

# SUCCESSFUL MODELS FOR COMMERCIALIZATION OF LABORATORY TECHNOLOGY AND SOME HARD LEARNED LESSONS

Dr. Donna M. Smith

*Los Alamos National Laboratory, Los Alamos, NM, USA, 87545*  
[smith\\_d@lanl.gov](mailto:smith_d@lanl.gov)

Los Alamos National Laboratory has collaborated with industry to develop technology for decades. The Laboratory has worked with industry only since the late 1980s to actively develop and apply research and technology to commercial and industrial products. During this time, several very successful partnerships and projects have grown, some with work extending over five or more years. In addition, there have been projects where the desired results were not realized or where the research relationship failed. Key elements of the successful projects have been identified and will be discussed and as well as the lessons from failed projects.

## **Background**

The University of California operates the Los Alamos National Laboratory for the United States Department of Energy (DOE), which has a total of twenty research laboratories. The Los Alamos National Laboratory mission is to enhance the security of nuclear weapons and nuclear materials worldwide. The Laboratory partners with universities and industry to develop the science and state-of-the-art technology required to accomplish the mission. In addition, the Laboratory actively pursues carefully selected civilian research and development programs that complement the mission. In the late 1980s, Congress passed legislation allowing government laboratories to share technology with industry and to work with industry to jointly develop technology with industry for commercial purposes. Consequently Los Alamos began working with industry to develop and apply technology in a variety of areas from basic computer and material science through new methods to sequence the human genome and new technology to explore for oil.

Over the 57-year history of the Laboratory, a number of research projects to develop technology for the Laboratory mission resulted in commercial products. For example, Los Alamos worked closely with Cray computers to create the first supercomputers for Laboratory research that also led to the supercomputing industry. Only since the late 1980s have such

collaborations occurred under research agreements with the express intent of creating commercial products or assisting companies. Los Alamos executed its first license to a company to use Laboratory-developed technology in 1988 and its first Cooperative Research and Development Agreement in 1992.

### **The Los Alamos Experience**

Since the first license and CRADA were executed, Los Alamos has been actively engaged in working with industry, to the benefit of both the Laboratory and industry. Table I summarizes the technology transfer and partnering activities of the Laboratory.

Table 1. Los Alamos Commercial Activities				
Agreement Type	Agreements Executed	Total Funding	1999 Agreements	1999 Dollars
Cooperative Research and Development	338	\$691,300,000	59	\$87,892,000
Funds-In	519	\$126,400,000	77	\$8,792,000
User Facility	240	\$10,600,000	15	\$858,000
Licenses	758	\$3,521,700	240	\$866,143
Non-Disclosure		N/A	290	N/A

Research institutions that work with industry, or want industry to commercialize research results, must adopt a set of business practices that allow industry to access technology efficiently. While it is important to have efficient internal processes, well-written legal contracts and support from internal managers and sponsoring agencies, it is critical to have the appropriate general policies and operational practices in place. From the experiences of the past ten years, Los Alamos National Laboratory has identified several practices that are critical to a successful technology transfer program. In summary, the lessons are:

1. Manage the institution's intellectual property, so that industry has a reason and basis to work with the institution,
2. Understand the motivations and goals for the laboratory and the partner company, to establish a sound working relationship,
3. Ensure that the partner company is qualified and capable of working with the proposed technology,

4. Receive a fair market value for the research work and resulting intellectual property to provide income to the institution,
5. Be responsive to customers so that agreements are established and partnerships built, and
6. Develop and maintain a strong technical and business reputation.

### **Management of Intellectual Property**

Having a competitive advantage in the marketplace is the foundation for success in United States industry and in business throughout the world. Such advantage is obtained in a variety of ways from having an exclusive marketing position, such as having a patented technology that others cannot use, through providing better service to customers. Some industries, for example semiconductors, pharmaceuticals, biomedical devices, electronics and automobiles, live and die by the patented technologies in their products. If a research institution such a laboratory or university wants its technology to be successful in the commercial arena, the institution must take steps to protect the technology and provide the competitive advantage.

Los Alamos, like most United States research institutions and universities, pursued publication of research and technical advances as the mechanism to establish reputations and disseminate research results. While Los Alamos received its first patent in 1947 and has had a program of patenting since its inception, patenting was not a mainstream activity at the Laboratory and was pursued only if a researcher wanted to get a patent. The Laboratory did not train the researchers on how to perform research to obtain data for a strong patent, how to write an invention disclosure so that patent attorneys could efficiently obtain patent protection or how to publish important technical advances without jeopardizing future patent opportunities. In this environment, many good ideas and pieces of technology were published. No company could develop a competitive advantage, since everyone had equal access to the basic information. Companies often did not work with the Laboratory, as all the information they needed was freely available. Corporate research departments are full of bright, motivated, very capable researchers. Several times Los Alamos published initial research that pointed to promising technology. Industry was able to take that early work and complete the development without further interactions with Laboratory researchers. Some Laboratory researchers now feel they were “ripped off” and the institution received no recognition or future income from the commercial product developed from the initial research. Industry made smart commercial investments and the Laboratory erred in giving its intellectual property away for free through publication.

Patents are becoming valuable to Los Alamos National Laboratory because they are valuable to industry. The Laboratory is learning to build portfolios of patents that have greater value than single patents. For example, a couple of patent portfolios now contain patents for materials, processes to make the materials, and devices that can be made from the materials. Such a collection of patents is much more valuable to industry and consequently is more valuable to the Laboratory than a single materials patent.

Since patents are a primary mechanism for industry to develop competitive advantage, it is critical to research institutions to learn how to develop and protect inventions to most effectively work with industry and move research from the laboratory to industry.

### **Understand Motivations/Goals**

Ten years ago, when the Laboratory started collaborations with industry, the staff generally assumed that companies wanted to develop strong, long-term research collaborations on topics of interest to both parties. Such collaborations would be characterized by full sharing of information and data, research directions, commercial and Laboratory plans for the technology. A number of research projects ended, often with Laboratory staff unhappy and disillusioned about working with industry. Perhaps the most notable example was a company that sent approximately 20 of their staff to work at the Laboratory and paid the Laboratory \$3.3 million over several years. One day the company stated that they were done with the project, moved all the people back to the corporate headquarters, dismantled the lab space at Los Alamos, removed all the data and information generated in the project and left town. The Los Alamos staff thought they were engaged in a long-term mutually-beneficial research project. The company thought they were engaged in a short-term project to learn as much about the technology as they could, as quickly as possible, to develop a commercial advantage. As a result of not understanding the company's intentions and of not sharing a similar set of goals, several Laboratory staff felt used by the company and a general suspicion of corporate intentions developed within part of the research staff at Los Alamos.

In a separate corporate relationship, a consumer products company came the Laboratory six years ago for assistance on a specific problem. They stated that if the initial project was successful they were committed to developing a long-term relationship and providing funding to Los Alamos. The corporate goal was similar to the Laboratory's goal in working with the company to develop improvements in a specific technology. Over the past six years, the company has sponsored over \$6 Million in research and licensed a set of patents from the Laboratory. All

Los Alamos staff who work with the company have been impressed by the technical expertise of its staff and their willingness to share data and commercial plans, and to collaborate on projects to develop mutually beneficial projects. In this case, both the Laboratory and company are committed to working together, sharing information and developing mutually beneficial technology. This collaboration has been extremely successful as a result.

Over the past ten years the Laboratory has had a number of different reasons to work with industry including:

1. Developing new science and technology capabilities of interest to LANL,
2. Working on challenging problems to attract and retain the highest quality staff,
3. Developing long-term R&D partners for both sponsored research and federal funded research,
4. Receiving short-term funding for interesting research, and
5. Making Government funded R&D available to the industry.

These reasons have changed over time and vary from one organization to another. For example, some groups at the Laboratory need funding and are primarily motivated to obtain funding from an industry partner or to join with a partner to obtain funding. Other groups have sufficient funding but want to obtain or improve technology. As one might surmise, the interactions with and approaches to industry are quite different, depending on the Laboratory's goals for a specific project.

The Industrial Business Development Program Office (IBD) is responsible for negotiating contracts and for assisting Laboratory research staff in developing research collaborations. Consequently, the IBD business staff actively assess the motivations of both the Laboratory and industry partners to help both understand each other and to develop productive working relationships.

Typical types of questions that are asked to assist both parties in developing good relationships are:

1. What does the company want from the research project?
2. Does the company expect to develop a long-term relationship?
3. Does the company expect the government or Laboratory to provide funding for the research?
4. Does the project support a DOE or Laboratory mission need or activity?
5. Will the Laboratory staff be available for the duration of the project, or are they likely to be transferred?

6. Does the company have the expertise to actively contribute to collaborative research?

While the answers to these questions do not determine if the company and Laboratory will work together, they greatly assist in developing a good working relationship and ensuring that both parties understand what each other are attempting to accomplish and why. The experience at the Laboratory shows that companies generally respond positively to developing an understanding of the organization goals for a project. Companies are interested in productive working relationships, even if a relationship is short-lived.

### **Receiving Fair Value**

When the Laboratory first started licensing patents to industry, the terms were typically very low issue fees, low or no royalty payments and annual fees. This established an expectation among the companies that worked with the Laboratory that the patents were not very valuable and that the Laboratory was willing to give them away. Current Laboratory policy and practice is to review the commercial market for the technology, develop an estimate of the value of the patent to the commercial partner and negotiate with the partner to a reasonable and fair license.

License issue fees and royalty rates must set in a manner that provides the commercial partner a potentially profitable business, or they will not engage in commercialization of the technology. The fees must also provide a fair return to the Laboratory in order to provide a revenue source to the institution. The key in the negotiations is to agree on a fair return to both the company for their activities in commercialization and to the Laboratory for their activities in development.

### **Qualifying Partners**

Successful commercialization or utilization of technology from a research laboratory or university requires significant investment in product design or engineering. For the early stage technologies typically developed at Los Alamos the research expenses incurred by the Laboratory are ten to fifteen percent of the total commercial development expenses.<sup>1</sup> The commercial partner typically has a significant expenditure to develop the product. In addition, technical and business expertise is frequently required to engineer new products and introduce them into the market. If the expertise is not available within the company, the probability of successful commercialization of Laboratory developed technology is very low. Qualifying partners also ensures that the Laboratory is negotiating with a legitimate commercial company. Recently a United States Army research laboratory licensed a technology to a bogus corporation. The Army

did not realize the company was not legitimate until they attempted to contact the company for an update on the agreement.<sup>2</sup>

When Los Alamos National Laboratory initially began working with industry and licensing technology to companies, the policy was to work with any company that asked. As a result, few licensees successfully developed commercial products. They simply did not have the expertise required. In the past few years, the Laboratory changed the policy to license to qualified companies and to select research partners who could actively contribute to the research activities. The Laboratory requires that companies interested in licensing technology provide a business or commercialization plan with sufficient detail to assess three elements. A qualified licensee is one who has, or has plausible plans to obtain, the:

1. Technical expertise to complete the anticipated development work,
2. The business expertise to manage a company of the structure needed to commercialize the technology,
3. The marketing and sales experience or distribution network to support the commercial product, and
4. The financing available to fund the technical and business activities.

Qualified research partners are generally identified by reviewing the technical work that needs to be completed and identifying the company with the best expertise to assist in that development. This may be based on the company's current commercial products, in-house research and technical staff, or commercial plans.

As a result of working with qualified companies and receiving a fair market value for licensed technology, the Laboratory's licensing revenue has grown greater than twenty percent per year for the last four years.

### **Responsiveness to Customers**

Industry, in particular United States companies, are accustomed to receiving prompt, professional attention from service providers and suppliers, including research institutions. When Los Alamos initially started working with industry, the staff assigned to negotiate with companies and assist the Laboratory researchers in working with industry were not professional business people with legal or business training. Many were not efficiently responsive to customer requests and allowed bureaucratic processes to drive their interactions with both Laboratory researchers and outside customers.

In the past several years, the Laboratory has engaged in an active campaign to hire new staff with professional business backgrounds, legal training, and a strong sense of customer service. An understanding of the Laboratory's mission, the research goals of the Laboratory staff and strong desire to support the Laboratory and industry through partnerships now drive the business staff. This focus has allowed the business staff to develop strong relationships with Laboratory researchers, such that researchers will call their business representative to discuss ideas and approaches to partnerships. From these relations, new opportunities to develop patents can be identified and new opportunities for sponsored research or license developed. Industry partners also have contacts among the business staff that they call frequently for answers to questions, queries about new opportunities or resolution to any issues. This is a sign of a healthy business office that assists the research institution in developing new business and moving technology into the commercial sector.

### **Reputation**

The Laboratory or institute's reputation for technical work is the key to attracting and retaining industry interactions. The institution's reputation for operating in a business-like manner is a similarly critical element to successful relationships with industry.

As discussed previously, the Laboratory first started licensing patents to industry with very low issue fees, low or no royalty payments and annual fees. Through this approach, the Laboratory established a reputation as a cheap place to get patents and as a place that did not know what it was doing in a licensing program. When Los Alamos began to modify the program to a more business-like licensing program that recovers a fair market value for patents, companies pushed aggressively for the previous types of agreements. Licensing at Los Alamos now has a reputation of having a more business driven approach.

Similarly, when the government laboratories began executing Cooperative Research and Development Agreements with companies, the process was slow, difficult and frustrating for both the company and the Laboratory staff who wanted to work with industry. While great strides have been made over the past ten years to make the process of implementing research agreements between the Laboratory and industry more efficient and simple, most Laboratory staff and companies continue to believe that the process is very difficult. It will require several years to alter this perception and change the reputation of the agreement process.

Corporate business and technology development plans and the supporting intellectual property are extremely valuable to the companies. Companies want to know that their

information will be well protected from their competitors. At Los Alamos, corporate information is managed with almost the same care as national security information. Computer networks are not open to outside access, files are locked in cabinets in limited access areas. In some cases, parts and drawings from the corporate sponsor are stored in combination lock files, just like national security data. Part of the Laboratory's credibility with corporate partners rests with the ability to protect information and the record of not having published proprietary information.

It is important to realize that businesses work together in a variety of industry consortia, collaborative research programs and industry lobbying organizations. The experience that a company has with a research institution will be shared with other companies, particularly the negative experiences. If a research agreement or license takes a long time to negotiate, is poorly written, or if the business staff is unprofessional or non-responsive, the institution will have a reputation of being difficult to work with. If the business operations are poorly managed, companies may well decide that the technology available at the institution is not worth the business effort required to gain access to that technology. An experience of being difficult, slow and bureaucratic in business operations will be shared from one company to another and is difficult to overcome.

### **Conclusion**

Successful relationships with industry that benefit both corporate partners and the research institution require a constant balancing of interests. Researchers must balance developing technology in a manner that can be used by industry, publishing and publicizing developments so that industry recognizes the advances and the institution while protecting the technology with patents or other appropriate vehicles to preserve the commercial value. Research institutions must adopt a set of business practices that allow industry to access technology efficiently while protecting the legitimate institutional interests. Professional responsive business staff who are familiar with common industry practice, have contacts in appropriate industries and companies, and know how to publicize technology developments ensure efficient access to technology developed by the institution. The same business staff must understand the institutional and research goals in order to protect the proprietary interests of the institution. The business staff must provide benefit to the institution by receiving fair value for the technology and research developed by the institution and by ensuring that agreements are executed with only qualified companies.

A research institution that chooses to work with industry must achieve an effective balance of the industrial interests with the institution's interests. Too much emphasis on the industry interests will not provide sufficient return to the institution and will cause researchers to decline to work with industry. Too much emphasis on the institution's goals will cause industry to go other research organizations. The institution's staff are the key to developing a program that effectively uses an institution's research in the commercial arena. Business staff and research personnel who effectively balance the institutional and industrial goals can make a successful program.

1. Mohawk Research Corporation, Commercialization Planning Workshop held at Los Alamos National Laboratory 1996.
2. Commercialization Plan Called Key to Winning Tech Transfer. The McGraw-Hill Companies' Federal Technology Report – May 18, 2000. Page 9