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**BMDO - NEW MEXICO
TECHNOLOGY TRANSFER
DEMONSTRATION PROJECT**

INTERIM FINAL REPORT

**Prepared by
SAGE Management Partners**

**for
Los Alamos National Laboratories
on behalf of
BMDO New Mexico Technology Transfer
Demonstration Project**

November 1993

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BMDO-NEW MEXICO TECHNOLOGY TRANSFER DEMONSTRATION PROJECT

INTERIM FINAL REPORT

I. Introduction

The BMDO-New Mexico Technology Transfer Demonstration Project (BMDO-NM) was a collaborative effort among the national laboratories to identify and evaluate the commercial potential of selected SDI-funded technologies. The project was funded by BMDO (formerly known as the Strategic Defense Initiative Office or SDIO), the Technology Enterprise Division (NM-TED) of the NM Economic Development Division, and the three National Laboratories. The project was managed and supervised by SAGE Management Partners of Albuquerque, and project funding was administered through the University of New Mexico.

The BMDO-NM Demonstration Project focused on the development of a process to assist technology developers in the evaluation of selected BMDO technology programs so that commercialization decisions can be made in an accelerated manner. The project brought together BMDO, the NM-TED, the University of New Mexico, and three New Mexico Federal laboratories - Los Alamos (DOE), Phillips (DOD) and Sandia (DOE). Each national laboratory actively participated throughout the project through its technology transfer offices.

New Mexico was selected as the site for the Demonstration Program because of its three national and federal research laboratories engaged in BMDO programs, and the existing relationship among state government, the labs, universities and local economic development and business assistance organizations.

Subsequent Commercialization and Implementation phases for the selected technologies from LANL and SNL were completed by SAGE and the Project Team. Funding for those phases was provided by the individual labs as well as BMDO and NM-TED in kind services.

NM-TED played a proactive role in this New Mexico partnership. Its mandate is to promote technology-based economic development, with a commitment to facilitate the use of technology by industry and business statewide. TED assumed the role of program manager and executing agent for BMDO in this demonstration project.

It has been BMDO's experience that one of the most difficult tasks facing technology developers and technology transfer officials is the assessment of a technology when the invention disclosure is made. This is a critical time in the commercialization process because decisions made at this juncture about intellectual property matters or publication of invention results, for example, could have far reaching impact on the potential commercial value of the technology to the developing organization. Therefore, the BMDO Office of Technology Applications decided that a demonstration model could be created and analyzed for the purpose of assisting in the assessment activity.

The original program structure developed from a shared federal and state belief that the program would accelerate the commercialization of technology by identifying necessary elements for successful market application and acceptance.

The use of intermediaries from state government and the private sector and their networks was essential to the program's success. The intermediaries enhance the labs' internal processes with market expertise, focus on market pull, and business assistance and outreach capabilities. Also, the state intermediary, with experience in federal and laboratory standards of fairness of access and small business access to technology, can manage program expectations and negotiate through potential obstacles.

The premises of this project were:

- 1) technology developers can more quickly structure commercialization strategies and priorities if they can appraise their technologies early in the development cycle;
- 2) universities can participate and add value to the process;
- 3) local economic development organizations can assist in the commercialization process; and
- 4) last, but perhaps most important, networking each organization's capabilities can provide greater leverage and accelerate the movement of R&D to the commercial sector.

In summary, the intent was to create a working model which could have nation-wide applicability and impact while establishing a cooperative team in New Mexico which would endure beyond this project. **Exhibit 1** illustrates key tasks and milestones of the overall project.

Exhibit 1: Project Tasks and Milestones

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II. Organization and Funding

A. Project Development and Planning

Project vision was provided by the BMDO and NM-TED. The roles of the federal partner, BMDO, extended beyond sponsorship of the program. BMDO, in the forefront of technology application issues, added perspective about federal goals for technology transfer and acted as a contributing change agent to stimulate a new model of interaction. BMDO was willing to approach commercialization from a perspective of what might be accomplished by working together, beyond any individual organization's procedures.

The standing relationship of NM-TED to the technology transfer managers at the national labs was important in establishing a forum for creating a new process. Project coordination was provided by the NM-TED, which, as a project intermediary, facilitated administration of funding, contract management, scheduling, and organizing and conducting the meetings of the Advisory Committee. As directors of the project, representatives from BMDO facilitated goal setting, resource allocation, problem solving and reconfirming the program objectives and accomplishments.

B. Technology Sources

Initial New Mexico sources of the technologies were The Air Force Phillips Laboratory, Los Alamos National Laboratory, and Sandia National Laboratory (Albuquerque). After the project began, the University of New Mexico and SNL-Livermore were included as a source of one candidate technology each.

C. Assessment Team and Project Management

The NM-TED provided overall project coordination. As originally conceived, the project was to be conducted by students and staff of the University of New Mexico's Technology Ventures Division. Due to transitions within that organization, project management was delegated to SAGE Management Partners, an entrepreneurial business investor and consultant. SAGE organized and participated with a team of four market assessors throughout the project. The team, which included graduate students from the University of New Mexico, had professional expertise in business planning, market research, and backgrounds in electronics, materials science, life science and medical technologies.

D. Advisory Committee

Each participating organization was represented on an Advisory Committee, a steering panel which met periodically throughout the project. This was a useful forum for overall coordination, discussion of individual participant's issues, and strategic planning. Because of organizational changes at many federal laboratories, representation on the Committee changed from meeting to meeting. While efficiency of the Committee may have been somewhat reduced and the amount of coordination increased, the project was enriched by exposing more participants to the project.

E. Funding

Funding for this project was provided by BMDO, NM-TED, Los Alamos National Laboratory, Sandia National Laboratories, and the Phillips Laboratory. The aggregate funding for the screening and assessment phase amounted \$120,000. Subsequent funding for commercialization support was provided by BMDO, LANL and SNL in the aggregate amount of \$70,000 plus in-kind services by NM-TED.

III. Technology Selection

The original scope of work of the demonstration project assumed that each laboratory would have a well-documented current inventory of SDI-sponsored technologies in a "pipeline to commercialization". However, this assumption was not correct. The process of identifying technologies was, therefore, significantly more time consuming and management intensive than originally anticipated.

Identification included learning each laboratory's policies and procedures for intellectual property, and the funding status of the technologies, defining potential commercial applications and soliciting technical abstracts, and meetings with researchers. As a result, the assessment team gained greater insights into the complex issues associated with technology transfer.

Various mechanisms had to be developed to facilitate the identification of eligible technologies, adding several months to the front-end of the project, beginning with establishing criteria of eligible technologies. As in production, the best time to identify potential problems is as early in the process as possible. The team sought to screen out technologies that were not available for transfer due to insufficient internal support, proprietary position, or constraints of the technologists.

The importance of involving the technologists in the process can not be overstated. An important mechanism for identifying technologies was to solicit abstracts from researchers in each organization. As a starting point using an abstract format developed by the assessment team, technologists provided the following information:

- technology description
- description of any patents that are pending, in process or issued
- status of any prototyping activities and plans
- primary commercial applications
- special attributes of the technology
- prior market assessments

Methods for identifying candidate technologies differed among the laboratories. One organization sent written requests for participation to individual technologists; a second institution relied on SDI-project line managers; the third depended heavily upon the personal knowledge of the technology transfer offices. All three were augmented by direct interaction of the assessment team with each technology team in an interview setting of two to four hours. The identification processes relied heavily upon the technologists' own ability to

assess commercial opportunities, as well as perceived value of his participation in the demonstration project. As a result, some viable technologies may not have been identified for inclusion in the project. However, meeting personally with researchers early in the process clarified the goals and requirements of the project, and in some cases, resulted in identifying additional potential commercial applications for a given technology.

Milestone: With the support of each technology transfer office, the project team interviewed technologists to generate abstracts and screen candidate technologies over two months. Fifty-three potential candidate technologies were evaluated and reduced to an inventory of thirty-six technologies to be further evaluated by the program (**Exhibit 2**).

The Phillips Laboratory (P)	Los Alamos Nat. Laboratory (L)
<ul style="list-style-type: none"> *1 IMU Gyroscope W. McPherson *2 Radiation Hardened Electronics J. Lyke *3 High Density Packaging R. Herdon *4 Cryogenics W. Wyche *5 Beam Direction Finder Y. Jones King *6 Adaptive Structures K. Slimak 7 IR Sensors H. Macklen 8 Space Debris Model A. Reinhardt 9 Fault Tolerant IBM RISC J. Emerick 10 ASCM Backplane J. Emerick 11 Cryocoolers - Medical/Semicon 	<ul style="list-style-type: none"> *1 Cryocooler-Coolahoop (TANGL) G. Swift *2 Cryocoolers - medical/semicon G. Swift 3 SuperLattice IR Sensors D. Watkins *4 Excimer Laser Surface Treatment T. Jervis 5 Sol-gel Coating of Fluorescents B. Sander 6 Cryogenics for Accelerator W. Fox *7 Photoinjector R. Sheffield 8 Free Electron Laser R. Sheffield *9 Photocathode Dip Process B. Springer *10 Laser Tissue Photoablation R. Dingus *11 Vacuum System Dryer: B. Springer
Sandia Nat. Laboratories (S)	The University of New Mexico (U)
<ul style="list-style-type: none"> *1 High Frequency Communication System: W.T. Whetstone 2 Advanced IR Sensor MODIL D. Schueller 3 Impulsively Loaded Target Response: R.A. Benham 4 Solid Lubricating Film: M. Dugger 5 Discrimination Technology: J.K. Rice 6 Core Support Module: J. Berringer 7 Parallel Processing: J.L. Tompkins 8 LACE 9 Exoatmospheric Information P.A. Kuenstler 10 Neutral Particle Beam Lethality: J.H. Renkan 11 Electromagnetic Coilgun: M.W. Cowan *12 Pattern Recognition- Mammography W.P. Kegelmeyer, Jr. *13 Noninvasive glucose monitor D. Haaland, R. Robinson 	<ul style="list-style-type: none"> *1 Ion Beam Figuring B. McNeil <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <ul style="list-style-type: none"> * One of highest ranked technologies * One of 11 recommended technologies </div>

IV. Screening and Prioritizing Technologies

Candidate technologies were first evaluated against four fundamental pre-requisite criteria:

- A "**champion**" is committed to the transfer of the technology.
- A **commercial application** has been identified.
- The technology is **not classified** or otherwise encumbered. A licensing or transfer opportunity is therefore feasible.
- A descriptive write-up or **abstract is available**.

Technologies which pass these criteria must then be more finely screened. In this model, the relative attractiveness of each technology was based on five criteria which reflect commercial potential, and five criteria which evaluate transfer potential. These are the heart of the screening process, and may be adapted to particular institutional needs. See **Exhibits 3A, 3B, 3C, and 3D** "SDIO Technologies Market Assessment Study, Selection Criteria".

Criteria used to screen for **commercial potential** included:

- Costs of commercial development are reasonable.
- A family of products or applications is possible.
- The commercial market is accessible.
- The competitive advantage in the market is possible.
- Discussions with industry have been held or are on-going.

Criteria reflecting **transfer potential** included:

- The technology is adequately developed for transfer.
- A team is available to assist the development or transfer.
- The technology has a proprietary position.
- The time anticipated for commercial development is reasonable.
- A transferee or licensee is identified or identifiable.

These are obviously not "hard data" criteria. Assigning relative values to each criterion for each technology relies heavily upon the assessment team's collective technical and business experience. Plotting the relative attractiveness of the thirty-six technologies on a matrix (**Exhibit 4**, "SDIO Technologies Market Assessment Study, Commercial and Transfer Potential") highlighted the top twelve candidates.

Milestone: The Advisory Committee accepted the team's recommendation that market assessments be made for the top twelve technologies. (**Exhibit 5**)

SDIO TECHNOLOGIES MARKET ASSESSMENT STUDY

Los Alamos National Laboratory (L)		Selection Criteria											Total	
Technology Description	Pre-Requisite Criteria	Commercial Potential						Transfer Potential						
		1	2	3	4	5	Sub-Total	1	2	3	4	5	Sub-Total	
*1 Cryocooler-Coolahoop (TANGL)	✓	U	Ø	U	Ø	✓	18	✓	✓	✓	✓	U	44	62
*2 Cryocoolers - medical/semicon	✓	U	✓	U	U	U	26	✓	✓	✓	U	U	38	64
3 SuperLattice IR Sensors	✓	U	U	Ø	U	Ø	12	✓	✓	U	U	U	32	44
*4 Excimer Laser Surface Treatment	✓	✓	U	✓	U	✓	38	✓	✓	Ø	✓	✓	40	78
5 Sol-gel Coating of Fluorescents	✓	✓	U	U	U	Ø	22	U	✓	Ø	✓	U	28	50
6 Cryogenics for Accelerator	Ø	N	N	N	N	N	20	N	N	N	N	N	20	40
*7 Photoinjector	✓	U	Ø	Ø	U	✓	18	✓	✓	✓	✓	Ø	40	58
8 Free Electron Laser	✓	Ø	U	U	✓	✓	28	Ø	✓	Ø	Ø	Ø	10	38
*9 Photocathode Dip Process	✓	✓	✓	✓	✓	✓	50	✓	✓	U	✓	U	38	88
*10 Laser Tissue Photospallation	✓	U	✓	U	✓	U	32	U	✓	U	U	✓	32	64
*11 Vacuum System Dryer	✓	✓	U	✓	✓	U	38	✓	✓	U	✓	U	38	76
Prerequisite Criteria		Commercial Potential (x-axis)						Transfer Potential (y-axis)						
a. Champion is committed		1. Costs of commercial development are reasonable						1. Technology is adequately developed for transfer						
b. Commercial application is identified		2. Family of products or applications is possible						2. Team is available to assist the development or transfer						
c. Licensing or transfer opportunity is possible		3. Commercial market is accessible						3. Technology has a proprietary position						
d. Descriptive write-up or abstract is available		4. Competitive advantage in the market is possible						4. Time for commercial development is reasonable						
		5. Discussions with industry held or on-going						5. Transferee or licensee is identified or identifiable						
Matrix Symbols		Note:												
✓ Pass		• Interpretation is based on limited available information and may be adjusted to reflect additional information												
U Unknown														
Ø Failed														
T Transferred														
N Not applicable														
* Included in top 12 ranking														

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SDIO TECHNOLOGIES MARKET ASSESSMENT STUDY

Sandia National Laboratories (S)		Selection Criteria												Total	
Technology Description	Pre-Requirement Criteria	Commercial Potential						Transfer Potential							
		1	2	3	4	5	Sub-Total	1	2	3	4	5	Sub-Total		
*1	High Frequency Communication System	✓	U	✓	✓	✓	U	38	U	✓	U	U	✓	32	70
2	Advanced IR Sensor MODIL	✓	U	U	Ø	U	Ø	12	✓	✓	✓	U	Ø	34	46
3	Impulsively Loaded Target Response	Ø	N	N	N	N	N	20	N	N	N	N	N	20	40
4	Solid Lubricating Film	T	U	U	U	U	✓	26	N	N	N	N	N	20	46
5	Discrimination Technology	Ø	N	N	N	N	N	20	N	N	N	N	N	20	40
6	Core Support Module	Ø	N	N	N	N	N	20	N	N	N	N	N	20	40
7	Parallel Processing	Ø	N	N	N	N	N	20	N	N	N	N	N	20	40
8	LACE	Ø	N	N	N	N	N	20	N	N	N	N	N	20	40
9	Exoatmospheric Information	Ø	N	N	N	N	N	20	N	N	N	N	N	20	40
10	Neutral Particle Beam Lethality	Ø	N	N	N	N	N	20	N	N	N	N	N	20	40
11	Electromagnetic Collgun	✓	Ø	Ø	Ø	✓	✓	20	Ø	✓	U	Ø	Ø	14	34
*12	Pattern Recognition-Mammog.	✓	✓	U	✓	✓	✓	44	✓	✓	✓	✓	✓	50	94
*13	Non-Invasive Glucose Monitor	✓	U	U	✓	✓	✓	38	✓	✓	✓	✓	✓	50	88
Prerequisite Criteria		Commercial Potential (x-axis)						Transfer Potential (y-axis)							
a. Champion is committed		1. Costs of commercial development are reasonable						1. Technology is adequately developed for transfer							
b. Commercial application is identified		2. Family of products or applications is possible						2. Team is available to assist the development or transfer							
c. Licensing or transfer opportunity is possible		3. Commercial market is accessible						3. Technology has a proprietary position							
d. Descriptive write up or abstract is available		4. Competitive advantage in the market is possible						4. Time for commercial development is reasonable							
		5. Discussions with industry held or on-going						5. Transferee or licensee is identified or identifiable							
Matrix Symbols		Note:													
✓ Pass		• Interpretation is based on limited available information and may be adjusted to reflect additional information													
U Unknown															
Ø Failed															
T Transferred															
N Not applicable															
* Included in top 14 ranking															

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SDIO TECHNOLOGIES MARKET ASSESSMENT STUDY

The Phillips Laboratory (P)		Selection Criteria												Total	
Technology Description	Pre-Requisite Criteria	Commercial Potential						Transfer Potential							
		1	2	3	4	5	Sub-Total	1	2	3	4	5	Sub-Total		
*1	IMU Gyroscope	T	✓	U	U	✓	✓	38	N	N	N	N	N	20	58
*2	Radiation Hardened Electronics	T	✓	U	✓	✓	✓	44	N	N	N	N	N	20	64
*3	High Density Packaging	T	✓	✓	✓	✓	✓	50	N	N	N	N	N	20	70
*4	Cryogenics	T	U	✓	U	✓	✓	38	N	N	N	N	N	20	58
*5	Beam Direction Finder	✓	U	U	U	U	✓	26	✓	✓	✓	U	Ø	34	60
*6	Adaptive Structures	T	U	✓	✓	U	✓	38	N	N	N	N	N	20	58
7	Infrared Sensors	T	U	U	Ø	U	U	16	N	N	N	N	N	20	36
8	Space Debris Model	Ø	U	U	U	U	Ø	16	✓	✓	Ø	U	Ø	24	40
9	Fault Tolerant IBM RISC	T	✓	Ø	✓	U	✓	34	N	N	N	N	N	20	54
10	ASCM Backplane	T	✓	Ø	✓	U	U	28	N	N	N	N	N	20	48
11	Cryocoolers - Medical/semicon	✓	U	✓	U	U	U	26	U	U	U	U	U	20	46
Prerequisite Criteria		Commercial Potential (x-axis)						Transfer Potential (y-axis)							
a. Champion is committed		1. Costs of commercial development are reasonable.						1. Technology is adequately developed for transfer							
b. Commercial application is identified		2. Family of products or applications is possible.						2. Team is available to assist the development or transfer							
c. Licensing or transfer opportunity is possible		3. Commercial market is accessible						3. Technology has a proprietary position.							
d. Descriptive write-up or abstract is available		4. Competitive advantage in the market is possible						4. Time for commercial development is reasonable.							
		5. Discussions with industry held or on-going						5. Transferee or licensee is identified or identifiable							
Matrix Symbols		Note:													
✓ Pass		• Interpretation is based on limited available information and may be adjusted to reflect additional information													
U Unknown															
Ø Failed															
T Transferred															
N Not applicable															
* Included in top 12 ranking															

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SDIO TECHNOLOGIES MARKET ASSESSMENT STUDY

The University of New Mexico (UNM)		Selection Criteria												Total
Technology Description	Pre-Requirement Criteria	Commercial Potential						Transfer Potential						
		1	2	3	4	5	Sub-Total	1	2	3	4	5	Sub-Total	
*1 Ion Beam Figuring	✓	✓	U	✓	✓	✓	44	U	✓	✓	✓	✓	44	88

Prerequisite Criteria	Commercial Potential (x-axis)	Transfer Potential (y-axis)
a. Champion is committed	1. Costs of commercial development are reasonable	1. Technology is adequately developed for transfer
b. Commercial application is identified	2. Family of products or applications is possible	2. Team is available to assist the development or transfer
c. Licensing or transfer opportunity is possible	3. Commercial market is accessible	3. Technology has a proprietary position
d. Descriptive write up or abstract is available	4. Competitive advantage in the market is possible	4. Time for commercial development is reasonable
	5. Discussions with industry held or on-going	5. Transferee or licensee is identified or identifiable
Matrix Symbols ✓ Pass U Unknown Ø Failed T Transferred N Not applicable * Included in top 12 ranking		
Note: • Interpretation is based on limited available information and may be adjusted to reflect additional information.		

SDIO TECHNOLOGIES MARKET ASSESSMENT STUDY

COMMERCIAL AND TRANSFER POTENTIAL

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SDIO TECHNOLOGIES MARKET ASSESSMENT STUDY
TOP 14 BY SELECTION CRITERIA
THE ELEVEN RECOMMENDED FOR STUDY ARE SHADED.

	Technology	I.D.	Score
			Max. 100
1	Pattern Recognition for Mammography Software to augment interpretation of digitized or filmless mammographs	S12	94
2	Non-Invasive Glucose Monitor Spectroscopy-based equipment for patient monitoring of blood glucose	S13	88
3	Photocathode Dip Process Efficient innovative method to create reliable, long life photocathodes	L9	88
4	Ion Beam Figuring Software and system for precision polishing	U1	88
5	Excimer Laser Treatment of Surfaces Innovative use of excimer laser system for treating of metal surfaces	L4	78
6	Vacuum System Dryer New apparatus for improving vacuum in scientific equipment by eliminating water and other impurities	L11	76
7	High Frequency Communication System Potentially versatile GaAs MMIC system for reliable global or short distance communications	S1	70
8	High Density Packaging Method of packaging semiconductors which improves performance.	P3	70
9	Radiation Hardened Electronics Method to produce electronics to be tolerant of hostile environments	P2	64
10	Cryocooler-Medical Use of patented cryogenic system for medical applications	L2	64
11	Laser Tissue Photocoagulation Method of using stress waves and other mechanical properties of lasers in various medical/surgical applications	L10	64
12	Cryocooler-TANGL Patented cryogenic system for liquifying natural gas	L1	62
13	Beam Direction Finder Apparatus for determining the direction of ion beams (patent pending)	P5	60
14	Adaptive Structures LEAP/IMU Gyroscopes Cryogenics Photoinjector	P6 P1 P4 L7	58 58 58 58

V. Market Assessments

The proprietary nature of the subject technologies and adherence to fairness of access policies limited this phase of the demonstration project to publicly-available information (secondary market sources). The goal of the assessment was to describe the relevant market and key issues to be addressed. In several cases, market assessors attended specific industry conferences, which were extremely valuable in gaining insights to the market and industry.

The scope of these assessments was necessarily limited by time and budget, with the average cost of an assessment of approximately \$6,000. Access to good business and engineering libraries, on-line databases and experts helped to provide high information value for the cost of the studies. It would have been difficult to obtain the same quality of information without such low- to no-cost resources.

An assessor was assigned to review a given technology application, but the actual evaluation, report integration, preparation and editing was a team effort which included others on the team in periodic seminar-type discussion sessions. The reports were to be distributed to project participants, including the researchers and technology transfer agents at the laboratories, and potentially other, unidentified readers.

Each report consisted of the following seven related topics reflecting readers' diverse interests: (1) background or description of the technology; (2) market research methodology; (3) existing relationships; (4) attributes and applications; (5) market description; (6) transfer, teaming, licensing opportunities; and (7) action items.

Milestone: Reports were published for limited distribution in two phases. The first six reports were completed eight months after the inception of the program. The second set of six reports and reports on transferred technologies were completed three months thereafter. These are Technology Transfer Demonstration Program: Interim Reports, April 1992 and May 1992.

VI. Commercialization Support

Three technologies with commercial potential were identified as a result of the demonstration project. The description and market assessments for these technologies are included in two reports entitled Technology Transfer Demonstration Program: Interim Reports, April 1992 and May 1992.

A brief discussion on each of the three is provided below:

A. Non-invasive glucose monitor

Sandia National Laboratories was interested in developing a strategy for licensing the non-invasive glucose monitor on a competitive basis to the most suitable candidate(s). Toward this objective, the Project Team developed a competitive market analysis of selected pharmaceutical and medical device companies serving the US diabetes market, including foreign companies, private companies, and emerging companies. Sandia eventually decided to license the technology to a newly established company in New Mexico, Rio Grande Medical Technologies, which was organized by Dr. R. Robinson, one of the inventors of the technology. The competitive market analysis served as a foundation for Rio Grande Medical Technologies' Business Plan.

B. Vacuum system drier

This Los Alamos technology was not previously identified by the LANL staff as a candidate for transfer. It was identified by the Project Team while investigating the potential of the Free Electron Laser and the Photocathode. An Illinois firm specializing in vacuum products became acquainted with this technology during the market assessment phase. When the firm contacted LANL during November 1991 regarding licensing, LANL was not ready to open discussions. When the same company was contacted on behalf of LANL in early 1993 to solicit its interest in licensing the technology, the company declined because marketplace dynamics had shifted significantly during the sixteen-month waiting period. This presented an important lesson about the value of coordinating the availability of the technology with the industry's market-driven interest in the technology.

C. Photocathode

This technology was targeted as a potential "demonstration" CRADA between a New Mexico R&D company and LANL, in which the developed technology would subsequently serve as a New Mexico-based joint venture between the local

company and an appropriate national firm that would provide the manufacturing and marketing knowhow. The project team and LANL staff developed a detailed 'road map' for such a program; however, before the plans were implemented, funding for the Free Electron Laser and its component programs, including the photocathode, was halted. As a result, a CRADA was no longer possible. Other strategies to commercialize the technology within NM were explored; however, the early-development stage of the technology made them difficult. In this case, too, timing was a crucial factor affecting commercialization activities and options.

VII. Results and Observations

A. Primary Results

An original goal of the program was to conduct market assessments on ten technologies by establishing a working model in which the independent organizations would collaborate. Commercialization strategies were to be developed for three technologies with the greatest potential. Exceeding the initial goals, the process resulted in:

- A shared understanding of the internal processes at each laboratory for identifying technologies with commercial potential, and opportunities and obstacles to commercialization;
- The adaptation of a methodology to qualify candidate technologies;
- Evaluation and ranking of fifty-three technologies with commercial potential;
- In-depth market assessments of twelve of the top technologies, published in Technology Transfer Demonstration Program: Interim Reports, April 1992 and May 1992
- Inventory and abstracts of previously transferred technologies (Phillips) published in Technology Transfer Demonstration Program: Interim Report, May 1992.
- Opportunities for training students in facets of technology commercialization.
- A prototype business workshop to introduce the local business community to technologies identified by this program;
- Development of commercialization strategies for three technologies having significant commercial potential;
- Subsequent funding for implementing commercialization strategies of two technologies;
- Cost and time data for conducting market assessments, a business workshop, evaluation of transferred technology, and administration. These cost data were used as a basis for costing subsequent independent projects.

- Interviews of project assessment team members upon completion of the market assessment phase, to determine their ideas about how the process could be improved.

B. Spin-Off Results

The program methodology was able to be adapted as needed to meet individual organization's needs and the status of specific intellectual properties. The program also served as a catalyst for additional collaborative projects aimed at strengthening commercialization strategies and application of resources for more successful results.

- SNL funded, with matching funds from BMDO, an extensive industry and competitive analysis (Non-Invasive Home Blood Glucose Monitor: Industry Analysis and Profiles, November 1992) of its non-invasive glucose monitor technology which was subsequently licensed to an entrepreneurial start-up in New Mexico.
- LANL funded a study to identify prospective licensing candidates for its vacuum system drier technology.
- Phillips adapted the technology transfer demonstration methodology and funded a method for ranking and prioritizing commercial support for its patented technologies (Screening Process to Rank Patents for Publications, August 1992).
- LANL's laser photospallation technology was further explored during a January 1993 BMDO/LANL-sponsored symposium on the Dynamic Response of Materials to Pulsed Heating.
- Two seminars related to this program were presented at the Los Alamos Entrepreneurs Forum during the summer of 1992. One described the methodology used to identify technologies with commercial potential; and the second described the programs of NM Economic Development Division related to technology commercialization.
- As a result of this collaborative program, the labs were encouraged to focus on market opportunities and candidate capabilities as part of their technology transfer processes.

- The New Mexico Economic Development Department's outreach efforts in technology commercialization were strengthened.

C. Observations

- This model is portable, cost effective and flexible. It may be tailored to fit local participants' needs and interests, such as varying degrees of involvement of local universities business students, the local business community, and state economic development groups.
- The researchers at the labs are an important part of the project team. Involving them with the market assessors in one-on-one discussions is essential.
- The role of an intermediary can be to successfully accelerate internal processes at the Labs by anticipating and identifying obstacles to project tasks.
- A good working relationship among partners helps to progress through internal administrative or other barriers by negotiating through standstills and helping to refocus on collaborative goals.
- Technology transfer departments at the laboratories can be assisted by developing business and marketing knowhow.
- Graduate university students with prior technical and business experience are very valuable for such projects; however, they need to work with seasoned professionals who organize and supervise the projects.
- Commercial interest in a technology reflects a willingness to assume new market risks which are driven by competitive opportunities and product entry cycles. If the labs cannot operate within this perceived window of opportunity, the technology transfer may not be achieved.

VIII. Recommendations

- Begin the project with a set of objectives that is developed by all participants.
- Bring to the project the resourcefulness to broaden the program to include opportunities identified along the way, such as additional technologies, applications, participants, and educational and business forums.
- Plan to augment participating technology transfer operations by drawing upon individuals having business and marketing expertise.
- Balance educational opportunities for participating students with adequate supervision and expertise.
- Each participating institution should have at least one designated representative and an alternate representative to accommodate potential organization and personnel changes.
- Provide project continuity, focus and management such as that provided by representatives from SDIO, NMED and SAGE.
- Technologies included in this type of program should have some defined proprietary base (including 'know-how'), and they should be unclassified. In other words, there should be as few constraints to their transfer as possible.
- Top management buy-in is needed from each participating organization.
- Lab management should be prepared to adapt internal processes to apply resources in a timely manner to help industry meet its needs when the opportunity exists.
- Each technology transfer organization should consider providing its research personnel a guide to intellectual property, disclosure and other technology commercialization issues and processes.
- A permanent, full time capability based on established methodologies, knowhow and relationships among collaborating organizations can increase the effectiveness of University programs assisting in technology commercialization.

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