOTECH Incubator in Columbia, Maryland (Fig. 3). NASA engaged the firm last November to lead a 2-year, \$900,000 initiative to develop a radically smaller and lighter ultrastable oscillator. Syntonics will team with APL and Goddard Space Flight Center on the project, and will also apply the results to future product lines.³

Other APL spin-offs include Dot21 Real Time Systems, Inc., which develops message-oriented middleware (software that moves information, or messages, from one place to another within a single system or between multiple systems), GuardedProfile Corp., which provides secure e-commerce vehicles for corporate and individual Web users, and emDevices, Inc., which develops MRI-compatible, wireless data transmission technology.



Figure 3. Ribbon-cutting ceremony at the NEOTECH Incubator in Columbia, Maryland.

The Laboratory continues to receive a steady flow of interest in APL technologies. Advances in such space technologies as global positioning systems, chip-on-board technology, arc fault detection, and the micro Digital Solar Attitude Detector have aroused interest from various sectors of the commercial space industry. These early successes place APL in favorable ranking

with other similar institutions with more established technology transfer programs.

CONCLUSION

APL has indeed set high expectations for its Technology Transfer Program to broaden public benefits derived from APL technology, impact the local and national economies, enhance APL's image as a creative and innovative institution, and acquire unrestricted funds for future scientific research and technology development. If first-year activities and the constant rate of invention disclosure are any indication, some of these goals have already been realized and some are just around the corner. Ambitious rates of invention disclosure, patents, licensing, and license income set by the OTT Strategic Plan may even be achieved ahead of time and will effectively position APL and The Johns Hopkins University among the top U.S. research universities in technology transfer activities.

REFERENCES

- ¹Association of University Technology Managers Web site, available at <http://www.autm.net> <http://www.autm.net> (accessed 23 Feb 2001).
- ²National Technology Transfer Center Web site, available at http://www.nttc.edu/flash/html_version/ (accessed 23 Feb 2001).
- ³Buckley, M., *Innovations* newsletter, JHU/APL Office of Technology Transfer (summer 2000).

THE AUTHOR



KRISTIN M. GRAY joined the Laboratory's Office of Technology Transfer in September 1999. She is the Assistant Director for Technology Transfer and heads the marketing efforts for the Technology Transfer Program. Ms. Gray is a member of the Senior Professional Staff and has 9 years of experience in university technology transfer, with an emphasis on technology marketing. Prior to coming to APL, she served as the Assistant Director for Marketing with the University of Maryland's Office of Technology Liaison. She is a member of the Association of University Technology Managers and the Licensing Executives Society. Her e-mail address is kristin.gray@jhuapl.edu.