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Building Business from Technology:

The Sandia Experience

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Sandia National Laboratories Technology Transfer
& Commercialization Center

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Building Business from Technology: The Sandia Experience

Abstract

This paper describes New Ventures, a new initiative at Sandia National Laboratories that encourages the creation of new businesses based on laboratory technology as a timely, efficient means of technology transfer.

Sandia's New Ventures program has shown that a dedicated effort can produce significant results. In the three years prior to this program's launch, just two ventures per year on average were created based on laboratory technology. By comparison, the New Ventures program has enabled 20 new ventures in its first nine months of full operation.

Our experience has yielded several lessons:

- Most ventures result from Sandia entrepreneurs, from technologies that are well-matched to market needs, and from laboratory projects that are ready for production.
- Entrepreneurship issues are tremendously complex, requiring policy changes to reduce risk, manage intellectual property and licensing determinations, plan for potential conflicts of interest, and tailor other strategies.
- A new ventures program must advocate these policy changes, assist entrepreneurs, put significant effort into matching outside companies to inside technologies, and identify lab projects ready for manufacture.
- Connection to the local business community is vital to good commercialization matches and to the development of Sandia entrepreneurs.
- Lab employees are far more interested in pursuing Technology Transfer Leaves of Absence than anticipated.

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Building Business from Technology: the Sandia Experience

Background

In the late 1980s, Congress directed the national laboratories to transfer technology to US industry to improve industrial competitiveness. The Technology Transfer Act of 1989 opened the doors of Sandia to industry on a large scale for the first time. Initial collaborations with industry focused on large-business Cooperative Research and Development Agreements (CRADAs) and technology licenses. Even with the success of the CRADA program at Sandia, technology transfer for various reasons did not produce a significant number of start-ups based on laboratory technologies. At about the same time, Martin-Marietta, now Lockheed-Martin, was preparing a bid to manage Sandia. Based on Lockheed-Martin's experience at Oak Ridge National Laboratory, the proposal team added the Technology Ventures Corporation (TVC) to address the need to move technology from the laboratory to the private economy.

TVC's mission is to encourage and enable the commercialization of technology from the national laboratories and research universities in the region. A primary focus of TVC is attracting risk capital; however, it also assists technology-based companies by facilitating technical, management, and business support. Today, TVC has seven employees; plans include co-locating the corporation with Sandia's Technology Transfer & Commercialization Center to foster an integrated approach.

The New Ventures Program

Following a formal agreement between Sandia and TVC, the New Ventures Program was established to "create spin-off enterprises based on laboratory personnel, technology, or activities." Our means of achieving that goal are to

identify opportunities, champion laboratory policy changes, and assist in the formation of new ventures.

The program started in March 1994 with one part-time employee and has grown to two full-time staff. In that time, New Ventures has granted leaves of absence to nine Sandia technologists who are starting or expanding private companies, and has fostered an additional 11 creations or expansions based on Sandia technologies. In May 1995, the first corporate partnership deal was inked. Today the program is working on about 65 projects at various stages.

The Venture-Creation Process

The first step in the venture-creation process is to identify laboratory projects that could be successfully transformed into new or expanded companies. The New Ventures program constantly seeks new opportunities by advertising past successes, researching the patent portfolio, and matching technologies at the laboratories to opportunities in the market.

We look for three critical elements:

- a committed entrepreneur;
- a market that could be serviced better, more quickly, or more cheaply by the candidate technology; and
- some form of exclusivity, whether a patent, copyright, or trade secret.

The second step, once an opportunity is identified, is to record the opportunity in a database available to TVC and other interested parties for evaluation. Third, the most promising prospects are reviewed by the Project Selection and Planning Committee of the Alliance for Technology Entrepreneurship. The committee's actions following review depend on the type of

opportunity, the obstacles to its success, and any deficiencies that require remediation.

A successful project results in business formation or expansion; for example, a company might create a new division focused on the transferred technology or headed by a Sandian on leave from the laboratories.

Scenarios for Venture Creation: Challenges and Solutions

Our experience at Sandia suggests that the critical elements named above — a ready market, a committed entrepreneur, and exclusivity — typically come together in one of three situations:

- **Technologist-based:** An employee identifies a market and expresses a desire to become an entrepreneur.
- **Market-based:** A private-sector entrepreneur identifies a market need, and a matching technology exists at Sandia.
- **Transfer of Operations:** Sandia has completed the R&D phase of a sponsored project, and the sponsor is looking for a commercial manufacturer.

Technologist-based

The first situation, in which a Sandian comes forward with an idea, accounts for about half of Sandia's new ventures. These potential entrepreneurs have many barriers to overcome before launching a successful company.

Reducing the Risk Factor: TTLOAs

Foremost is that our corporate culture is not conducive to risk-taking. To reduce the risk associated with leaving a secure position at the Labs, New Ventures successfully proposed the Technology Transfer Leave of Absence (TTLOA). This

policy allows Sandians to obtain leaves of absence specifically to start a new company or join an existing one while retaining a cooperative connection to the lab.

Sandia has granted TTLOAs to nine technologists. The fundamental criterion used by management when considering a TTLOA is that the requesting employee must either require rights to intellectual property developed at Sandia for the business venture or have special expertise acquired at Sandia that is critical to the venture. In either case, the leave must further Sandia's technology transfer and commercialization mission.

A thorough and clearly defined policy not only reduces case-by-case snags and delays, but adds to the employee's sense of security and confidence in the process. Some fundamental points of the policy follow.

- The standard TTLOA is two years, but this can be extended as the case requires.
- During leave, the employee does not receive pay from Sandia or accrue Sandia service and retirement credit or savings-plan contributions, but is covered with life insurance for the first two-year period and can pay to extend the coverage beyond that period.
- The employee's decision to move on to a different company than that approved in the TTLOA could void the leave and its benefits.
- Should the employee return to the labs, reinstatement is guaranteed to the same or equivalent position; as with all aspects of the leave, the details of reinstatement are at management's discretion.

Enhancing Business Skills: The Alliance for Technology Entrepreneurship

Other barriers faced by technologist/entrepreneurs are lack of the business prowess required to manage or found a startup, and that as lab employees they have little contact with the local business community and therefore lack mentor

relationships with successful entrepreneurs. New Ventures addresses both of these through its parent department, the Small Business Initiative, and the Alliance for Technology Entrepreneurship.

The Alliance, a program established by Sandia under the New Ventures program, pools resources including the new Management of Technology curriculum offered by the University of New Mexico's Robert O. Anderson Schools of Management; business incubation support through New Mexico Industry Network Corporation (New Mexico INC); the funding contacts and business-development expertise of TVC; and the technical capabilities and talent of Sandia and Los Alamos National laboratories.

The key to the Alliance is the Project Selection and Planning Committee. Its work on a project begins when a potential Sandia entrepreneur provides a three-page description of an opportunity. The committee considers the paper, reviews the intellectual property situation and resolves property rights, gathers preliminary market data, and then meets with the potential entrepreneur. At this meeting, the entrepreneur gives a 30-minute presentation to and fields questions from the committee, and participates in discussions of intellectual property and market research results, if any. Following the presentation, the Alliance members meet privately to discuss the project and decide whether it should receive support. The entrepreneur then rejoins the meeting; if the project is accepted, the Alliance members assign appropriate action items, which can include further market research, developing strategies for intellectual property negotiations, TVC business and financing assistance, and incubator placement.

For cases in which the potential entrepreneur needs advice in diverse fields such as law, accounting, and manufacturing, the Alliance has established an auxiliary network of professionals from those areas. In the coming year, ATE will

produce a database to simplify the mapping of entrepreneurs' needs to network services.

Another aspect of providing know-how is putting would-be entrepreneurs in touch with the local business community. New Ventures works with the Alliance and local entrepreneurial societies to encourage Sandian participation and to introduce Sandians to local and national mentors who can contribute to projects.

Ensuring Minimal Conflicts of Interest and Equitable Negotiations

Just as certain conditions and attributes make it difficult for lab personnel to transition into the private sector, the very idea of public-to-private transfer has built-in pitfalls: conflicts of interest, intellectual property ownership, and licensing favoritism issues. These are compounded when the transfer partner is, or employs, a Sandia technologist. Although solid ground rules and careful project assessment ensure a good start, each subsequent step requires close attention to avoid problems.

To address potential conflicts of interest, New Ventures requires the Sandia technologist to develop, in conjunction with management, a conflict-of-interest management plan that details in writing the conflict of interest as well as the steps that will be taken to mitigate that conflict. The plan is reviewed by Sandia management, the Technology Transfer & Commercialization Center at Sandia, and any legal or ethics professionals as needed. Once the plan is approved, it can be modified to deal with new conflicts as they arise. The logic behind this approach is simple: The act of preparing a plan in advance spurs discussion and concurrence between the employee and management on a method for handling conflicts.

Again in the cases of intellectual property and licensing, firm ground rules and scrupulous assessment should drive case-by-case decisions. The ground rules are that if the technology's development was either paid for by DOE or related to the inventor's work at Sandia, Sandia can claim title. If not, the inventor can confirm

ownership by applying to DOE, then pursue a private patent. If Sandia and DOE don't claim title, the inventor can ask DOE for a waiver of title and then pursue a private patent.

If Sandia or DOE do elect title to an invention, the inventor can pursue a license to the intellectual property. Licensing to employees and former employees, however, can lead to the perception of favoritism; in fact, the licensing organization must neither favor nor penalize an employee in a licensing negotiation — a difficult balance to achieve. At Sandia we have developed a procedure that is both fair and efficient; it starts with the preparation, prior to negotiations, of a conflict-of-interest plan as described previously. In addition, DOE is notified of any form of exclusivity envisioned as part of the licensure. The key is that the licensing function is handled by a separate group at Sandia so that New Ventures can serve as an advocate for the entrepreneur, and the licensing professional can maintain neutrality during the negotiation.

A Technologist-Based Transfer Success Story

One lab employee who has made use of New Ventures' services is Ned Godshall, who at Sandia worked on silicon micromachines. Ned's outside interests in the biomedical arena inspired an idea: to adapt silicon microdevices into a device capable of delivering drugs through the skin. He began to investigate the possibility of forming a new company to commercialize his idea; this led him to contact the New Ventures program. With our help he prepared a business plan, secured the intellectual property rights, took a technology transfer leave of absence, and obtained corporate financing. Today, Ned is working to perfect his idea, obtain FDA approval, and build a functional prototype. As he works to commercialize the device, Ned continues to receive support from New Ventures.

Market-based: Technology Spin-offs with External Entrepreneurs

The second scenario is when a Sandia technology meets a market need identified from outside the labs. Our experience in this area yields a clear equation: Success depends on a strong market pull, and an entrepreneur or entrepreneurial company to drive the process. The critical task is matching the Sandia technology to an external entrepreneur who has a market in mind.

Making the Match

This match is rare and difficult to discern: Most markets are not well-matched to Sandia technologies, and many Sandia technologies are far from market-ready. The lesson here is that the New Ventures program must be tightly tied to the local and to some extent the national business community so that the greatest possible number of strong matches can be identified.

Matches come from a variety of sources, some the direct result of small-business CRADAs in which the industry participant has a specific market in mind and teams with Sandia to obtain the required technology. In other cases, TVC or the New Ventures program became aware through its network of contacts of a market opportunity and works from there to find a match within the labs.

A Market-Based Transfer Success Story

Interstate Glass Distributors is a good example of a company coming to Sandia with a market in mind. Diego Ruiz approached Technology Ventures Corporation with an idea to redesign auto-glass shipping containers so that they would be reusable and better serve the needs of the glass transport industry. As owner of a large glass distribution company, Diego knew well the shortcomings of the existing glass transportation systems and already had a patent pending on a concept and design of a new shipping container. He lacked, however, the design expertise required to carry the project to completion on his own. Sandia's nuclear weapon shipping-container design group was a strong match; a CRADA was launched

within months. As a result of this CRADA, Diego has a much-improved container prototype and is going forward with plans to build containers in Albuquerque, employing about 150 people. One of the most valuable contributions that Sandia made to the project was to back up Diego's claims with hard data so he could get the attention of the large auto-glass companies.

Transfer of Operations: The Make/Buy Decision

In the third scenario, a sponsor from the government or private industry will commission research at Sandia with the expectation that the products developed will be available either from Sandia or a private source. When R&D is completed on these projects, Sandia faces a make/buy decision and often opts to find a manufacturer to produce the resulting item(s).

Creating Multilevel Opportunities

These transfer opportunities are plentiful but have proven difficult to complete, frequently because the market is too small or because the technology does not complement the product lines of any existing manufacturers. This very difficulty, however, can be the source of another opportunity: Sandia can select the most appropriate manufacturer, then provide technical assistance to bring that company up to speed. When these projects succeed, they make a valuable manufacturing resource available to DOE or other sponsor at little or no cost.

A Transfer of Operations Success Story

For example, Re/Spec Inc. worked with Sandia on contract to help develop the TDAP water-well monitor for use in the WIPP program. After development and testing, Sandia licensed the technology to Re/Spec and provided technical assistance toward a commercial implementation. DOE can now buy an improved commercial product for use at the WIPP site; meanwhile Re/Spec is making this DOE-developed technology available to the private sector.

Similar but more difficult is when a useful application is reached through basic research — that is, with no specific sponsor. In this case the New Ventures program assesses the opportunity, finds an appropriate company or creates a new company to meet the need, and executes the appropriate technology transfer mechanism. The result is that a company is formed or expanded, and a technology with a ready market is moved to the private sector.

Benefits of the New Ventures Program

Our experience has yielded several lessons:

- Most ventures result from Sandia entrepreneurs, from technologies that are well-matched to market needs, and from laboratory projects that are ready for production.
- Entrepreneurship issues are tremendously complex, requiring policy changes to reduce risk, manage intellectual property and licensing determinations, plan for potential conflicts of interest, and tailor other strategies.
- A new ventures program must advocate these policy changes, assist entrepreneurs, put significant effort into matching outside companies to inside technologies, and identify lab projects ready for manufacture.
- Connection to the local business community is vital to good commercialization matches and to the development of Sandia entrepreneurs.
- Lab employees are far more interested in pursuing Technology Transfer Leaves of Absence than anticipated.

The most direct benefit of the program is that new ventures help fulfill Sandia's obligation to move technology to the private sector where possible. This program is also helping complete the cycles of advanced technology development

and defense conversion, moving advanced ideas from the laboratory to industry in a timely, efficient manner and simultaneously illustrating the upside of downsizing the laboratories. New ventures also create jobs and advanced technology suppliers for DOE. In short, the creation of new ventures is an efficient, effective way to achieve the goals of technology transfer.

The New Ventures program is yielding other, less measurable benefits for the laboratory. A new spirit of entrepreneurship is emerging as the pioneers of the TTLOA policy succeed and become role models, even heroes. The Labs' staff are beginning to consider the industrial relevance of their work and to indicate greater interest in entrepreneurial opportunities and activities.

Appendix: Highlighted New Ventures Projects

Technology Transfer Leaves of Absence (TTLOAs) to Form New Businesses

Advanced Tribal Integrated Information Networks (ATIIN)

Laurence Brown has formed a 100% Native American-owned business with the primary goal of moving Native American businesses, governments, and communities onto the Information Superhighway. ATIIN is now using incubator space provided by TVC.

BEAR Inc.

Peter T. Boissierre is forming a small business to provide remote robotic systems to the waste remediation industry for retrieval of hazardous materials. BEAR Inc. has negotiated a license and has received technical assistance from Sandia.

Bergan Air Inc.

Nina Bergan French has formed Bergan Air Inc. to commercialize air-pollution monitoring technology that was developed at Sandia under DOE and DOD funding. Further plans include equipment based on laser spark spectroscopy to take real-time measurements of all 14 metals regulated under the Clean Air Act Amendment and the Resource Conservation and Recovery Act.

Castillo Homes

Ted Castillo has started a custom home construction business. He specializes in energy-efficient, water-conservative, and ergonomic home designs. (No intellectual property involved; no license required.)

Conductor Analysis Technologies (CAT Inc.)

Tim Estes has started a company that will work with US electronics manufacturers to improve their processing methods, materials, and equipment for producing high-

definition electronic packages such as printed wiring boards, multichip modules, and flat-panel displays. (No license required.)

Silicon MicroDevices

Ned Godshall formed a company to commercialize an invention that could be used to deliver drugs to the human body through the skin. Intellectual property rights were released to Ned by DOE and Sandia.

Trackware

James Wiczer has formed a company called Trackware to develop, publish, and market computer software tools that automate the preparation of funding proposals and manage engineering and science R&D activities. (No intellectual property conflicts; no license required.)

TTLOAs to Join Existing Companies

Bankers Trust Electronic Commerce (BTEC)

Ernest Brickell has joined BTEC to commercialize work on electronic cash. BTEC, a start-up business within BankersTrust, is funded by venture capital to develop a business for electronic commerce. (Another Sandian, David Kravitz, has just initiated his TTLOA application to join BTEC.)

Fluid Dynamics International (FDI)

Ted Blacker has joined FDI, one firm that has licensed Sandia's mesh-generation technology.

Optex Communications Corporation

Dale McIntyre has joined Optex, a start-up that is developing new, very high-density optical storage media based on its patented electron-trapping optical memory technology. (Does not involve any specific patented or undisclosed information developed at Sandia.)

Businesses Expanded with Sandia Technology

Alliance Technologies

Alliance is working with Sandia through a small-business CRADA to develop a PC-based version of the SWORD electronics reliability software package. SWORD is already a commercial product through Hewlett-Packard for use on HP's 4062 test system.

Gulton Data Systems

Gulton, which produces space flight avionic systems, worked with Sandia to apply the labs' public-domain technology called the SMART Telemetry System. Sandia, which used the package for a DOD customer, provided technical assistance to help Gulton explore the technology and potential commercial applications.

Innovative Recycling Corporation (IRC)

IRC has received technical assistance and is now working with Sandia through a CRADA to test and characterize the mechanical response of a co-mingled plastic material, made from recycled plastics, fabricated in a cold-extrusion process. IRC has a product on the market directly resulting from its work with Sandia.

Interstate Glass Distributors (IGD)

IGD has a CRADA with Sandia to perfect the design of a reusable plastic shipping container for automobile windshields. IGD formed its Glass Transit System division as a result of this work.

Permacharge

Permacharge received technical assistance from Sandia that led to a CRADA. The partners are working to develop a prototype of technology that uses protein to trap heavy metals in aqueous environments.

Quantum Manufacturing Inc. (QMI)

QMI was formed by several Sandians around an invention in high-energy ion-beam technology. A wide range of applications are possible, but the group currently has

targeted specific commercial applications. A license is planned, and potential exists for a CRADA with Sandia.

Re/Spec Inc.

Re/Spec worked with Sandia on contract to help develop the TDAP water-well monitor for use in the WIPP program. After development and testing, Sandia licensed the technology to Re/Spec and provided technical assistance toward a commercial implementation.

Rhomed

Rhomed has a CRADA and a technical assistance agreement with Sandia to develop drugs that fight cancer using isotope therapy and to pursue the design of a robotic system for safer handling and administration of products.

Sparton Technology

Sandia's Remote Sensing Department has provided circuit diagrams of a monitoring device to Sparton. Sparton will build the device for Sandia and other customers.

VIGA Inc.

VIGA has negotiated a license for Sandia's MUSE computer software, and is receiving technical assistance from Sandia toward its further development for commercial markets.