

PARTNERS ON A MISSION: **Federal Laboratory Practices** **Contributing to Economic** **Development**

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Contributing to Economic Development

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FOREWORD

Just as research universities have long catalyzed economic development in knowledge clusters across our nation, federal laboratories are playing an increasingly important role in promoting regional growth. From the National Institute for Standards and Technology in Maryland, to Sandia National Labs in New Mexico, to NASA's Glenn Research Center in Ohio, many of our national labs are partnering with entrepreneurs to create new jobs, products and companies.

Labs serve as unique and effective partners by bringing unique and hard-to-duplicate facilities, longstanding relationships with the most innovative companies, highly educated experts, and a Congressional mandate to promote tech transfer. Many labs are taking additional steps to facilitate tech-led economic development – building incubators and research parks, offering business assistance and mentoring for new firms, providing entrepreneurship education, training and networking for start-up businesses, and even securing seed capital for new firms.

This increase in regional economic partnering by national labs comes at a critical time for the nation, as the global innovation landscape is profoundly changing. Many factors are reshaping the way in which technology is developed, deployed and commercialized, such as the convergence of multiple disciplines, integration of information technologies, emphasis on speed-to-market, shorter product lifecycles, and greater technical complexity, as well as globalization's impact on trade, technology sourcing, capital flows, and scientific and technical talent.

If innovation and entrepreneurship profoundly *shaped* the 20th century, they will *define* the 21st. Knowledge development and technology commercialization are the new drivers of economic growth, both in the U.S. and around the world. Our ability to create new innovations and harness their power will directly impact our national prosperity, security and global influence.

But American leadership is anything but assured in today's global economy – in fact, it's very much at stake. We face more significant challenges to our innovative capacity and long-term competitiveness than ever before. To succeed in the face of growing challenges we're going to need extraordinary efforts from industry, educators, and policy makers. And we're going to need our federal labs to continue in their long tradition of rising to meet our toughest challenges.

By partnering more closely with industry, labs can create new competencies and capabilities to achieve their missions; ensure their work has maximum impact; and better position themselves for future funding. Industry can get better access to breakthrough innovations at a time when it is moving more heavily into applied research and tap into unique talent, tools and technology. Realizing this win-win through effective partnerships with industry and universities may prove to be the key to our labs' and America's continued leadership in the Age of Innovation.

In 2002, the Commerce Department's Office of Technology Policy contracted with Innovation Associates to provide case studies on several exemplary federal lab programs supporting technology-led economic development. The purpose of this report is to provide policy-makers, economic development organizations, and federal labs and agencies with examples of effective partnerships, encouraging greater collaboration on tech-led economic development going forward. We would welcome feedback, suggestions or other representative case studies.

Bruce P. Mehlman
Assistant Secretary for Technology Policy

PREFACE

More than 15 years ago, the author of this report directed a project on using federal laboratories for economic development, and the consultant to the current project wrote a report summarizing the original project's results – "Tapping Federal Laboratories and Universities to Improve Local Economies". The project was sponsored by the U.S. Conference of Mayors and funded by the Economic Development Administration, U.S. Department of Commerce.

Much has changed in the past 15 years. Some federal laboratories now have research parks and even more have incubators. Some federal laboratories sponsor or participate in seed and venture capital forums, provide business assistance, and conduct extensive education outreach. Technology transfer has increased substantially. But some of the same issues remain. Those issues include the need for (a) ways to bridge the "valley of death"; that is, the gap between originating research ideas and "proofs of concept" and their possible commercial application; (b) technical and business assistance to help small enterprises commercialize technologies; (c) better access to federal laboratory technologies for small enterprises; and (d) greater recognition and resources for agencies and laboratories to support economic development and related activities. There also continues to be skepticism in the business community and economic development circles about the applicability of research conducted at federal labs and its usefulness as a tool for economic development.

We hope that 15 years from now many of these issues will be resolved. In the meantime, we hope that policy makers and agency administrators will take notice of some practices provided in this report that support community and regional economic development. We also hope that more states and communities recognize the potential of working with federal laboratories and implement efforts that leverage federal laboratory resources. Until then, we applaud the innovativeness of federal laboratory and economic development professionals who use creative ways to conduct business and technical assistance and who have made strides in economic development using federal laboratory resources.

Diane Palmintera
President, Innovation Associates, Inc.

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We wish to thank representatives from federal laboratories and economic development organizations who contributed their time and knowledge to this report in an effort to promote effective economic development practices in federal laboratories. Those representatives who provided input to the report, particularly review and comment on conclusions and recommendations were: Dan Brand, former Chair, Federal Laboratory Consortium; Jay Brandinger, President, JA Brand Associates, Inc.; Victor Chavez, Sandia National Laboratories (New Mexico); Beatrice Droke, U.S. Food and Drug Administration; Steven Ferguson, National Institutes of Health; David Foster, Los Alamos National Laboratory; Cynthia Gonsalves, U.S. Department of Defense; Nicholas Karvonides, MEP Management Services Inc.; Philip Singerman, Maryland Technology Development Corporation; Gary Spanner, Pacific Northwest National Laboratory; and Richard Todd Zdorkowski, Ames Laboratory (Iowa). Some of those mentioned, and several others who are listed in Appendix A, were part of a National Advisory Group that provided review and input to the report. We also want to thank the more than 50 federal laboratory and economic development representatives who contributed information contained in case studies, and additional representatives who provided responses to the economic development questionnaire.

We thank the Office of Technology Policy (OTP), U.S. Department of Commerce for funding the project. As OTP's contract officer, Douglas Devereaux provided us with helpful guidance, thoughtful input and comment. Mark Boroush of OTP also gave us insight into technology transfer policy. Benjamin Wu, Deputy Under Secretary for Technology, provided valuable policy input early in the project. Senator Bingaman's staff in Washington, D.C. and in New Mexico also contributed to our understanding of technology transfer and development issues.

The principal of the project and author of this report was Diane Palmintera. Sally Rood was a consultant to the project and wrote much of the legislative and administrative discussion in the introduction chapter. She also generously shared her knowledge of the federal laboratory system. Jerry Joy, a research assistant on the project, spent many hours preparing, distributing and tabulating responses to the economic development questionnaire.

EXECUTIVE SUMMARY

Research universities have been a source of new ideas and technologies in Silicon Valley, North Carolina Research Triangle, and other recognized technology regions. Federal laboratories like universities also can be a source of new ideas and technology for communities and regions. Federal laboratories as economic development catalysts, however, face somewhat different challenges and expectations than universities stemming from a more mission-oriented focus. Nevertheless, some federal laboratories have successfully transferred technologies to the private sector and provided other related activities to surrounding communities and regions. There are now some outstanding examples of federal department and agency programs, and federal-state collaborative programs that have significantly contributed to economic development around federal laboratories.

It is generally recognized that a federal laboratory's presence benefits local economic development by attracting highly educated scientists and engineers to the area and creating an attractive atmosphere for entrepreneurial development and growth. By adding physical infrastructure, such as incubators and research parks to the area, some federal laboratories provide additional incentives for entrepreneurs. Some federal laboratories also sponsor technical and business assistance, capital incentives and linkages, business networking, entrepreneurial leave programs, education and training, and information dissemination that promote entrepreneurship, expand high-tech enterprises, and advance other firms.

In order to bring some of these examples to the federal research and economic development communities, the Office of Technology Policy (OTP), U.S. Department of Commerce, entered into a cooperative agreement to Innovation Associates (IA). IA administered a questionnaire, conducted on-site research and produced case studies on federal laboratory activities in economic development. IA found that federal laboratories were pursuing a variety of activities that benefited the communities and states in which the laboratories were located, and at the same time, benefited the laboratories themselves.

IA found that the labs participating in the study benefited from involvement in local economic development in several ways. Laboratories were able to attract more qualified employees when the area in which the lab was located became more economically attractive, the spouses of lab employees were able to find employment, and school systems were more attractive for their children. Labs directly benefited from helping local suppliers improve their quality and meet standards needed to support the lab's sophisticated research and development (R&D). Labs also benefited when technologies stemming from their R&D were developed and adapted for dual use by lab employees and when lab employees assisted other businesses in adapting technologies. The results of these activities benefited the lab by raising the level of technology available to it and to other government and commercial markets.

The study indicated that business assistance programs sponsored by federal laboratories can facilitate and add value to technology transfer programs. Programs such as the business assistance and Mentor Protégé programs at Sandia National Laboratories (SNL) enable technology enterprises to commercialize technologies originating at federal labs. They also augment and enhance technology supply chains that enrich the laboratories and the private sector. Federal lab activities performed in conjunction with universities such as Pacific Northwest National Laboratory's (PNNL) use of MBA students to conduct marketing studies on lab technologies and Los Alamos National Laboratory's (LANL) use of university interns as technology scouts leverage university and federal laboratory strengths.

Entrepreneurial leave programs at some DOE laboratories were shown to promote technology transfer by encouraging lab employees to start their own businesses and assist other businesses to mature and adapt lab technologies for commercial and government use. Entrepreneurial leave programs benefited the government by improving the supplier pool available to the labs and benefited the community and region by increasing and enhancing start-up enterprises. SNL's program, for example, has helped start or expand almost 100 technology enterprises, some of which have become suppliers to the lab. Entrepreneurial leave programs also were shown to improve the labs' ability to recruit and retain productive employees who may have been attracted to other research organizations that provide flexible opportunities to carry their basic research through to practical applications.

The study also indicated that networking activities sponsored by federal labs and community organizations can provide a valuable service by linking labs with outside business, education and economic development entities. Through conference and liaison activities, the Patuxent Partnership in Maryland brings the Naval Air Warfare Center Aircraft Division closer to regional sources of suppliers, other businesses, universities, and local and state policy makers. Several labs sponsor or participate in venture capital forum. SNL brings venture capitalists to New Mexico to participate in an annual Equity Capital Symposium that showcases entrepreneurs, and PNNL critiques technical presentations for entrepreneurs participating in its state forum.

Intermediary organizations can play an important role in facilitating business-laboratory relations, linking geographically distant labs with enterprises, and leveraging resources that benefit enterprises working with labs. The study included several such organizations. Wright Technology Network (WTN) and MEP Management Services Inc. (MEP MSI), for example, have "embedded" technical specialists in labs to identify and transfer technologies to local and distant enterprises. These specialists can add value through their dual understanding of federal laboratory and commercial perspectives and goals. TechLink, a center of Montana State University, brings distant federal lab technology and know how to enterprises in Montana and other rural states.

Other federal, state, and local organizations are partnering with federal labs to leverage resources. For example, in Ohio, the NASA-sponsored Great Lakes Industrial Technology Center identifies minority and disadvantaged enterprises, and provides grants and assistance to help them work with federal labs in Ohio and the region. In Maryland, the Technology

Development Corporation provides grants for enterprises to work on technology commercialization of federal laboratory technologies. In New Mexico, through a special legislated return of gross tax receipts from SNL, the Lab is able to give technical assistance to small and minority-owned enterprises. In Maine, MEP MSI leverages the federal Manufacturing Extension Partnership (MEP) and other federal and state funding resources to bring distant federal lab technologies to local enterprises.

Incubators and research parks add another dimension to federal lab R&D. The study showed that research parks were attracting research corporations and major suppliers that work with the labs, bringing them closer to the source of R&D and promoting access to lab researchers and facilities. Some incubators such as the Tri-Cities Enterprise Center associated with PNNL offer business assistance and technical support to help enterprises commercialize technologies originating in PNNL. DOD's Center for Entrepreneurship in Camden, New Jersey helps enterprises transfer DOD technologies and also helps DOD "spin in" commercial technologies. The Center serves an added economic development function through its presence in a city Enterprise Zone.

IA's study confirmed that federal lab activities with education institutions, from K-12 to community colleges and universities, are well supported in some labs and well received in communities. Federal labs that sponsored tours of R&D facilities and dispensed mobile lab units to schools gave students and teachers an unusual opportunity for "hands-on" experience with sophisticated technologies. Programs such as the Science, Engineering, Mathematics, and Aerospace Academy sponsored by NASA Glenn provided academic enrichment and career awareness that encourage K-12 students to pursue math and science careers. These types of programs may help insure a future labor pool of scientists. Lab employees also contributed to curriculum development at all education levels. Special apprentice programs such as the Pre-Apprentice Machining Program at NASA Glenn provided innovative workforce development that served the technical labor needs of the Lab and at the same time helped meet the employment needs of the community.

These are just some of the ways in which federal labs are actively engaged in economic development and related activities. As a result of responses to the economic development questionnaire and discussions with federal laboratory, federal agency and economic development representatives, IA identified numerous issues that affect the ability of federal laboratories to actively support economic development and related activities. Chief among these issues is the tentative and precarious support for technical and business assistance, and economic development in federal labs. This stems from unclear Congressional and agency mandates for such activities. Although there is a clear technology transfer mandate, there is little recognition and support for federal lab activities that facilitate and enhance technology transfer; that is, technical and business assistance needed to realize the commercial potential from technologies and know how originating in the laboratories.

There is also wide recognition that the "valley of death" remains a major obstacle to maximizing economic development benefits from federally funded R&D. The "valley of death" – the gap between originating research ideas and "proofs of concept" and their possible

commercial application – is a complex and pervasive issue that affects technology transfer in various research venues including federal laboratories. Although strides have been made to address this challenge, it may be timely to revisit the issue, review the latest research findings, and engage federal policy makers in a dialogue to consider available options and whether new initiatives might be warranted. It was suggested that a national advisory committee composed of public and private sector representatives, including representatives of small technology enterprises, would be helpful to explore the policy and administrative options. The following highlights other findings and conclusions.

- Representatives in some federal labs would like policy makers to clarify their intent with regard to federal lab participation in technical and businesses assistance, and support for economic development, and back up this intent with dedicated funding.
- Technical and business assistance, now a peripheral activity for most federal labs, can be beneficial to the federal labs' technology transfer mission. Some lab and economic development officials suggested that agencies may want to review and consider support for programs such as DOE's former TPP and other programs at particular laboratories with similar intent to provide technical and business assistance.
- Entrepreneurial leave programs are potentially valuable mechanisms for promoting commercial use of laboratory technologies and know how. More study is needed on the costs and benefits of these programs to determine whether they should be expanded to other agencies and labs.
- By sponsoring and/or participating in entrepreneurial, seed and venture capital, and business networking events, some federal laboratories are contributing valuable technical expertise and credibility to these events.
- Programs such as SNL's Mentor Protégé Program and others designed to encourage small business partnering are helping to strengthen suppliers, benefiting communities and federal labs.
- A number of labs have developed research parks and incubators at or near laboratory facilities. But proximity alone appears insufficient to insure effective linkages between enterprises in parks/incubators and labs; labs and economic development organizations should facilitate these linkages.
- Education programs were popular among lab managers and employees as well as the communities included in the study. These programs contribute to the future talent pool available to labs and promote federal labs as "good neighbors".
- Information dissemination activities of labs, once limited to publicizing scientific and technological research, now often cover broad areas of interest to technology firms. Internet-based dissemination also can be used to provide on-line tutorials, facilitate third-

party evaluations, and promote technology transfer. Expanded use of Internet-based services by labs can assist in achieving better information dissemination.

- Federal lab representatives are often confused about allowable work with SBIR firms and are looking for clarification about the restrictions and the waiver process.
- In near future years, labs may experience difficulties in filling technical and scientific positions. Policy makers should take notice of this potential short fall and consider policies aimed at meeting future labor needs.

In conclusion, strengthening the business communities in which the labs are located appears to make good economic sense for the communities and states in which labs are located and for the federal laboratories. Building stronger, higher quality enterprises provides better suppliers for the labs; stimulating science and engineering interest in students develops a stronger future labor pool; and working in more effective and flexible ways with business and industry insures that federal laboratory-inspired technologies and knowledge will be transferred and commercialized. Moreover, fostering maturation and commercialization of federal lab technologies through business and technical assistance and entrepreneurial programs adds value to lab technologies, sometimes contributing back to the lab higher quality technologies than the original, and raising the scientific and engineering bar higher for all.

ABBREVIATIONS

ACIN	Applied Communications and Information Networking
AFRL	Air Force Research Laboratory
APEL	Applied Process Engineering Lab (PNNL)
BAT	Bureau of Apprenticeship and Training (DOL)
BRAC	Base Realignment and Closure
CBDG	Community Development Block Grant (HUD)
CCC	Cuyahoga Community College
CECOM	Communications Electronic Command Research, Development, and Engineering Center (DOD)
CRADA	Cooperative Research and Development Agreement
CRO	Community Reuse Organization
CSU	Cleveland State University
CWRU	Case Western Reserve University
DARPA	Defense Advanced Research Projects Agency (DOD)
DOC	U.S. Department of Commerce
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOL	U.S. Department of Labor
EDA	Economic Development Administration (DOC)
EPSCoR	Experimental Program to Stimulate Competitive Research
EPSCoT	Experimental Program to Stimulate Competitive Technology
FAST	Federal and State Technology Partnership
FLC	Federal Laboratory Consortium
GLITeC	Great Lakes Industrial Technology Center
GOCO	Government-owned, contract-operated (federal laboratory)
GOGO	Government-owned, government-operated (federal laboratory)
GSA	U.S. General Services Administration
HBCU	Historically black colleges and universities
HHS	U.S. Department of Health and Human Services
HUB	Historically underutilized business (zone)
HUD	U.S. Department of Housing and Urban Development
INEEL	Idaho National Engineering and Environmental Laboratory
INRA	Inland Northwest Research Alliance
IRD	Independent research and development (DOD)
LANL	Los Alamos National Laboratory
LIFT	Lewis Incubator for Technology
MADA	Montana Aerospace Development Authority
MEMS	micro-electromechanical systems
MEP	Manufacturing Extension Partnership (U.S. National Institute for Standards and Technology, DOC)
M&O	Maintenance and operations

MSU	Montana State University
NASA	U.S. National Aeronautics and Space Administration
NAWCAD	Naval Air Warfare Center Aircraft Division
NAVAIR	Naval Air Systems Command
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NSF	National Science Foundation
ODOD	Ohio Department of Development
ORTA	Office of Research and Technology Applications
OTP	Office of Technology Policy (DOC)
PFI	Partnerships for Innovation (NSF)
PLA	Patent license agreement
PNNL	Pacific Northwest National Laboratory
R&D	Research and development
RTTC	Regional Technology Transfer Center (NASA)
SBA	U.S. Small Business Administration
SBDC	Small Business Development Center (SBA)
SBIR	Small Business Innovation Research program (SBA)
SEM	scanning electron microscope
SEMAA	Science, Engineering, Mathematics and Aerospace Academy
SME	Small- and medium-sized enterprises
SMI	Small- and medium-sized industries
SNL	Sandia National Laboratory, New Mexico
STPDC	Science and Technology Park Development Corporation (SNL)
STTR	Small Business Technology Transfer Program
TEDCO	Technology Development Corporation (Maryland)
TPP	Technology Partnerships Program (DOE)
TVC	Technology Ventures Corporation (subsidiary of Lockheed Martin)
USDA	U.S. Department of Agriculture
WPAFB	Wright Patterson Air Force Base
WTN	Wright Technology Network

I. INTRODUCTION AND BACKGROUND

As research universities have been a source of innovative ideas and technology to support economic development in Silicon Valley, North Carolina Research Triangle, and other famous technology regions, some regions are now looking to federal laboratories as similar sources of new ideas and technology. The road to federal laboratory supported economic development has been a slower one than that based on universities. This is partly because federal laboratories may be more narrowly focused on agency-mandated missions, have different priorities, and therefore, face some different expectations and limitations than many university research programs. Nevertheless, federal laboratories have a Congressional mandate to transfer technologies to the public and private sectors and many laboratories have active and successful technology transfer programs. In addition, some federal laboratories have gone beyond their federally defined mission and technology transfer obligations to actively support local and regional economic development. There are now some innovative examples of federal laboratory and state and regional collaborative programs that are significantly contributing to technology clustering around federal laboratories. This report identifies some of those federal laboratory programs.

Through a cooperative agreement with the Office of Technology Policy (OTP), U.S. Department of Commerce, Innovation Associates, Inc. (IA) conducted a study of exemplary practices by federal laboratories in support of local economic development. For purposes of this report, we viewed economic development practices broadly, covering a wide range of activities initiated by federal laboratories and intermediary organizations working directly with federal laboratories. Those activities included incubators and research parks, technical and business assistance, capital investment and linkages, business networks, entrepreneurial leave programs, educational outreach, technology and business development workshops, and numerous other activities that actively contribute to economic development. Although “pure” technology transfer activities such as CRADAs, etc. directly contribute to economic development, they were not covered in this report since they have been covered in numerous other studies. IA, in conjunction with OTP, selected seven federal laboratories that conduct innovative and exemplary practices supporting local economic development. IA/OTP additionally selected two intermediary programs that work with geographically distant federal labs to bring those resources to regions without major laboratories. We believed it important to include the latter two examples for those regions that do not have federal laboratories present in their immediate geographic areas.

The purpose of this report is to provide policy makers and representatives of agencies, federal laboratories, economic development and technology organizations/agencies with some examples of economic development initiatives supported by federal laboratories. The reader should note that these examples are not the only examples of innovative and exemplary activities at federal laboratories or intermediary organizations. IA/OTP presented the selected examples in the hope that other federal laboratories will replicate innovative and effective technology initiatives in support of community economic development. Moreover, these examples are

intended to show economic development and technology organizations/agencies possible activities with federal laboratories in their communities and states and to encourage collaboration. We also hope to bring to the attention of policy makers and administrators issues that may hamper or foster economic development activities and outcomes.

In this report, we: (1) briefly describe the federal laboratory system and relevant background on federal laboratory technology transfer; (2) present the results of a questionnaire on economic development support activities in federal laboratories; (3) provide case studies on federal laboratory activities in support of economic development; and (4) present conclusions and issues arising from discussions with federal laboratory and economic development representatives, and briefly highlight lessons learned.

THE FEDERAL LABORATORY SYSTEM

The nation's federal laboratory system evolved after World War II when the President's science advisor, Vannevar Bush, wrote his landmark 1945 memo to the President titled "Science, The Endless Frontier." This critical memo recommended applying the existing federally-supported laboratories toward broader societal goals. Since then the federal laboratory system in the United States has grown to comprise over 700 laboratories with a combined federal research and development (R&D) budget of over \$100 billion.¹

The U.S. Department of Energy (DOE), U.S. Department of Defense (DOD) and National Aeronautics and Space Administration (NASA) have the largest and most visible laboratories, but many other agencies such as the U.S. Department of Agriculture (USDA), National Institutes of Health (NIH), and U.S. Department of Commerce (DOC) also have active laboratories. Some of the largest laboratories today such as the U.S. Department of Energy's laboratories were created during World War II to contribute to the war effort. For example, the DOE Ames Laboratory in Iowa was founded in the mid-1940s to develop a uranium production process for the Manhattan Project. Ames Lab now employs over 500 people and has a budget of over \$40 million and conducts broad ranging R&D in energy, environment, and related areas. Today, the federal laboratory system also includes NASA "field centers". The NASA Langley Research Center in Virginia, for example, employs over 5,000 people with a \$500 million budget and has special research facilities such as mach-20 wind tunnels. The federal laboratory system also includes traditional "defense labs" of DOD military services network. Federal labs may be government-owned government-operated (GoGo) or government-owned contract-operated (GoCo) by private firms or non-profit organizations such as universities and research institutes.

Legislation for Technology Transfer and Economic Development

¹ FY 2002. Source: Federal Laboratory Consortium for Technology Transfer.

Since 1980, with the passage of the Stevenson-Wydler² and Bayh-Dole Acts³ (as amended over the years since then), Congress has tried to stimulate technology transfer. The Federal Laboratory Consortium (FLC)⁴ defines technology transfer as “The process by which existing knowledge, facilities or capabilities developed under federal R&D are utilized to fulfill public or private domestic needs.” The early technology transfer legislation grew out of the military focus of the 1960s and the economic recession in the 1970s. During that time, interest in technology transfer focused a great deal on the federal government as a source of expertise to assist state and local jurisdictions to solve problems and meet the demands of constituents that could be addressed by the technical solutions.

The early legislation⁵ required laboratories over a certain size⁶ to establish a technology transfer office, or Office of Research and Technology Applications (ORTA), as it is referred to in the legislation. The legislation also required laboratories to devote at least 0.5 percent of their R&D budget to transferring technologies to outside users. Later 1986 legislation⁷ made technology transfer a responsibility of all laboratory scientists, not just the laboratory’s technology transfer staff, and allowed federal employees to participate in commercial development as long as there was no conflict of interest. The same legislation allowed the laboratories to enter into Cooperative Research and Development Agreements (CRADAs) with outside partners. In 1989, additional legislation⁸ applied similar provisions to the DOE laboratories operated by government contractors, including the nuclear weapons laboratories.

With this technology transfer legislation, the federal laboratory system expanded in the 1980s and early 1990s to include relationships with outside users. In the mid-1990s when the country was experiencing a major budget deficit and partisan conflicts, federal support for basic research decreased. At that time, a variety of studies were commissioned on the proper role of government laboratories in fulfilling their missions. Some of these studies questioned the need for government laboratories to establish public-private partnerships. DOE’s Technology Partnerships Program (TPP), which provided millions of federal dollars for technology partnerships, was virtually eliminated as some in Congress associated it with being “industrial welfare.” In spite of the mid-90s budget cutbacks, most agencies’ labs actually increased technology licensing and technology partnerships in the late 1990s.⁹ In the early 2000s, the licensing has continued to grow while partnerships have either increased or leveled off for most agencies^{10, 11}. In contrast, DOE’s labs generally experienced a decrease in the number of

² Stevenson-Wydler Technology-Innovation Act of 1980 (P.L. 96-480, U.S.C. Sec. 3701-3714).

³ University and Small Business Patent Procedures Act of 1980 (P.L. 96-517, 35 U.S.C. Sec. 200-211).

⁴ The FLC is a Congressionally-chartered network of the technology transfer officers in federal laboratories.

⁵ Stevenson-Wydler Technology-Innovation Act of 1980 (P.L. 96-480, U.S.C. Sec. 3701-3714).

⁶ Over 200 employees and budgets over \$20 million.

⁷ Federal Technology Transfer Act of 1986.

⁸ National Competitiveness Technology Transfer Act of 1989.

⁹ “Tech Transfer 2000: Making Partnerships Work.” (May 2000) U.S. Department of Commerce. Office of Technology Policy.

¹⁰ “Recent Trends in Federal Lab Technology Transfer: FY1999-2000 Biennial Report: Report to the President and the Congress under the Stevenson-Wydler Act.” U.S. Department of Commerce. Office of Technology Policy. May 2002.

partnerships after the changes to the TPP. DOE went from having only one CRADA in FY90, to having over 1,000 CRADAs in FY94 and FY95, with a high of 1,677 in FY96. But the number of DOE CRADAs decreased to 550 in FY01.¹²

In the late 1990s, Senator Jeff Bingaman (D-NM) unsuccessfully introduced two bills¹³ intended to strengthen the ties between the laboratories and regional economic development. The intent of the most recent bill was to authorize \$10 million for each of fiscal years 2003 and 2004 for an expanded Technology Infrastructure Program that would have funded DOE National Nuclear Security Administration laboratories to create technology clusters by building relationships and initiating projects with businesses, universities, non-profit organizations, and state, local and tribal agencies.

Recent Economic Development Incentives and Trends

In the 1990s, NASA initiated an agency-wide network of nine business “facilitators” to incubate small start-up companies with significant business promise and establish joint-sponsored research agreements. Many of these incubators are co-located with NASA field centers. Examples are the NASA Business Incubation Center located near the Kennedy Space Center in Florida; the Business Technology Development Center near the Marshall Space Flight Center in Alabama; and the Hampton Roads Technology Incubator near Langley Research Center in Virginia. NASA’s business facilitators are part of a comprehensive National Commercial Technology Network which includes the ten NASA field Centers, the nine incubators, and six NASA Regional Technology Transfer Centers (RTTCs). The RTTCs provide technical assistance to foster partnerships based on NASA-sponsored research and technology.

In the late 1990s, state governments joined the federal-laboratory based efforts by creating federal-state collaborative programs to pursue common goals, including economic development. As an example, the National Institute of Standards and Technology (NIST) signed a letter of partnership with the state of Maine in 1998 to leverage the state’s science and technology investment by linking NIST activities with activities of related state organizations. In 2000, DOE instituted a model agreement that encouraged the DOE laboratories to use when they sign agreements with state governments and universities.¹⁴

¹¹ “Summary Report on Federal Laboratory Technology Transfer: Agency Approaches; FY2001 Activity Metrics and Outcomes – 2002 Report to the President and the Congress under the Technology Transfer and Commercialization Act.” U.S. Department of Commerce. Office of the Secretary. September 2002.

¹² Ibid.

¹³ National Laboratories Partnership Improvement.

¹⁴ In April 2000, DOE established: (1) a model CRADA for cooperative research projects between DOE laboratories and state governments and universities, and (2) a model Work for Others agreement for reimbursable projects between DOE laboratories and state governments and universities. For more information see: <http://www.eren.doe.gov/stateagreements>.

The trend toward greater support for economic development in the last five years has also manifested at the individual lab level as federal laboratories themselves are recognizing the benefits of becoming more involved in their communities and regions. Some laboratories have structurally reorganized to establish an economic development office in addition to the technology transfer office. In the case of the DOE laboratories, organizations that wish to become maintenance and operations (M&O) contractors for the laboratories must specify economic development plans and the plans are reviewed and rated competitively along with other factors. Once selected, these contractors work with the state and local governments to further develop and implement economic development strategies. Several of the laboratories were behind the inclusion of a provision in a recent technology transfer law¹⁵ that specified ways in which laboratories could become more involved with certain institutions in their communities (e.g., by donating or leasing equipment to schools and nonprofits).

In general, federal laboratories now provide a wide range of services to the private sector and outside users. They typically transfer their technologies through licenses, contracted work or “work for others”, and CRADAs.¹⁶ They also sometimes offer: technology assessments and technical assistance, particularly for small firms; use of specialized laboratory facilities and equipment; personnel exchanges; educational outreach; and information dissemination through workshops, training, and Internet.

As services are provided to firms in the vicinity of the laboratory they contribute to local economic development. However, it is often the case that agreements for technology licenses, cooperative R&D, etc. are signed with companies in states and localities other than where the laboratory is located. And often the lab’s services assist companies from other high-tech regions of the country. Moreover, federal laboratory procurement opportunities may or may not directly benefit local suppliers. This is because local suppliers may not be able to meet the federal laboratory’s procurement needs or may not be adequately liaised with federal agency procurement operations.

When a laboratory signs a technology agreement with a small firm or when its technology is used as the basis of a start-up enterprise, these firms often need multiple technical, business, and financial services in order to help insure commercialization of the technology.¹⁷ These firms often need, at minimum: investment capital, qualified personnel, patenting and licensing, lab and office space, networking and partnering opportunities, and procurement and marketing assistance. Federal laboratories may have the technical expertise and other resources to help these firms, either through direct assistance or by providing referrals and linkages to local and state economic development, university and technology organizations. Some of the business and economic development activities supported by federal laboratories across the country have included:

¹⁵ The National Technology Transfer and Advancement Act of 1995 focused on specific legal technicalities of partnerships and the laboratories’ relationships with outside users.

¹⁶ Or comparable Space Act Agreements in the case of the NASA field centers.

¹⁷ *Commercialization Needs of Small Business Innovation Research Firms*, Innovation Associates, Inc., December 2001. See <http://www.InnovationAssoc.com>.

- Facilitating capitalization of firms to commercialize federal laboratory technologies, including seed capital, angel match-making, and other forms of start-up and early-stage capitalization, and coordination with state venture and seed funds.
- Conducting workforce development, particularly retraining of displaced employees from federal laboratory and defense downsizing.
- Supporting technology business networks and entrepreneur clubs.
- Sponsoring incubators and research parks.
- Initiating education outreach, internships, and mentor services aimed at improving know-how and stimulating interest in science and technology at all academic levels.
- Spinning off local technology enterprises and advancing other technology enterprises via entrepreneurial leave programs for laboratory employees.
- Providing various types of business assistance, or providing linkages to sources of business assistance to help technology enterprises develop and commercialize technologies and know-how originating in the federal labs.
- Disseminating information on technologies and business services, including Web-based business support, linkages and databases.

Generally, involvement in these types of activities typically requires effective coordination with multiple economic development entities; e.g., community organizations, state/regional economic development organizations, business associations, financial/venture capital representatives, and others.

In summary, over time the focus of technology transfer at the federal level has changed from encouraging federal laboratory relationships with state and local governments to encouraging relationships with, and technology transfer to the private sector. Technology transfer at federal laboratories increasingly became focused on intellectual property sharing with private industry aimed at contributing to national technological innovation. Most recently, the focus of certain agencies and laboratories has evolved to include business assistance and support for economic development activities. These activities are wide ranging and intended to optimize the technology transfer potential resulting from federal laboratory R&D.

RESEARCH APPROACH

In order to identify and select models of federal laboratory-based economic development and to discuss issues affecting laboratory participation in economic development, IA carried out the following tasks: (1) emailed questionnaires to more than 250 FLC members in laboratories across all departments and agencies; (2) interviewed by telephone representatives from selected federal laboratory ORTAs and economic development offices; (3) solicited input from FLC regional representatives and NASA RTTC directors; (4) held discussions with members of the Interagency Working Group on Technology Transfer and additional agency representatives and program directors; and (5) contacted representatives of local and state economic development and technology programs. IA/OTP also formed a National Advisory Group composed of 10 representatives from agencies, federal laboratories, economic development organizations, and

technology programs. This National Advisory Group reviewed research approach, provided input to the selection of federal laboratories, and added to discussions on issues, conclusions and lessons learned. Members of the National Advisory Group are shown in Appendix A.

Seven federal laboratories and two intermediary programs were selected for case studies that appear in this report. They represent diverse types of efforts, laboratories, and community economic bases. Outcome data was reported where available. In order to be selected, federal laboratories had to be engaged in at least one of the following:

- Capitalization of firms to commercialize federal laboratory technologies, including seed capital, angel match-making, and other forms of start-up and early-stage capitalization.
- Workforce development, particularly focused on turning around displacements resulting from federal laboratory and defense downsizing.
- Cluster- and network-focused initiatives.
- Incubators, particularly hybrids and “virtual,” and research parks.
- Educational outreach aimed at improving know-how and stimulating interest in science and technology at multiple educational levels.
- Entrepreneurial development activities.
- Web-based initiatives focused on technology transfer, contracts and acquisitions, and other business services.
- Initiatives aimed at technology transfer to small, woman-owned and minority-owned firms.
- Innovative activities aimed at spinning off technology enterprises from laboratory R&D.
- Industry-led activities at federal laboratories, including consortia.
- Effective federal laboratory coordination and involvement with multiple economic development entities; e.g., community organizations, state/regional economic development and technology organizations, business associations, financial/venture capital representatives, and others.
- Other innovative activities aimed at stimulating business/industry development and expansion, and improving the climate and infrastructure for technology business growth and entrepreneurship.

For all of the categories listed above, IA/OTP weighed the degree of involvement. IA/OTP gave greater weight to laboratories that exhibited active rather than passive involvement, and gave the greatest weight to those laboratories that demonstrated initiative and leadership. To the extent possible, IA, in conjunction with OTP and the National Advisory Group also tried to achieve some distribution with respect to: (1) type of economic development effort, (2) funding agency, (3) management structure, (4) size, (5) geographic location, and (6) degree of urbanization. Although IA tried to achieve some distribution with regard to the criteria, it also recognized that certain categories would likely be over represented because: (1) laboratories that have greater funding probably would have more total funding devoted to economic development activities and therefore exhibit stronger programs; (2) laboratories representing certain funding agencies, particularly DOE, place greater emphasis on economic development as part of their laboratory mission, and therefore may have more active economic development programs; and

(3) laboratories in certain states may be more active in economic development because of state-funded technology programs that augment laboratory activities.

It is important to note that the models selected for the report represent just some of the many laboratories that deserve recognition. Other federal laboratories across the nation also are conducting noteworthy activities that contribute to economic development and may not have been included here because of study limitations.

II. RESPONSES TO THE ECONOMIC DEVELOPMENT QUESTIONNAIRE

Thirty-eight federal labs responded to the OTP/IA questionnaire on economic development activities, of which about one-fourth were from DOE and an additional one-fourth from DOD; 60 percent were GoGos. Slightly more than half had annual revenues (FY02) below \$250 million. Labs were evenly distributed in rural and urban areas.

About four-fifths of labs conducted some type of economic development activity; of the seven labs that did not, they reported that economic development “was not a priority” and/or the lab “did not have sufficient funding/staff.” Of the labs that conducted economic development activities, over half conducted those activities through technology transfer offices. Labs that conducted economic development most often (a) participated in meetings with business and industry associations and economic development organizations, (b) served as a resource for the federal Small Business Innovation Research program, and (c) sponsored or participated in business networking activities (See Figure 1.)

Figure 1	
Types of Economic Development Activities	
(% of Responsive Labs, N=31)	
Participated in meetings with local business and industry associations	86
Participated in meetings with local/state/regional economic development organizations	80
Served as resource for Small Business Innovation Research program	66
Sponsored or participated in other business networking activities	63
Assisted local/state government with technical problems	52
Contributed to economic development planning at local or state levels	46
Initiated or participated in development of incubator and/or research park	43
Provided services to businesses in incubator and/or research park	43
Served as resource for Small Business Technology Transfer Research program	40
Sponsored or participated in seed/venture capital activities	29
Loaned laboratory personnel to state or local government	17
Served as resource for Manufacturing Extension Partnership program	14
Other	14

Labs that responded to the questionnaire were active in a variety of efforts to assist business and industry. In addition to formal working relationships, at least three-fourths of labs: (a) hosted tours, (b) provided consulting, (c) disseminated technical information, (d) held workshops, (e) provided technical assistance, (f) participated in consortia, and (g) conducted demonstrations. About half of the labs conducted some of these activities through intermediary organizations such as local economic development and technology organizations. (See Figure 2.) Labs directed two-thirds of these activities to small- and medium-sized enterprises (SMEs). They directed a little less than half of the activities to businesses in the communities and states in which they were located, and an additional 20 percent to the region (adjacent states).

Figure 2
Activities to Assist Business and Industry
(% of Responsive Labs, N=32)

Issued CRADA's or SAA's	91
Hosted tours	89
Issued patent/technology license agreements	86
Provided consulting by scientific or technology personnel	83
Disseminated technical information	83
Sponsored workshops/conferences for business/industry	80
Provided technical assistance	77
Participated in consortia	77
Performed demonstrations	74
Sponsored/participated in SBIR/STTR activities	71
Made available laboratory facilities	63
Conducted "work for others"	60
Conducted small business outreach	60
Assisted business through intermediaries	51
Exchange personnel	43
Formed laboratory industrial advisory committee	34

All labs engaged in activities with universities and other academic institutions. Activities ranged from lab employees teaching courses to sponsorship of interns to involvement in a university’s incubator. (See Figure 3.) Labs reported that slightly more than half of the activities were conducted with universities and other academic institutions in the state in which the labs were located.

Figure 3
Activities with Universities and Other Academic Institutions
(% of Responsive Labs, N=38)

Conducted lectures or taught courses by lab personnel	80
Sponsored internship programs	77
Conducted CRADA’s	74
Provided students/professors access to lab facilities	71
Conducted education partnership agreements	69
Contributed to curriculum development	69
Involved in development or providing services to university incubator/research park	29
Conducted partnership intermediary agreements	20
Other	25

All labs engaged in K-12 educational activities including sponsoring and participating in science fairs, competitions, and science camps, and conducting tours and demonstrations. (See Figure 4.) Several of the case studies in this report highlight some of these activities including mobile scientific demonstrations, sponsorship of science competitions, and other efforts that actively engage laboratory personnel in their local K-12 and higher education communities.

Figure 4
K-12 Education Activities Conducted by Labs
(% of Responsive Labs, N=38)

Sponsored/participated in science fairs or competitions	83
Conducted tours (of lab) for students or teachers	83
Conducted lectures or demonstrations in schools	71
Sponsored/participated in “science camps” and similar activities	49
Other	43

The labs that responded to the economic development questionnaire were less engaged in workforce development activities than in business and industry assistance and educational activities. About half of the labs reported sponsoring or participating in high-tech job fairs; two-fifths reported contributing to specialized training for local residents and businesses to upgrade skills; and a little more than one-third reported working with local and state governments to develop workforce strategies. Some also conducted career counseling and workshops for displaced lab workers and other activities for displaced workers.

Almost two-fifths of labs reported that there were federal government policies that “hamper the laboratory’s ability to conduct economic development and related activities.”

Several labs also cited state and local policies that they believed “hampered the laboratory’s ability to conduct economic development and related activities.” These policies as well as other obstacles to laboratories conducting economic development are discussed in the “Issues” section of Chapter IV – Conclusions and Recommendations. The questionnaire appears in Appendix B.

III. CASE STUDIES

This section of the report presents examples of seven federal laboratories – three DOE, three DOD and one NASA laboratory. It also includes descriptions of two intermediary programs involving organizations that provide linkages between businesses and multiple federal laboratories. Each of the laboratories covered operates in somewhat different environments and conducts somewhat different activities. One of the laboratories sponsors an incubator located in a distressed Eastern city; one laboratory is located in a rural area in Maryland and works closely with a local non-profit organization; two are located in New Mexico, with one lab operated by a university and the other by a private corporation; one laboratory is located in a rural Western community; one is headquartered at an Air Force base; and one is a NASA research center. The two intermediary programs involve distant linkages with numerous federal laboratories in primarily rural states.

Most of the seven laboratories conduct multiple economic development-related activities including: technical assistance to small and minority enterprises; entrepreneurial leave programs; industrial brokering and liaison; workforce development; K-12 education programs; seed and venture capital facilitation; and development and operation of incubators and research parks. This report does not cover all of the laboratories' activities in economic development, but instead highlights those that appear the most innovative and distinctive. We do not cover all of the laboratories' activities in economic development, but instead highlight those most outstanding and innovative. These activities represent just some of the outstanding activities being performed by federal laboratories across the nation and are not intended to be portrayed as "the best" or "the only" programs of their kind. Rather, they provide outstanding examples of programs and activities that can be replicated by other federal laboratories. They also show communities and states the types of activities that can be tapped for technology development and economic development in their regions and nationwide.

FEDERAL LABORATORIES

Air Force Research Laboratory



AFRL: <http://www.afrl.af.mil>
WPAFB: <http://www.wpafb.af.mil>
WTN: <http://www.wtn.org>
Edison Program:
<http://www.odod.state.oh.us/tech/edison>
GLITEC: <http://www.glitec.org>

The Air Force Research Laboratory (AFRL), with headquarters at Wright-Patterson Air Force Base (WPAFB), Ohio, was formed in 1997 through the consolidation of four former Air Force laboratories and the Air Force Office of Scientific Research. Research is conducted through nine technology directorates located throughout the U.S., five of which are headquartered at WPAFB. The Air Force Research Laboratory (AFRL) located and headquartered at Wright Patterson Air Force Base (WPAFB) conducts technology transfer, commercialization, and education outreach activities. Its partnership intermediary organization – Wright Technology Network (WTN) – actively works with ARFL to conduct technology transfer throughout the United States.

Wright Technology Network: WTN was formed, as a not-for-profit corporation, in 1989 by leaders from WPAFB and the State of Ohio to help companies and universities gain access to Air Force expertise, facilities, and technology. Over the years, WTN’s relationship with AFRL has grown and has been formalized in a Partnership Intermediary Agreement (PIA) with the five AFRL Technology Directorates headquartered at WPAFB. These Directorates include Air Vehicles, Human Effectiveness, Materials and Manufacturing, Propulsion, and Sensors. Through its services to the Air Force, WTN creates linkages between businesses and AFRL and other federal laboratory researchers.

WTN presently has seven technology specialists “embedded” in the AFRL Technology Directorates at WPAFB, who work with the AFRL scientists and engineers on a daily basis on a variety technology transfer activities, including technology commercialization, CRADAs, Commercial Test Agreements, technical assistance, Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs¹⁸, and related activities. Several additional WTN specialists are “embedded” in the Education Outreach Office and the High

¹⁸ The SBIR and STTR programs are administered by the U.S. Small Business Administration and operated by 10 agencies. The programs provide competitive grants and contracts to SMEs to conduct feasibility studies and prototype development of promising technologies meeting agency missions. For more information see: <http://www.sba.gov/sbir>.

Performance Computing Manufacturing Program (HPCMP) at the Aeronautical Systems Center. Specialists have a technical understanding of the science or engineering field and have experience in the private and public sectors. This allows them to assess what realistically is applicable to the private sector and what is important to the Air Force.

WTN develops close relationships with companies. We're "in the trenches" working on-site with companies and Air Force scientists and engineers. We are successful when companies and the Air Force benefit mutually from their collaboration.

- Tony Jensen, Director, Partnership Development, WTN

The two major WTN activities on behalf of AFRL are commercialization and technical assistance. Commercialization consists of identifying AFRL technologies with the highest commercial potential. This involves performing market assessments of AFRL technologies including assessment of competing technologies, delineation of intellectual property issues, and assessment of manufacturing and other issues that may be barriers to commercialization. If the assessment is favorable, WTN identifies an appropriate firm, develops an agreement and works with the firm to commercialize the AFRL technology. WTN may also assist in finding business partners for the firm to ensure a successful venture. Technologies that are identified as having no immediate commercialization potential are tracked for future use as they mature. In FY02, WTN assisted AFRL with commercialization of 122 technologies.

Technical assistance is provided when a business approaches WTN or is referred to WTN to solve a technical problem or address a technology need. Successful technical assistance projects require a firm to identify a specific technical problem or technology need. WTN will then identify and establish a relationship between the firm and the Air Force – a scientist or engineer who has an interest in working on the problem or need. Referrals to WTN for technical assistance come from a variety of sources including AFRL, Ohio's Edison Technology Centers, and Great Lakes Industrial Technology Center (GLITeC), a NASA RTTC, or from other collaborators.¹⁹ When providing technology transfer services to companies, WTN may identify other needs such as business plans, financial assistance, and marketing assistance, and in those cases, WTN will refer the company to a Small Business Development Corporation (SBDC)²⁰ or other assistance provider. WTN and SBDC representatives will frequently work collaboratively with a specific business; the WTN representative focusing on the technology aspects of the business, and the SBDC representative focusing on the business development aspects. WTN

¹⁹ For more information on Thomas Edison programs see: <http://www.odod.state.oh.us/tech/edison>; for more information on GLITeC see: <http://www.glitec.org>.

²⁰ The SBDC program is administered by the U.S. Small Business Administration and provides a variety of business assistance to small businesses. For more information see: <http://www.sba.gov/sbdc>.

also participates as a subcontractor to GLITeC in the Garrett Morgan Commercialization Initiative that assists small, minority-owned or woman-owned businesses with commercialization of NASA technologies.²¹

At the local and state levels, WTN works with economic development organizations such as The Entrepreneur Center, an Edison technology incubator located in Dayton, and collaborates with other Edison technology incubators and Edison technology centers throughout Ohio. On a regional level, WTN works collaboratively with Indiana Business Modernization Technology Corporation, Manufacturing Technology Transfer Center (Louisville, Kentucky), Minnesota Technology Inc., and TechLink²² to promote business and technology opportunities at WPAFB.

In FY02, WTN assisted 204 companies, 134 of which were located in Ohio. About of those companies were “new customers.”

SBIR Activities: Through 20 locations across the U.S., the Air Force spends about \$170 million in SBIR/STTR awards to small technology firms. About 100 of 230 SBIR/STTR research topics are managed by the Technology Directorates at the AFRL/WPAFB. Scientists and engineers in the AFRL/WPAFB Directorates prepare research topics, review and evaluate proposals, and manage SBIR/STTR awards. The Air Force SBIR Manager estimates that approximately 100,000 person hours at AFRL each year are devoted to SBIR/STTR activities. WTN plays an important role in the process by facilitating access to engineers and scientists for businesses interested in proposing under the SBIR/STTR programs, and by helping Directorates manage the program. WTN also works with individual firms to coach and provide “honest broker” review of proposals that help firms put their “best foot forward.”

Because the WTN professionals are on-site, they have their fingers on the pulse of the Lab; they know what is important to the Lab and the Air Force. They also understand what is important to the private sector. This allows them to almost immediately identify technologies with commercial potential.

- Preston Scott Hall, Technology Transfer Manager, Human Effectiveness Directorate, AFRL

Human Effectiveness Directorate: Although each of the five AFRL technology directorates differ with respect to their economic development activities, the Human Effectiveness Directorate serves as a good example. As the other Directorates, the Human Effectiveness Directorate has a partner intermediary agreement with WTN to foster private sector linkages. Two of WTN staff are located in the Directorate offices. The WTN staff work

²¹ For detailed information on the Garrett Morgan Commercialization Initiative see the case study on the NASA Glenn Research Center. Also see: <http://www.nasagmci.org>.

²² See case study on “TechLink”.

on a day-to-day basis with researchers to identify technologies for potential transfer and develop agreements with the private sector. At the writing of this report, about 38 cooperative agreements with business and industry are active, about one-third with small business.

In addition to WTN, the Directorate works with several economic development organizations in Ohio and with organizations in other Directorate locations. In Ohio, they work with the Dayton Economic Development Coalition, in Texas with the San Antonio Technology Accelerator Initiative, and in Arizona with the Mesa economic development agency. Through linkages with these organizations, the Directorate encourages small businesses to participate in the SBIR program and develop collaborative research agreements with AFRL. The Directorate's Technology Transfer Manager believes that linkages with the economic development organizations help bring to the attention of local business leaders the importance of technologies coming out of AFRL. AFRL also works with Ohio's Thomas Edison Centers.²³ The Human Effectiveness Directorate particularly works with the Omeris (formerly Edison Biotech Center) to inform them about AFRL technologies in the field and to develop collaborative research relationships between the Center and AFRL.

The AFRL Directorate fosters development of organizations that benefit AFRL's mission and at the same time promotes an emerging scientific field. Beginning in FY02, the Directorate has contributed to the development of a Cognitive Systems Engineering Consortium that now is transitioning to a not-for-profit organization. AFRL funded the concept development for the Consortium that involves AFRL, Wright State University, Ohio State University, Georgia Institute of Technology, and several private corporations. When fully operational, the Consortium will conduct research, create standards, develop curriculum and generate student enrollment in the field. The organization will eventually be incorporated as part of the Wright Brothers Institute. AFRL also has been one of the partners to establish the Genome Research Infrastructure Partnership in Ohio. Other partners include the University of Cincinnati, Children's Medical Center in Cincinnati, Wright State University, Procter & Gamble Inc., and Acero Corporation.

The Directorate also works with 10 universities and has educational partnership agreements with those universities. The agreements give AFRL the flexibility to transfer staff, equipment and facilities to the universities. Currently, the Directorate is in the process of transferring some specialized laboratory equipment to a minority institution – University of Texas Pan America – that will facilitate the use of advanced equipment by the university faculty and students and will still allow access by AFRL researchers.

Education Outreach: The WPAFB Education Outreach Office conducts an impressive array of activities that have impacted over 47,000 students and since 1999 has provided almost \$1.4 million in K-12 educational programs to the local community. With funding from AFRL, and the Aeronautical Systems Center, a Base-wide educational program involves a corporate board and working group that meet monthly to discuss educational strategies.

²³ For more information on Ohio's Edison programs see: <http://www.odod.state.oh.us/tech/edison>.

Programs include a wide range of activities: demonstrations, tutoring, curriculum design, and providing judges and advisors for science fair competitions. The “Wizards of Wright” (WOW) is one of the most popular programs. WOW volunteers bring science and math demonstrations to local classrooms. Since fall 1999, WOW has brought over 750 demonstrations to over 19,000 students in 45 schools in Ohio. An active robotics education program focuses on elementary and middle school children, providing curriculum and competitions. A grant from the American Society of Mechanical Engineers provided funding for the Educational Outreach Office to conduct introductory workshops for teachers on robotics. Teachers who attended the day-long workshop received training and a robotics building kit in exchange for their commitment to participate in a local robotics “challenge” to build a core interest group in the area. The WPAFB Educational Outreach Office was asked by the US FIRST LEGO League organizers to host the State of Ohio “Championship” and is the lead organization for the State of Ohio hosting the annual competition. The event has grown from 20 Dayton area teams in 2001, to almost 200 teams from across the Ohio in 2002 because of coordination and training activities undertaken by WPAFB.

Our goal is to get kids fired up about math, science, aviation and aerospace. We do it to help excite and recruit the next generation of scientists and engineers.

- Kathy Schweinfurth, Director, WPAFB Educational Outreach Office

An after school, scanning electron microscope (SEM) program hosts students in a real-life laboratory setting to learn about SEM technology. TECH TREK Mobile Research Laboratory was established through a partnership between WTN and WPAFB that expands on the SEM program concept by taking a portable SEM directly to local schools. By the end of 2002, TECH TREK had brought SEM technology to 12,000 students.

AFRL/WPAFB is active in Ohio’s reading mentor program – “Ohio READS” – providing more than 2,300 hours of volunteer time. Over 100 volunteers from AFRL/WPAFB have participated in this program, providing mentoring to children in 14 Miami Valley (OH) READS schools.

AFRL/WPAFB is also an active member of the Miami Valley Interactive Distance Learning Consortium, an organization that provides content and technological support for distance learning activities to local high schools. Through a consortium grant, WPAFB was given \$45,000 of distance learning equipment to provide educational programs to schools across the State of Ohio.

AFRL/WPAFB has an email network that disseminates education information to more than 500 teachers throughout the state. All education outreach programs are provided at no cost to the schools; and WPAFB volunteers donate over 1,200 hours each month in support of these activities.

Ohio Nanotechnology Commercialization Initiative: Conducted in FY02, the Initiative was intended to expand the awareness and understanding of nanotechnology by Ohio industries. The Initiative was conceived by WTN and funded initially by the Ohio Department of Development; AFRL subsequently provided additional funding. The Initiative focused on applying nanotechnologies being developed by AFRL to Ohio's plastics industry. More than 25 per cent of the country's plastics compounding companies are headquartered in Ohio, and WTN worked closely with these companies on potential applications. WTN conducted an educational awareness program for Ohio industries on the importance of using nanotechnology for product development, and conducted other related activities to inform them about the commercialization potential of nanotechnology research at AFRL.

RECAP OF AFRL/WTN DISTINCTIVE FEATURES

- Since 1999, education activities sponsored by AFRL/WPAFB have impacted over 47,000 students.
- In FY 2002, WTN assisted 204 firms; 107 of which were “new customers.” Of the 204 firms, 134 were located in Ohio.
- About 100 of 230 SBIR/STTR research topics for the Air Force are managed by AFRL/WPAFB. Scientists and engineers prepare research topics, review and evaluate proposals, and manage SBIR/STTR awards.
- The Human Resources Directorate, one of five Technology Directorates at WPAFB, helped develop the Cognitive Systems Engineering Consortium involving AFRL, three universities and several private corporations.
- Through the Ohio Nanotechnology Commercialization Initiative, WTN disseminated information and provided applications assistance to Ohio plastics industries on AFRL nanotechnologies.

Communications Electronic Command Research, Development, and Engineering Center

State: NJ **City:** Fort Monmouth/Camden
Agency: DOD/Army
Mgt: GOGO
Annual Revenue: \$500 million +
Geographic Characteristics: ACIN is located in Camden, NJ in Empowerment and HUB zones.

ACIN:
<http://www.acin.info>
CECOM:
<http://www.monmouth.army.mil/cecom>

In Fall 2001, the Army Communications-Electronics Command (CECOM) Research, Development, and Engineering Center started a pilot program – Applied Communications and Information Networking (ACIN) – focused on military application of commercial communications and networking technologies. As part of the ACIN program, CECOM created the Center for Entrepreneurship in Technology, an incubator designed to assist and promote business start-up companies with dual-use information technologies of importance for network-centric military operations. It is the first exclusive defense-related incubator in the nation. Other CECOM activities in the ACIN program focus on adapting commercial technologies for military use, and educating DOD soldiers, planners, decision-makers and staff on the lessons learned by industry in applying information technologies in the 1990's. CECOM has contracted with Drexel University and Sarnoff Corporation to conduct ACIN activities.

ACIN Center for Entrepreneurship in Technology: The ACIN Center is a 17,000 square foot incubator located in both an Empowerment and a Historically Underutilized Business (HUB) zone in Camden, New Jersey. CECOM contracted with Drexel University to manage the incubator; and ACIN's Board of Directors includes the three ACIN "partners": Drexel University, Sarnoff Corporation and CECOM. This unique defense-related incubator allows DOD to get a "first look" at the technologies being developed by the resident firms. The mission of ACIN is to enable commercial technologies, particularly information technologies, to be leveraged and adapted for use by DOD. Part of the ACIN budget is used to attract companies to the ACIN Camden Center that already have commercial technologies that can be adapted by DOD, and to help DOD "insert" or "spin-in" those technologies. In late 2002, there were 12 firms in the Center that were developing technologies and solutions for various aspects of: wireless, secure, dependable communications and information networking for military and commercial use.

In order for a prospective firm to be admitted to the Center, the members of the ACIN Board must review the firm's business plan. That plan must clearly articulate the technologies the firm intends to market and the firm's preliminary marketing plan. Moreover, the technology must have both commercial and military applications.

ACIN promotes its services through numerous channels including (a) a web site, (b) national, regional and local press, (c) networking among various technology organizations such as the New Jersey Technology Council and the Eastern Technology Council in Pennsylvania, (d) building relationships with venture capital and financial groups, major accounting and law firms, (e) attending small business conferences such as SBIR conferences, and (f) interacting with the technology transfer offices at Drexel University and other universities in near-by Philadelphia and New Jersey.

ACIN works with the Federal and State Technology Partnership (FAST) program²⁴ that operates from the SBDC at Rutgers University. FAST supplies consultants to help companies write SBIR proposals at no cost to the company. ACIN also helps firms, particularly small and disadvantaged firms, to navigate DOD's contract processes, and generally guides them to relevant contract opportunities with DOD.

The ACIN Camden Center works with banks, such as PNC Bank, and with a regional network of venture capital angels to help resident firms secure investment capital. ACIN works closely with the N.J. Economic Development Authority, and two ACIN companies have pending applications for loans from the N.J. Technology Fund operated by the Authority. ACIN also works with the N.J. Commission on Science and Technology, and the Commission is examining ACIN to potentially replicate it in other parts of the state.

Some of ACIN's resident firms work directly with Drexel University's faculty. One firm is working with bio-engineers in Drexel's College of Engineering and medical researchers in Drexel's MCP Hahnemann Medical School on developing a centralized information system that integrates medical monitoring equipment, and supports remote physicians' access, in the context of intensive care.

The mission of ACIN is to serve DOD's needs by leveraging commercial technologies into DOD applications, and at the same time to generate economic activity in the Camden area.

- Stewart Personick, Program General Manager, ACIN

The Camden Center's "Entrepreneur in Residence", Lou Bucelli, said that the Center's goal of stimulating economic activity in the Camden area is already beginning to be realized. He said that two "cyber cafés" have already opened near the incubator, and he believes the ACIN Camden Center has contributed to a new entrepreneurial atmosphere in the area. The ACIN

²⁴ FAST is part of the Small Business Innovation Research program administered by the U.S. Small Business Administration. For more information, see: <http://www.sba.gov/sbir/indexfast.html>.

Program General Manager, Stewart Personick also envisions using Camden as a “virtual and experimental theater” to test new homeland security technologies that could also be used for military operations, and to improve urban security.

ACIN R&D Projects: The greatest part of ACIN’s program budget is used to develop and demonstrate “proof of concept” for key enabling DOD-relevant information networking technologies and methodologies, outside of the incubator. Through these R&D projects, dual-use technologies are developed and adapted for the military and commercial sectors. A secondary aim of these R&D projects is to improve the general cost/performance ratio for information technology (IT) based products purchased by the military. The intent is to give potential suppliers role models and “proof of concept” of highly leveraged commercial technology. In late 2002, six “proof of concept” development projects were at the end of a 12-month cycle in the program, and several resulting technologies were nearing product development. Some of these projects involve development of (a) ad-hoc networked wireless sensors, (b) low-cost terminals for Ka-band satellite communications and (c) smart antennas for mobile users in high multi-path and interference environments.

ACIN Knowledge Dissemination: ACIN has conducted dozens of workshops, and developed and disseminated tutorial videos on: the application of modern, and emerging, telecommunications, networking and computing technologies, in the context of network-centric operations. As of late 2002, ACIN had videotaped 87 hours of workshops. In 2003, ACIN anticipates that thousands of soldiers, planners, decision makers and managers will be reached with these videotaped workshops. Additional workshops will be targeted to administrative and support people.

RECAP OF CECOM/ACIN DISTINCTIVE FEATURES

- DOD support for the ACIN Camden Center facilitates business development of “dual use” technologies that can be “spun in” to the Army for military application and also applied to commercial markets.
- Secondary economic development benefits – development of an entrepreneurial atmosphere in a HUB zone, downtown area – are already being seen as a result of business development activities at ACIN Camden Center.
- DOD’s contract with Drexel University and Sarnoff Corporation extend valuable university and corporate technical expertise to ACIN Camden Center resident firms and R&D projects.

Los Alamos National Laboratory

State: NM **City:** Los Alamos
Agency: DOE
Mgt: GoCo - operated by University of California
Annual Revenue: 1.75 billion
Geographic Characteristics: Located in rural Northern NM

LANL: <http://www.lanl.gov> & <http://www.lanl.gov/partnerships>
LA Research Park: <http://www.la-rp.org>
LACDC: <http://www.losalamos.org/lacdc>

Started during World War II, Los Alamos National Laboratory (LANL) is best known for the Manhattan Project. Today, LANL conducts research in a variety of national security and energy related fields including biosciences, information technology, communications and telecommunications, advanced materials and manufacturing, microelectronics and chemical technologies. Located in the “company town” of Los Alamos, about a half hour from Santa Fe, LANL is the major employer in Northern New Mexico. Operated by the University of California, LANL’s philosophy and working environment are somewhat different from its sister DOE New Mexico laboratory – Sandia National Laboratories – that is operated by Lockheed Martin Corporation, a private for-profit corporation.

As suggested by New Mexico’s business and political leadership, DOE required that, as part of renewing its operating contract in 1997, the University of California establish new proactive economic development initiatives that would benefit the northern New Mexico region. In response, LANL formed a new Technology Commercialization Office that launched a variety of entrepreneurial and business development activities including:

- Establishing a regional and national “external advisory board” of experts in technology commercialization and entrepreneurship;
- Conducting training programs, and providing business mentors and consultants to assist emerging entrepreneurs;
- Identifying and investing in the maturation and commercialization of early-stage LANL technologies;
- Facilitating regional networking organizations and events;
- Helping regional start-ups secure angel and seed venture capital;
- Supporting the enhancement of regional business development infrastructure in the region, including the establishment of the Los Alamos Research Park; and
- Recruiting and growing the entrepreneurial pool in the state via an innovative MBA internship program.

LANL’s entrepreneurial training programs have been attended by over two thousand participants; its MBA Internship Program innovatively involves MBA students in identifying potential commercial products/processes and assisting in their commercialization; and the Los Alamos small business incubator and the Los Alamos Research Park, which the Lab helped develop, have on-going close ties to the Lab.

Entrepreneurial Training Programs: Since 1997, LANL's Industrial Business Development (IBD) office has conducted over 20 full-day entrepreneurial training workshops involving over 2,500 participants. These workshops have featured entrepreneurs from the state and across the country to discuss how they started and ran successful technology businesses. Laboratory staff said that not only have the workshops played an important information dissemination role, they also have provided valuable networking opportunities. They report that several company participants who met at the workshops later formed partnerships.

In 2001 IBD also initiated an innovative new "Commercialization and Entrepreneurship" training course for LANL inventors. The course introduces the inventors to the language, concepts and process for identifying early-stage technologies with commercial potential; and instructs them on how to assess market opportunities and competition, value the technology, and develop a commercialization strategy. By early 2003 about 90 LANL technical staff members from 16 divisions had participated in the training. The participants collectively have identified over 60 LANL-developed technologies with commercial potential. LANL also works with the New Mexico Economic Development Department to organize and conduct ISO-9000 quality training programs that have been attended by over 20 firms.

Through the MBA program, LANL has established excellent extended networks and ongoing interactions with the students, faculty, and technology businesses. Moreover, since most of these students have degrees from leading science and engineering schools, they not only bring their business expertise and contacts to the Laboratory but also help the Lab attract and retain outstanding technical and business leaders of the future.

- Donna Smith, Division Leader, Industrial Business Development, LANL

MBA Intern Program: Over the past five years, LANL has sponsored 47 MBA interns from 18 leading business schools across the country to assist the Lab's technical staff and regional entrepreneurs in identifying commercially viable LANL technologies, performing market assessments, creating business strategies and plans, securing capital and facilitating the start-up of almost 70 new technology firms in northern New Mexico. In 2002, LANL sponsored eight new MBA Interns in the program. The MBA interns coordinate their efforts with IBD's staff of about 50 professionals and with "intellectual property coordinators" (technology scouts) who are placed in various technical divisions to identify promising technologies for commercialization. Of the 47 participants in the MBA intern program, 10 have relocated to New Mexico as full-time employees of LANL or other regional businesses, thus serving as an effective recruitment tool as well as a business development one.

Entrepreneurial Leave Program: Several DOE laboratories sponsor entrepreneurial leave programs, the terms of which are negotiated with individual laboratories as part of their management and operation contracts. Under the LANL program introduced in 1998, employees can take up to three years of unpaid leave to participate in the formation and management of technology firms that are based upon LANL-developed technologies or expertise. During the first year, the Laboratory continues to fund its share of the medical and dental benefits and employees may return to a job of a comparable level at any time. In the second year, the Laboratory provides reduced support for medical and dental benefits and employees are given hiring preference for open jobs. In the third year, employees are on par with others in the Lab regarding hiring, but must pay all of their benefit costs.

Since 1997, 26 Lab employees have participated in the entrepreneurial leave program and have played key roles in the start-up and growth of technology firms based on LANL technologies and expertise. Six employees have returned to full-time employment at the Laboratory; over 20 additional employees have voluntarily terminated their employment to participate in the start-up and growth of new technology firms in northern New Mexico. Almost 40 of the 70 start-up technology firms formed since 1997 in the Los Alamos area have involved LANL employees on entrepreneurial leave or those who have voluntarily terminated from the Lab to become technology entrepreneurs.

One example of a successful firm started in 1995 by five LANL employees through is the Center for Adaptive Systems Applications (CASA), which was sold in 2000 for \$24 million. Four LANL scientists and a business development specialist from IBD started the firm based on computer and mathematical algorithms developed at LANL to detect anomalies in large databases. The LANL scientists adapted the technology to detect credit card or health claim fraud, to identify targeted marketing opportunities, and for use in other commercial applications. Prior to being sold, the company had grown to 40 people. The CASA founders have gone on to launch 10 additional “complexity science” based firms in northern New Mexico.

Technology Maturation and Commercialization: Since 1997, LANL’s Technology Commercialization Office in IBD has assisted almost 200 technologists and entrepreneurs with their start-up and early-stage growth. Companies have received assistance from MBA interns, contracts from the Laboratory to develop technologies or technical consultations, and/or direct business development support via the IBD staff and consultants.

Through its new “Technology Maturation Fund”, started in December 2002, LANL has provided technology maturation and commercialization awards to further the development of five emerging LANL technologies. The Fund provides up to \$50,000 for maturing Laboratory technologies with high commercial potential. The total amount of the Fund is about \$450,000 per year.

Regional Networking Activities: IBD is a co-sponsor of the Cornado Ventures Forum²⁵ that holds bi-monthly networking meetings in Santa Fe, usually attended by 50 to 100 entrepreneurs, investors, technologists and service providers. These meetings are held in the evening with a cash bar and feature a speaker of interest to local entrepreneurs. Participants report to LANL that they find valuable the opportunity to network through the Forum as well as learn from presenters. LANL also introduced an after-work “Safari Club” held weekly at a Santa Fe hotel. The “Safari Club” provides an informal networking atmosphere for emerging entrepreneurs to exchange ideas and opportunities.

LANL has also helped nurture the establishment and growth of several new professional associations. These include the N.M. Information Technology and Software Association, the Biotechnology and Biomedical Association, the N.M. Entrepreneurs Association, and the N.M. Internet Professionals Association.²⁶ LANL employees have served as board members and officers in most of these organizations and have also assisted the startup and growth of almost 20 other economic development organizations and initiatives in the state. Two of the past Presidents of the Los Alamos Commerce and Development Corporation board of directors were LANL employees.

LANL has been a co-sponsor and co-organizer of two “International InfoMesa Summit” conferences held in Santa Fe in 2001 and 2002. These annual conferences highlight the growing Northern New Mexico technology region and are attended by about 150 entrepreneurs and technologists interested in the application of data mining, anomaly detection, and complexity science to the needs of the business community. LANL played the leading role among 20 co-organizers of the original conference, recruiting national presenters, handling promotion, and overseeing the logistics. For 2002, a newly formed International Informatics Society²⁷ handled all the planning and organization of the conference. Senior LANL executives including the Laboratory Director have participated as speakers at both conferences. Founders of the over 25 complexity science-based “InfoMesa” firms in northern N.M., investors, service providers, and other state and national business leaders and government officials have participated in these conferences.

Additionally, IBD maintains a database of about 700 northern New Mexico businesses and individuals and regularly informs them about workshops, training, available capital and other important business development and networking opportunities.

Investment Capital: Prior to 1997, there was only one early-stage venture capital fund with a New Mexico office. As of January 2003, there were 10 seed-venture capital firms

²⁵For more information on Cornado Ventures Forum see: <http://cvf-nm.org>.

²⁶For more information on NM Information Technology and Software Association see: <http://www.nmitsa.org>, the NM Biotechnology and Biomedical Association see: <http://www.nmbio.org>, and the NM Internet Professionals Association see: <http://www.nmipa.org>.

²⁷ For more information on the International Informatics Society see: <http://www.internationalinformaticssociety.org>.

operating in New Mexico, all attracted to the state by the New Mexico State Investment Council's (NMSIC) matching funds incentives. Through January 2003, these funds and their co-investors have made investments totaling \$194 million in 12 NM-based companies, four of which have been directly assisted by IBD. Additionally, many other venture capitalists and angel investors throughout the country are actively seeking investments in emerging New Mexico-based firms.

IBD works routinely with venture capital firms, private angel investors and government funding sources to assist the emerging regional technology firms in their efforts to secure investment capital. Since 1997, the more than 70 technology start-up firms in northern N.M. have been assisted by IBD's Technology Commercialization Office; collectively they have secured over \$67 million in investment capital from various sources and created over 270 new jobs.

LANL is also among the co-sponsors of an annual Equity Capital Symposium conducted each May by Technology Venture Corporation (TVC), a subsidiary of Lockheed Martin Corporation (which operates Sandia National Laboratories in southern New Mexico). In 2002 and 2003, four of the sixteen firms selected to present at the Equity Capital Symposium were based on LANL technologies or personnel.²⁸

We believe that there is terrific potential for private business to gain value from commercialization of LANL technology and collaboration with LANL technologists. LACDC is determined to see this potential turn into economic development opportunities for our community and region.

- Kevin Holsapple, Executive Director, LACDC

Regional Infrastructure – Los Alamos' Small Business Incubator and Research Park: Los Alamos has a small business incubator – the Small Business Center – and a research park; both of which have ties to LANL. For its support of the planning and development of the Los Alamos Research Park, LANL was recognized as the 2001 “Laboratory of the Year” by the Midwest region of the FLC. The Small Business Center and the Research Park are owned and operated by the Los Alamos Commerce and Development Corporation (LACDC), a private not-for-profit economic development organization.

Operational since 1983, LACDC leveraged a Community Development Block Grant²⁹ and DOE support to renovate an existing building. In late 2002, about 25 firms occupied space

²⁸ For more information on the TVC Equity Capital Symposium see the case study on Sandia National Laboratory.

²⁹ For more information on Community Development Block Grants see:

<http://www.hud.gov/offices/cpd/communitydevelopment/programs/cdbg.cfm>

in the incubator, which was at full occupancy. Kevin Holsapple, Executive Director of LACDC, describes the incubator as “eclectic” with about half of the firms technology-oriented. Many of the technology firms have ties of some sort to LANL, and former LANL employees manage some of these firms. The University of New Mexico Los Alamos SBDC, operated by LACDC, provides business assistance to incubator firms and other businesses in the community.

Located across the street from LANL's main technical area, the Research Park is in close proximity to researchers, laboratories and facilities at LANL. The Research Park was developed as a result of an unusual collaboration between DOE, the County of Los Alamos and LACDC. Since LANL’s contract operator is a university it, like other not-for-profit institutions, is tax-exempt. In *lieu* of taxes, DOE provided a long-term land lease to the County of Los Alamos. The county in turn gave the right of the lease to LACDC in exchange for its development services. In 1999, DOE gave LACDC the long-term lease for a 44-acre site on which to build the Research Park. As part of the agreement, LACDC will share revenues derived from the Research Park with the County. To develop the Research Park, LACDC received \$2.6 million in grants from Los Alamos County, EDA, and the Regional Development Corporation (the Community Reuse Organization (CRO) in Northern New Mexico), and \$11 million in loans from several banks in the community and state.

Still in development at the writing of this report, the Research Park now has one 83,000 square foot building offering flexible office and laboratory space. The “Synergy Center” in this building involves about 7,000 square feet that serves start-ups and outposts of corporate R&D. Development plans over the next 10 years call for four additional buildings and a conference center. The first “anchor” tenants were Motorola Corporation, which located one of its largest high-computing centers in the Research Park, and LANL’s Superconductivity Technology Center. Present companies in the Research Park include Motorola, HP/Compaq, Veriscape, Isotag, Radion Corp., Avanza Technology, Frola Corporation, and Technology Ventures Corporation. Firms in the Research Park have the ability to access some of LANL’s facilities, including their resource library. When complete, LACDC expects the Research Park to encompass 300,000 square feet of office and laboratory space, and employ about 1,500 workers.

RECAP OF LANL DISTINCTIVE FEATURES

- Since 1998, LANL sponsored 47 MBA interns from 18 leading business schools to assist LANL transfer and commercialize technologies. These activities contributed to 70 technology start-ups in Northern New Mexico.
- In the past five years, LANL has conducted over 20 entrepreneurial training workshops involving over 2,500 participants.
- Since 1997, the 70 new technology firms in northern New Mexico assisted by LANL have secured more than \$67 million in investment capital from various sources and created over 270 new jobs.
- LANL's Technology Maturation Fund, launched in 2002, will provide about \$450,000 in awards to LANL inventors to adapt LANL technologies for commercialization.
- LANL helped nurture the establishment and growth of state professional associations in information technology and software, biotechnology and biomedical sciences, and the Internet.
- A local incubator with 25 small firms and a research park with major international firms have established close ties to LANL.

NASA Glenn Research Center

State: OH **City:** Lewis Field/Cleveland
Agency: NASA
Mgt: GOGO
Annual Revenue: \$500 million +
Geographic Characteristics: Located near urban area

GRC: <http://www.grc.nasa.gov>
LIFT: <http://www.liftinc.org>
SEMAA: <http://www.semaa.net>
GMCI: <http://www.nasagmci.org>
Glennan: <http://www.glennan.org>
GLITEC: <http://www.glitec.org>

NASA Glenn Research Center (GRC) at Lewis Field in Ohio fosters economic development through a comprehensive program of business incubation, technology and business assistance, education outreach and workforce development. NASA Glenn's Science, Engineering, Mathematics, and Aerospace Academy has been replicated throughout the country; its incubator is considered one of NASA's best; its Garrett Morgan Commercialization Initiative encourages use of NASA technologies by small, woman- and minority-owned firms, and its Glennan Microsystems Initiative has become a model for successful collaboration between industry, government and academia.

Lewis Incubator for Technology: The Lewis Incubator for Technology (LIFT) is designed to nurture new and emerging technology-based businesses with the potential to incorporate NASA technology. NASA Glenn co-funds LIFT with Ohio's Department of Development (ODD) and it is operated in partnership with Enterprise Development, Inc., a not-for-profit subsidiary of Case Western Reserve University (CWRU). Additional support is provided by the GLITeC, a NASA RTTC.

LIFT operates two sites: the first opened in March 1997, is located in ICI corporate offices and focuses on businesses needing wet-lab space. The second site, which opened in May 1999, is located on the NASA Glenn campus and focuses on software, electronics and communications companies. Tenants have access to fully equipped wet laboratory and office space, conference and library facilities, and a cafeteria. The NASA Glenn site offers office space, high speed Internet access, and limited use of the NASA technical library. Services for LIFT tenants include managerial assistance, marketing, planning and business development, office services, assistance in locating financing sources, and public relations. To be considered for the program, firms must have a sound business concept with commercially focused technology as its foundation. The tenants and graduates are developing businesses in areas such as high-performance rechargeable batteries, computational fluid dynamic simulation of turbine engines, wireless communications, biomedical products, high-strength composite materials, environmentally-friendly polymers and coatings, advanced ceramics and early detection of drug adverse reactions. Since its inception, LIFT has supported the growth of 20 new businesses, half of which have been women- and minority-owned businesses. The tenants and graduates now employ over 100 people, and in 2002 attracted over \$3.5 million in investment and grant capital.

Science, Engineering, Mathematics, and Aerospace Academy: The Science, Engineering, Mathematics, and Aerospace Academy (SEMAA) was established in 1993 as a

partnership between NASA Glenn and Cuyahoga Community College (CCC). SEMAA is a national innovation program designed to increase participation and retention of K-12 youth who are underrepresented in Science, Technology, Engineering and Mathematics (STEM). SEMAA provides academic enrichment and career awareness programs to encourage K-12 students to acquire a strong academic background in science and math and to prepare them for undergraduate programs in science, mathematics, engineering and technology. At the end of FY01, the SEMAA management contract with CCC ended. In early FY02, a small disadvantaged firm, Paragon TEC in Cleveland, OH was selected to manage the SEMAA program.

SEMAA students meet on Saturday mornings or after school during the academic year and are actively involved in a hands-on, inquiry-based cooperative learning. Summer programs are also offered. Part of the SEMAA program is a strong parent component, called the Parents' Cafe. Parents are taught how to enhance their children's knowledge of math and science through activities at home. In addition, parents receive information on college selection and admission and how to apply for financial assistance. In FY02, the SEMAA program served over 45,000 students, parents and teachers.

Each SEMAA site is equipped with an Aeronautics Education Laboratory (AEL). The AEL is a computerized classroom that allows middle and high school students to explore aeronautics and micro-gravity environments. At an AEL, a state-of-the-art classroom, students can simulate a cross-country flight using NASA's aeronautics as a theme. The AEL has 10 workstations, including an operating wind tunnel and a virtual reality station. SEMAA students across the country are able to work simultaneously on projects via the Internet in their respective AELS. Planned projects include positioning a large telescope to view constellations and an automated electron microscope to analyze substances. NASA Glenn staff participates in SEMAA's programs by serving as mentors and guest speakers. NASA Glenn's Office of Educational Programs contributes to curriculum development and oversight.

Since 1998, the SEMAA program has been replicated in eighteen sites around the country, in addition to the original site in Cleveland, Ohio. The Dayton program is housed at Sinclair Community College and utilizes the expertise at Wright Patterson Air Force Base. Other programs are located throughout the U.S. in community colleges, Historically Black Colleges and Universities, four-year institutions, high schools, middle schools and elementary schools in urban and rural communities. SEMAA's national office is located at Cleveland's Cuyahoga Community College.

Small businesses are a cost effective source for many of NASA's technology needs. Studies performed of invention disclosures received by the NASA Glenn Research Center show that small businesses consistently generate four to six times as many inventions as large businesses for the same R&D funding.

- Kathy Needham, Commercial Technology Lead, NASA Glenn

Garrett Morgan Commercialization Initiative: The Garrett Morgan Commercialization Initiative (GMCI) is a program for very small minority-owned, and woman-owned businesses that can benefit from NASA resources.³⁰ Operated by GLITeC through a cooperative agreement with Battelle, GMCI provides qualified companies with in-depth, customized support including comprehensive business assessments, identification of promising NASA technologies and opportunities, strategic planning, partnership and project facilitation, staff augmentation and market development assistance. It also helps firms obtain funding from sources such as SBIR programs. Consultation and basic services are free of charge. Participating companies are obligated to periodically complete service and progress assessment surveys, participate in mutually beneficial promotional activities, and provide written feedback on the Initiative's impact and value. The Initiative also provides annual competitive technology commercialization awards totaling \$400,000 to companies with promising SBIR-developed or other NASA technologies.

The program is funded through a special Congressional NASA appropriation and through a small grant from the Cleveland Foundation. Since 1998, GMCI has provided education and/or direct assistance to over 500 small businesses. GLITeC reports that the Initiative has created 200 jobs, and generated \$2 million in cost savings, \$9 million in revenue increases and \$1.5 million in new investments.

³⁰ For more information see: <http://www.nasagmci.org>.

In a world where basic research funding is drying up, our work with the SBIR program is particularly important. It provides working capital to small R&D companies to solve NASA problems, while building the US technological and economic base. At GRC, our SBIR companies have been able to attract, on average, 39 percent funding leverage in addition to the NASA investment, providing even more value back to NASA.

- Walter Kim, SBIR Program Manager, NASA Glenn

SBIR/STTR Assistance: NASA Glenn takes an active role in helping companies apply for SBIR and STTR contracts and, after an award is made, manages the contract. Researchers at NASA Glenn can work with interested firms to clarify technologies being sought, before the program solicitation opens. Center managers work with contracting officers for successful awards and have regular, sometimes daily contact with SBIR/STTR award winners. In 2002, CTO worked with 462 companies, of which 447 companies submitted proposals for SBIR/STTR contracts, and 54 were awarded contracts. CTO also fielded many additional telephone inquiries to address questions about the SBIR/STTR program and application process. In 2002, 15 companies worked with NASA Glenn to develop "Success Stories" describing the economic and commercial benefits resulting from the companies' SBIR/STTR research and development. NASA Glenn reports that the SBIR/STTR firms with which it has worked show an average 39 percent funding leverage for Phase III.

Commercial Technology Fund: The Fund is intended to "bridge the gap" between basic research and commercial product development by supporting NASA Glenn scientists and engineers to explore, along with commercial partners, commercial applications of their technology inventions and innovations. Projects are selected on a competitive basis. In order to receive an award: (a) the scientist or engineer must file an invention disclosure; (b) the commercial partner must be willing to contribute at least half of the resources; and (c) the proposal must include a commercialization plan. Preference is given to NASA-owned intellectual property. Normally seven awards of approximately \$70,000 each are made each year.

Pre-Apprentice Machining Program: Partly in response to local industrial layoffs and NASA's need for skilled machine workers, NASA Glenn has engaged in a variety of collaborative activities in adult education with the Bureau of Apprenticeship and Training (BAT) at the US Department of Labor (DOL), and professional associations including National Tooling and Machining Association, Precision Metal-Forming Association and Precision Metal Products Association. The NASA Glenn Pre-Apprentice Machining Program is a 32-week full-time training program that develops manual machining skills for adults who qualify to participate under the Workforce Investment Act. The program was implemented in response to Welfare to

Work legislation, and is intended to enable people to move from welfare assistance roles to a sustainable career. Through this program, students earn National Institute for Metalworking Skills (NIMS) Level I credentials.

The program, created by the Manufacturing Engineering Division at NASA Glenn, was designed to use NASA resources to form partnerships that would benefit the community and help insure a continuing supply of skilled machinists. Recognizing the opportunity presented by welfare-to-work legislation, NASA Glenn approached Cuyahoga Community College, which in turn introduced them to other community and state organizations. A partnership was formed between NASA Glenn and WIRE-Net, a not-for-profit community development corporation, whose activities under the program are supported by Workforce Investment Act funds to the City of Cleveland, by the Ohio Industrial Training Program and by private foundations. NASA Glenn formed a Space Act Agreement³¹ with WIRE-Net to provide in-kind services for the program. Those services involve use of NASA Glenn's classroom facilities and machinery, and make available NASA journeymen machinists who provide "hands-on" instruction.

To facilitate employment, other local not-for-profit employment and training organizations teach students in the program employment readiness skills and educate them about employee assistance programs and veterans' services. Local industries support the program by providing representatives to serve as industry observers and by hosting monthly student tours of their companies. By late 2002, four classes totaling 37 students had graduated. Of the 37 students, 29 were working at the completion of training.

In 2001, NASA Glenn received the Trailblazer Award in the Employer Category from the National Network of Sector Partners, a project of the National Economic Development and Law Center, as an employer who exemplifies achievements in the sector initiatives to improve employment and economic development opportunities for low income individuals, families, and communities.

GLENNAN Microsystems Initiative: The Glennan Microsystems Initiative (GMI) was created to advance the development and use of microsystems by industry and NASA. Started in 1999, the five-year program is a collaborative effort among NASA Glenn, CWRU and other universities and industries and is supported by NASA, the State of Ohio's Technology Action Fund and dues-paying industry members. GMI's purpose is to research, develop and commercialize silicon carbide based microelectromechanical systems (MEMS). MEMS are integrated systems of miniaturized devices such as sensors, actuators, motors, valves, and microprocessors manufactured together on a single semiconductor chip. The goals of the Initiative are to create value through strategic technology investments, guided by industry and NASA, and to capture that value through member based commercialization. Benefits to industry members of GMI include access to multidisciplinary microsystems expertise, access to new innovations and developments, rapid prototyping and testing, reduced research to market cycle and economies-of-scale.

³¹ Space Act Agreements are contractual vehicles for partnerships between NASA laboratories and industries. They are similar to CRADAs.

Fifteen companies, more than half of which are small- and medium-sized industries, are participating in the research and development. Currently, there are four product lines: (1) a multi-user silicon carbide (MUSiC™) process, (2) pressure sensors to operate in harsh environments, (3) chemical sensors for detection of emission products, and (4) medical devices to improve coronary angioplasty. Potential commercial applications for these innovations are enormous and wide ranging, from automotive and aerospace engines to minimally invasive medical devices. For example a GMI member company is offering the MUSiC™ process as a commercial service. To date usage of the service has been impressive with participation in the first two “runs” by 10 companies, 6 government labs and 15 universities representing over 35 different products or devices.

Ohio Aerospace Institute (OAI): Over 10 years ago, NASA Glenn pioneered within the agency a venue to foster industry, university and government collaboration; OAI is the realization of that vision. Today, NASA Glenn is an active participant and along with DOD, a major funder of OAI. OAI is a private, nonprofit university, industry, and government consortium that includes NASA Glenn, Wright Patterson Air Force Base, 10 Ohio universities, and an array of technology-driven corporations. OAI is located adjacent to NASA Glenn. OAI specializes in bringing together collaborative teams from industry, academia, and government addressing critical challenges in research, workforce and education.

OAI's collaborative research approach brings together industry, university and federal government researchers to jointly pursue pre-competitive, high-risk technologies. OAI's activities include targeting market-driven high-risk industry and government needs, building teams of experts, facilitating proposals to obtain funding, providing contract management and administration, and protecting proprietary information. OAI also builds collaborative consortia of industry, government and universities to both pool and seek funding for cross-cutting, pre-competitive research efforts. NASA Glenn is involved directly in many of these projects. One example is the Aeroacoustics Research Consortium, partnering five major companies and NASA Glenn to fund research efforts to mitigate aircraft engine noise; the Consortium achieves 8:1 funding leverage for industry participants and 2:1 funding leverage for NASA Glenn. Another effective collaboration is OhioView, which partners NASA Glenn, the US Geological Service, the Ohio Library and Information Network, the Ohio State Center for Mapping, the AmericaView Consortium, and 10 different Ohio universities to conduct research and development in applications of satellite remote sensing data, promote the use of remote sensing data in education, and facilitate its use to address environmental issues such as urban sprawl and loss of wetlands.

Over 80 OAI researchers also work in close collaboration with NASA Glenn scientists and engineers. OAI works to strengthen the current and future aerospace workforce by providing on-site, university-delivered courses for NASA Glenn employees, bringing university faculty and students to the Center for research experiences, and collaborating in numerous K-12 education activities specifically targeting improvement of student performance in math and science.

RECAP OF NASA GLENN DISTINCTIVE FEATURES

- SEMAA is an award-winning program to stimulate K-12 children's interest in math and science. It has been replicated in 18 communities, and in FY02, served over 45,000 students, parents and teachers.
- GMCI assists small minority- and woman-owned businesses to commercialize NASA resources. Operated since 1998 by GLITEC, a NASA RTTC, it has created 200 new jobs and generated \$1.5 million investments in technology enterprises.
- GMI is a collaborative R&D program between NASA Glenn, universities and industries aimed at advancing the micro-systems industry. To date, the Initiative has developed 35 different products and devices that are being applied to wide-ranging government, industrial and medical uses.
- Through the Pre-Apprentice Machining Program, NASA Glenn provides training to student machinists who want to move from welfare-to-work. Initiated by NASA Glenn, this innovative program involves a partnership with national associations, local industry and organizations.
- Lewis Incubator for Technology involves a partnership between NASA Glenn, GLITEC and a university. It has supported the growth of 18 technology firms employing over 100 people.
- OAI partners NASA Glenn, Wright Patterson Air Force Base, universities and industry to collaborate in R&D, workforce enhancement and education, leveraging resources for the benefit of all participants.

Naval Air Warfare Center Aircraft Division and the Naval Air Systems Command

State: Maryland **City:** Patuxent River
Agency: DOD/Navy
Mgt: GOGO
Annual Revenue: \$1.6 billion
Geographic Characteristics: Located in rural tri-county area involving Calvert, Charles and St. Mary's counties.

NAWCAD:

<http://nas.nawcad.navy.mil>

TPP:

<http://www.paxriver.org>

TEDCO:

<http://www.marylandtedco.org>

The Naval Air Warfare Center Aircraft Division (NAWCAD), a business unit of the Naval Air Systems Command (NAVAIR), works closely

with the Patuxent Partnership (TPP) to bring together county economic development organizations, technology councils and private sector firms to promote technology-based business development in a rural area. The NAWCAD and the TPP promote business development through symposia and workshops, educational outreach, networking and, in cooperation with the Maryland Technology Development Corporation (TEDCO), special technology grants to small businesses.

Community Response to Economic Threat and Opportunity: Because of DOD Base Realignment and Closure (BRAC) threats in the mid-1990s, it became imperative for the rural tri-county area to begin working together toward economic stability. Ironically, the area gained from BRAC cuts in Norfolk, Virginia; Alameda, California; Pensacola, Florida; and Warminster, Pennsylvania. The major gain to Patuxent River was from the relocation of research and development personnel from Warminster, Pennsylvania in 1996, and the relocation of Naval Air Systems Command headquarters personnel from Crystal City, Virginia in 1997. The cumulative gain of over 5,000 jobs, presented a new opportunity for the tri-county Southern Maryland area to attract and stimulate growth of local-based contractors and suppliers. As Navy activities relocated to the tri-county area, the major challenges for the area were to insure that the national contractors would relocate at least some of their operations to the tri-county area, and to form linkages between existing local businesses and the Navy.

Patuxent Partnership: In response to new opportunities brought about by BRAC relocations, local leaders formed TPP. TPP was intended to foster the promotion and development of aerospace and maritime technologies for the region and to create a closer relationship between the Navy, industry, local government and economic development organizations. The founding fathers included representatives from industry, academia, local government and the NAWCAD. The organization was given a boost from Senator Barbara Mikulski who attended and spoke at the first TPP event held at St. Mary's College in December of 1996. Today, the TPP is a membership-based, not-for-profit consortium of more than 200 technology businesses, federal laboratories and academic institutions. Its board is composed of vice presidents from business, academia and the NAWCAD.

The TPP has a staff of 20, including “subject matter experts” who are deployed on assignments in various government activities across the nation. The TPP provides a number of economic development related activities including workshops for businesses, conferences, networking events, trade show exhibits, international joint venture activities, technology transfer programs, workforce development programs and “Tech Talk’s”. TPP’s “Tech Talk” luncheons are held monthly to provide information and network entrepreneurs. They typically are attended by about 50 people and involve wide-ranging speakers from the Navy and the entrepreneurial community.

TPP headquarters serves as an incubator for three companies, and in 2003, TPP plans to expand its incubation role. In addition, an incubator at Southern Maryland Higher Education Center is in the planning stages.

TPP is now self-supporting. About one-third of their income is derived from major events such as the Business Development Symposium, another one-third from other services, and about one-third from membership dues. TPP is a DOD “Professional Association”, which facilitates DOD using the organization to hold workshops and other events. It allows TPP to collect fees for the events and generally handle events in a way that DOD could not do directly.

NAWCAD-TPP Promotional Activities: For five years the NAWCAD has co-sponsored with TPP an annual Business Development Symposium and exhibition. The 2002 event focused on aerospace technologies. Over 500 people attended the Symposium, which included over 50 commercial and government sponsored technology exhibits. The Symposia are attended by senior NAVAIR headquarters personnel as well as personnel from the NAWCAD business unit, and political and business leaders. NAVAIR and the NAWCAD personnel use the symposium as a venue for receiving feedback from the business community.

The NAWCAD and TPP recently organized the first NAVAIR Maritime Aviation Requirements Summit (MARS) in October 2002. The objective of the MARS 2002 was to provide key industry leaders a better understanding of the long-range research, development and procurement projections for naval aviation and to focus their attention on the needs of the Navy and Marine Corps. Invited participants included over 200 senior industry and government decision makers that were responsible for the development and fielding of aviation weapon systems. Participants reported to TPP that the event was highly successful and recommended that the summit become an annual event. Plans are ongoing for a MARS 2003 event to be held in October.

As a result of TPP’s successful working relationship with NAWCAD, a national network of intermediary organizations working with Naval aviation was created – the National Aviation Community Partners (NACP). This network promotes the exchange of ideas among the intermediary organizations. It is supported by NAVAIR that facilitates national networking through its teleconference facilities. NACP and NAVAIR have held five conferences at various sites throughout the country, similar to the Business Development Symposium held at Patuxent River.

TEDCO-TPP Development Activities: Maryland's technology organization – TEDCO – has located its only satellite office in the TPP headquarters and works closely with TPP in Navy technology liaison and business facilitation activities. TEDCO and TPP also work together on developing strategies for future technology development and commercialization initiatives. As part of this effort, TEDCO is conducting a workforce development inventory to identify gaps in workforce demands and educational output in the tri-county area.

NAVAIR Technology Commercialization Initiative: TPP, TEDCO and NAWCAD work collaboratively on a Congressionally mandated national pilot project, the NAVAIR Technology Commercialization Initiative (NTCI). Through the pilot program, NAVAIR intends to facilitate transfer of technologies being developed at NAWCAD to the commercial sector; “spin-in” is also part of the effort. The Partnership provides \$50,000 to qualified firms for this purpose with equal matching from the firms. Eight grants have been awarded to spin out and to rapidly insert technology into the Defense environment.

TEDCO also has a CRADA agreement with NAVAIR to help firms by paying up to 90 percent or up to \$20,000 (whichever is less), of joint NAVAIR-industry technology development projects. In 2002, there were four projects underway.

The close relationship that has developed between TPP and the Navy at Patuxent River, Maryland has been a win for the Navy and the business community in Southern Maryland. This tie becomes stronger with every passing year.

- Philip Zalesak, Director, Business Development, NAWCAD

NAWCAD/NAVAIR Community Strategy: The business community in the tri-county area has a close relationship with the Navy through an informal network as well as a more formal contractual and supplier network. People who have retired from NAVAIR/NAWCAD sometimes work as consultants or work voluntarily through organizations such as TPP to form a close relationship between the Navy and businesses in this small community. According to TPP executives, these relationships have been built slowly over time and had to be carefully cultivated, one person at a time.

All community and military leaders in the tri-county area agree that one of the major changes that stimulated more interaction between the Navy and industry was NAVAIR's commanding officer – Admiral Dyer – who championed business development by making it part of the NAWCAD agenda when he was the commander of the business unit. Admiral Dyer was the first flag officer within NAVAIR to assertively speak about "business development" in a public forum. At the first Business Development Symposium held in January 1998, an event

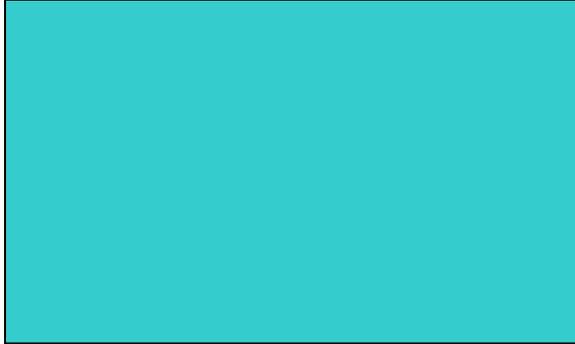
coordinated by the NAWCAD Business Development Office and sponsored by TPP, Admiral Dyer encouraged industry to "lease" Navy facilities. He was also the first flag officer to directly participate in a tradeshow marketing the NAWCAD's capabilities to the private sector.

Admiral Dyer's two major business development strategies were (1) increase non-Naval Aviation business and (2) reduce operating costs. Business development of the non-Naval Aviation market sector was an element of the strategies. The ultimate goal of this business development was to reduce the Navy's labor, facility and flight rates. Admiral Dyer accomplished his goal of reducing labor rates due to these strategies.

RECAP OF NAWCAD/NAVAIR DISTINCTIVE FEATURES

- TPP, a not-for-profit organization, effectively brings together business and community leaders to work with the NAWCAD/NAVAIR in a way that would not be possible by the federal laboratory alone.
- In 2002, NAWCAD-TPP's Business Development Symposium attracted over 500 people to learn more about doing business with NAWCAD/NAVAIR.
- Leadership from the "top" – the Commanding Officer of the NAVAIR – promoted a strong working relationship between NAWCAD/NAVAIR and the local business community.
- Informal personal relationships in this small community have built the TPP organization and strengthened ties between corporate, academic and community sectors and the Lab.
- As a result of TPP's successful working relationship with NAWCAD, a national network of intermediary organizations working with Naval aviation was created – NACP.

Pacific Northwest National Laboratory



PNNL: <http://www.pnl.gov>
TRIDEC: <http://www.tridec.org>
APEL: <http://www.apel.org>
Tri-Cities Entp Cntr:
<http://www.enterprisecenter.net>

The Economic Development Office (EDO) at Pacific Northwest National Laboratory (PNNL) in Richland, Washington has developed an impressive array of services for entrepreneurs and technology start-ups. With a small office of only

two professional staff, EDO has developed several innovative programs, some of which have received national awards. Some of these programs focus on attracting and creating jobs to replace those lost at DOE's near-by Hanford site, which laid off over 20 percent of its workforce. Other programs focus more generally on entrepreneurial development and economic diversification.

Technology Assistance: In the past seven years, PNNL has provided various types of technology assistance to over 550 firms. PNNL gives entrepreneurs and small businesses up to five days of free technical assistance in areas such as: (a) creating new applications for information technology companies, (b) testing and recommending product materials, (c) improving production and manufacturing processes, and (d) resolving technical problems. EDO also provides specialized services to start-ups including: (a) access to intellectual property, (b) assistance with business planning and market assessments, (c) loaned equipment and facilities, and (d) hands-on scientific expertise. Most assistance is provided in the fields of materials characterization, design, software applications and training, life science experiments, and chemical process development. About three-fourths of the assistance is provided to local firms.

EDO, through the Targeted Support Program, offers three hours of assistance for each job brought to the area by a newly relocating company. PNNL also actively assists firms to apply for SBIR grants/contracts, and its SBIR Alerting Service provides information via the Internet to 3,000 subscribers. This service won a national Hammer award. EDO additionally produces an on-line newsletter geared toward technology-based business development that is viewed by nearly 1,000 subscribers. Each year, EDO conducts a survey to register firms' satisfaction with its services; in 2002, firms reported an impressive 93 percent satisfaction rate.

Many of us who work for PNNL grew up here; we're part of the community. We're concerned with educating a workforce and attracting good companies to the region for our children's future.

- Gary Spanner, Manager, Economic Development Office, PNNL

Entrepreneurial Leave of Absence Program: This program encourages PNNL staff members to become entrepreneurs while reducing the risk of starting a new venture. PNNL researchers can participate in this program either full or part time. Under this program, 40 PNNL staff have started 27 businesses, of which two-thirds of the businesses are successfully operating. PNNL has gone a step further than some other labs by providing researchers in the entrepreneurial leave program up to \$10,000 per company to develop and mature prototypes started in the lab.

MBA Marketing Assistance: Each semester, PNNL works with local firms and student teams in a Washington State University (WSU) Tri-Cities MBA class to conduct up to five marketing studies for local firms. The firms, which are selected by PNNL, receive in-depth market analysis and plans. Students are split into teams who conduct semester-long marketing projects. At the beginning of the project, students write proposals that they submit to the firm for approval, which helps insure that students understand and address the problem or opportunity. At the end of the semester students provide the firm with an in-depth market report and verbally brief the firm. Most of the students in the MBA class that undertake the projects have had professional or managerial work experience. PNNL provides about \$4,500 per study; the firm pays \$1,000 of that amount. The course professor, Pamela Henderson uses the grant to cover expenses, and students receive full course credit for their work. Based on the marketing studies, several firms have successfully marketed their products/processes, some of which were related to laboratory technology.

Activities with Local and State Economic Development Groups: PNNL takes an active role in several local business networking and venture capital groups such as the Three Rivers Venture Group, an interest group of entrepreneurs, start-up companies, supporting companies and local economic developers. The group sponsors bi-monthly networking breakfasts that are attended, on average, by 30 people. PNNL also sponsored a one-day equity capital workshop that is now available to local companies at no charge via streaming video on the PNNL Website. Along with a dozen collaborating organizations, PNNL recently founded the Northwest Technology Investor Network, a Web-based service that links entrepreneurs and accredited investors.

PNNL also works with the Seattle-based Technology Alliance, a not-for-profit association focused on technology policy, research and venture capital. The Alliance of Angels is a key program of the Technology Alliance, and PNNL has worked closely with it to conduct an equity capital forum in the region. Thus far, eight firms based on PNNL technology or in

some way associated with PNNL, have presented to potential investors. EDO worked with the firms to prepare them to meet with potential investors.

PNNL is quite active with several local economic development groups in the region, particularly TRIDEC. TRIDEC is a not-for-profit organization representing 350 members mainly from the private sector. TRIDEC is the main economic development organization in the region focusing on business development and retention; it is also the designated Community Reuse Organization. The organization's Entrepreneurial Support Network helps firms write business plans and provides some equity capital. The organization also works closely with PNNL's technical assistance program, and PNNL helps attract speakers to TRIDEC's monthly business luncheons. William Martin, President of TRIDEC said that the organization "uses PNNL to lure businesses to the area" and that the lab has been involved in "just about everything that has been done in this area concerning business recruitment, expansion and retention."

Many labs are the dominant economic force in a region and we need to recognize labs as an important element in economic development.

- Lee Cheatham, Executive Director, Washington Technology Center, Seattle, Washington

In the fall of 2001, in conjunction with TRIDEC, PNNL benchmarked the Tri-Cities region against other metropolitan areas in the Northwest as a location for technology-based businesses. The technology index is reported in the *Tri-Cities, Washington Innovation and Technology Index* available through PNNL's Website. TRIDEC uses the technology index to market the region to prospective businesses.

PNNL participates in a Community Roundtable and several focus groups conducted by the Roundtable. At the state level, PNNL is involved in a statewide Bio-Based Products Initiative. A state Agri-Business Committee is working with the lab on identifying high-value chemicals coming from the Lab that can be derived from agricultural byproducts, with the intention of attracting companies to Washington state that can use processes being developed at PNNL. In 2002, the Governor also appointed an Economic Development Commission and Batelle's liaison to the state is part of that new Commission.

Applied Process Engineering Lab (APEL): Located across the street from PNNL, APEL is a technology start-up center. The center was started through a partnership involving PNNL, the Port of Benton, DOE, the City of Richland, WSU-TC, and Energy Northwest. Energy Northwest provided a building and five acres of land for the new Center, and an initial \$5 million investment came from DOE through TRIDEC (the community reuse organization), Port of Benton (through two bonds), a PNNL guarantee, Energy Northwest, the City of Richland, and additional private donations. The funds were primarily used to renovate an existing building,

and Energy Northwest retained ownership of the building. In addition, there were many in-kind contributions. The City of Richland contributed all utility infrastructure such as power lines and sewer lines; Energy Northwest laid gas lines and contributed landscaping and grounds work.

PNNL has been APEL's anchor tenant leasing about half of the center's space. Eight to 10 entrepreneurs and start-up firms, and Hanford site tenants that work on environmental clean-up technologies, lease the remaining half. APEL has 90,000 square feet of office, light manufacturing space, wet and dry labs and a high bay. The space includes exhaust air, compressed air and vacuum for labs, and a category five LAN (high speed fiber optic). About 75,000 square feet is now being used with phased plans to move to full capacity. APEL charges market rates for its space and has been financially self-sustaining since its first year.

When resident firms require business counseling and services, APEL refers them to PNNL's technology assistance program, and several of the current resident businesses have worked with PNNL's program. APEL also may refer them to Washington State University's Business Links Program that provides marketing assistance; to Washington Technology Center, that provides financial assistance and grants; and to Spokane Intercollegiate Research and Technology Institute, a state-owned and operated institute that also provides grants. APEL management helps businesses acquire specialized laboratory and office equipment, often purchased from PNNL, and they have a special preferential agreement for those state purchases. APEL has a special relationship with Tri-Cities Enterprise Association and the NW Entrepreneur Network located in Seattle, that also can provide assistance to resident firms. APEL's Director, Chuck Allen, said that a center such as APEL "needs all kinds of connections with networks – from venture capital to lab equipment, and that these connections are critical."

Tri-Cities Enterprise Center: The Tri-Cities Enterprise Center, which opened in 1987, was started by the City of Richland, with PNNL playing an active role on the founding board. The City of Richland contributed the land for the Center, and the U.S. Economic Development Administration (EDA) provided a \$1.4 million grant for construction of the building. The Tri-Cities Enterprise Association, a not-for-profit organization operates this incubator and two other incubators – one in Kennewick and an IT incubator in Pasco, located at and co-managed by Columbia Basin College.

Three of the current 12 resident companies are spin-offs from PNNL. Since its inception, 135 firms have graduated with at least one-fifth of the companies related in some way to PNNL. Some of the graduating companies affiliated with PNNL include:

- Credit Card Solutions (now called Expense Path Software) – The three partners who started this company participated in PNNL's entrepreneurial leave program. The company has grown to seven employees and now occupies other facilities in Richland. They developed project control system software for a purchasing "P" card. NASA and several major universities are their clients.
- BioGuard Technologies – This enterprise is based on slow release technology developed by PNNL involving application of laboratory-developed coating materials to a termite repellent biocide.

It is important for PNNL to sponsor and participate in angel and venture capital activities, and other networking events, because it lends credibility and visibility to these events.

- Bill Henderson, President & General Manager, Tri-Cities Enterprise Center

The incubator provides resident firms a “coaching program” that helps firms set business goals and develop action plans. For most firms, the incubator management forms an Advisory Team and meets with the firm on a quarterly basis. The team usually involves an accountant and a marketing expert, and may involve others depending on the firm’s needs. The Center’s Association manages an SBA micro-loan program, and incubator residents usually get first opportunity at the loans. The Association also helps firms prepare for presentations to angels. EDO/PNNL works closely with the Association in many of these activities. Bill Henderson, President and General Manager of Tri-Cities Enterprise Center, said that an important role for the incubator is to connect resident firms with other resources in the community, and provide a “short-cut” to the resources such as PNNL.

This Center serves as a good model for others wishing to establish relationships with federal labs and generally is a well designed and operated incubator. In 1998, the National Business Incubation Association named the Tri-Cities Enterprise Center “Incubator of the Year”.

RECAP OF PNNL DISTINCTIVE FEATURES

- PNNL gives entrepreneurs and small businesses up to five days of free technical assistance. In seven years, PNNL has provided technology assistance to over 550 firms.
- The MBA Marketing Assistance program provides high-quality marketing assistance to small technology firms, giving a valuable commercialization boost to the firm and promoting the Lab's technology transfer: a win-win situation.
- The Tri-Cities Enterprise Center provides incubation space and business assistance, and APEL specialized high-tech facilities for Lab-related companies. Both give "value added" service to businesses through close ties to the Lab and, particularly its Economic Development Office.
- PNNL takes a "pro-active" role in networking businesses and helping businesses find investors. Its new Northwest Technology Investor Network is a Web-based service that links entrepreneurs and accredited investors.
- PNNL's "SBIR Alert Service" provides information via the Internet to 3,000 subscribers. Nearly 1,000 subscribers view an on-line newsletter on technology-based business development.

Sandia National Laboratories

State: NM **City:** Albuquerque
Agency: DOE
Mgt: GoCo – Operated by Lockheed Martin
Annual Revenue: \$500 million +
Geographic Characteristics: Located in Southwest NM; most economic development activities cover state.

SNL: <http://www.sandia.gov> & <http://www.sandia.gov/smallbusinessprograms>
Sandia Sc & Tech Park: <http://www.sstp.org>
MEP: <http://www.newmexicomep.org>
Hispano Chamber: <http://www.ahcnm.org>

Sandia National Laboratories (SNL) in New Mexico is actively involved in statewide economic and business development to help

improve and expand opportunities for New Mexico businesses. To this end, the state of New Mexico has creatively compensated for DOE cutbacks in its technical assistance programs. Through a special legislated return of gross tax receipts from SNL, the Lab was able to continue its technical assistance to small and minority-owned businesses. The Lab's Small Business Assistance Program and Mentor Protégé Program serve as successful examples for other federal labs.

We will take advantage of our potentially enormous economic resources. We will reinvigorate our state universities, our national laboratories and work with the business community. We will actively promote the transfer of technology from the cutting-edge research of our labs to the private sector. We can nurture this growth to build a high-wage economy.

- Governor Bill Richardson, Inaugural Speech, January 2003

Regional and Small Business Partnering Department: The Regional and Small Business Partnering Department in SNL's Corporate Business Development and Partnerships Center conducts four major programs to promote small business development and optimal relations with the Lab: (a) small business assistance, (b) Small Business Advocacy which includes the Mentor Protégé Program, (c) New Ventures which includes training, and (d) Regional Economic Development. These programs are intended to expand the supplier base in the region, primarily by improving quality and diversification and promoting teaming.

Small Business Assistance Program – Through the Small Business Assistance Program, SNL helps New Mexico firms by providing up to \$10,000 of assistance per firm at no cost to the firm. Since July 2000, SNL has conducted over 650 projects for New Mexico firms to solve their business and technical problems. Technical assistance is provided by Lab staff and staff

from other partnerships that have been established. A key partnership is with New Mexico's Manufacturing Extension Partnership (MEP).³² Through this partnership, SNL and MEP have created a unique partnership that does not exist elsewhere within the national MEP program. The services MEP offers are utilized by SNL to provide lean enterprise training and assessment to enhance the quality of small business suppliers and to help qualify them as government suppliers.

The Small Business Assistance Program, in partnership with the Albuquerque Hispanic Chamber of Commerce recently started "E-Mercado" that will help Hispanic businesses and others become e-commerce competent and competitive in e-business as well as being better positioned to compete for procurement contracts from the large buying organizations in the state. This Internet-based service will also help facilitate teaming among firms to better prepare them to compete for contracts from SNL and other federal entities. It is hoped that "E-Mercado" will increase federal procurement to New Mexico businesses, and at the same time make available high quality suppliers to the Lab.

The integration of various programs with the Department and coordination with other organizations in Sandia is critical to providing adequate and appropriate support for the small business community and in building constituency support for Sandia.

- Victor Chavez, Manager, Regional & Small Business Partnering, SNL, New Mexico

Small Business Advocacy Program – In addition to these services, SNL refers about 150 businesses per year to appropriate SNL staff and to various organizations around the region for technology and business assistance. The most common request from firms is help in conducting business with the Lab, which is handled internally by staff; other questions involve business development and are referred to outside organizations. SNL refers businesses to SBDC, MEP, Wesst Corp that helps woman-owned small businesses, Accion that is a private, micro-lender, and various Chambers of Commerce. The Small Business Advocacy Program also works with the Office of Procurement to identify and help firms with procurement opportunities; the Office of Procurement refers businesses to the Program when the business requires technical assistance. In addition staff from the two offices sometimes jointly visit a firm to discuss how to work with SNL and business assistance services.

³² MEP is a nationwide network of not-for-profit centers in over 400 locations nationwide, whose purpose is to provide small and medium sized manufacturers with various types of business and technical assistance. For more information see <http://www.mep.nist.gov>.

Because a private sector contractor operates Sandia, we speak a similar language and have a similar mindset to the businesses we serve.

- David Goldheim, Director, Corporate Business Development & Partnerships, SNL, New Mexico

Mentor Protégé Program – The Mentor Protégé Program was developed as a result of meetings conducted by SNL with businesses around the state in which the Lab asked businesses to identify their needs and what services they wanted from the Lab. The Mentor Protégé Program is intended to increase supplier competencies by pairing successful suppliers to the Lab with businesses that want to become suppliers. The program also pairs volunteer business service advisors with small firms to help meet various business needs such as writing business plans and improving quality control. Currently, there are nine business service advisors including accountants, a venture capitalist, a U.S. General Services Administration (GSA) schedule consultant, an SNL recruitment person, and a SNL quality expert. Firms are matched with business service advisors based on the firm’s specific needs. Most of the participating businesses request help to improve quality control. One of the advisors is a local supplier that said he wanted to give something back to SNL after having received contracts from the Lab. Business advisors give each supplier team up to eight hours of assistance. Because the activities take place during a normal workday, SNL staff participating in the program are paid for the service, and are allowed to devote up to eight hours per month to the program.

By close of 2002, 16 partnerships had been formed, including two partnerships outside of the state. Victor Chavez, Manager of Regional and Small Business, said that in 2003 they would like to take the program to the next level by teaming companies to help them collectively compete more successfully. He also said that an indirect benefit of the Program’s marketing and activities has been to introduce many new state businesses to the Lab. About half of one staff person’s time, in addition to the volunteer and paid business advisors, is required to operate the program.

Training – In 2002, SNL conducted two training courses for small firms “Patents 101” and the “GSA Schedule”. Two classes of the patents training were held with a combined attendance of about 40 people who were instructed on the basics of patenting and given sufficient instruction to work effectively with a patent attorney. The second course instructed firms on registering and effectively using the GSA schedule, and was attended by about 40 people. SNL initiated a partnership with LANL, Honeywell FMT, and the State of New Mexico to begin a statewide ISO-9000 training program that has been successful in creating ISO compliant and ISO certified businesses throughout the state. The program has proven to be a cost effective method of developing a more qualified supplier base.

In 2003, Technology Venture Corporation (TVC), a wholly-owned subsidiary of Lockheed Martin, in collaboration with the Lab, the Albuquerque Hispano Chamber of Commerce, and the Greater Albuquerque Chamber of Commerce will conduct a series of nine workshops including accounting, writing business plans, technical marketing, negotiating, and successful new business creation. These workshops are for SNL entrepreneurs, related businesses and others, and will be held once per month for four hours each.

New Ventures Program: This “entrepreneurial separation to transfer technology” program allows SNL employees to leave the Lab in order to start their own business or to help expand other small businesses. Since 1994, 127 employees have participated in the program starting 36 new companies and helping expand about 60 additional small businesses.

Through the New Ventures Program, TVC acts as a broker on behalf of SNL researchers to help secure venture capital for SNL start-ups and other technology firms. TVC holds an annual Equity Capital Symposium that brings together national venture capitalists and firms in New Mexico. The Symposium is particularly designed to facilitate investment in firms spinning off from DOE laboratories in the state. Each year about 200 to 300 people attend the Symposium, of which about 50 are investors. Almost all entrepreneurial presenters at the Symposium are from New Mexico. TVC has helped broker 51 collaborations worth \$175 million of investment. SNL also has sponsored and participated in National Association of Seed and Venture Funds conferences in the state.

SNL also partners with TVC to perform some technology transfer, defense conversion and entrepreneurial related services on behalf of the Laboratory. TVC’s activities are paid in part by DOE, in part by Lockheed Martin, and in part by EDA’s Southwestern Regional Office. These activities include entrepreneurial courses, venture capital symposia and technology brokering on behalf of small technology businesses collaborating with SNL. SNL also networks technology corporations by hosting technology breakfasts every two months. Usually successful entrepreneurs speak at the breakfasts and networking is encouraged afterwards. TVC also operates an electronic job bank “Techjobs.org”.

Regional Economic Development: This program promotes partnerships with industry associations, state and local government agencies, federal programs with SBA and SBDC, universities and community colleges, and not-for-profit regional and national economic development organizations. Various initiatives have been initiated and coordinated through this program. These initiatives include the Native American Initiative, Oil & Gas Initiative, Telecommunications Infrastructure initiative and support for State Science and Technology Institute and SWRI Conferences.

Sandia Science and Technology Park: The Sandia Science and Technology Park is located outside Kirtland Air Force Base and was built on 200 acres of vacant land owned by various organizations including the City of Albuquerque, State of New Mexico, DOE and others. Four partners founded the park: SNL, DOE, TVC and the City of Albuquerque. SNL brought together major stakeholders including local and state government, DOE, and interested business residents, and was instrumental in every stage of development and operation of the Park. TVC

formed a non-profit organization – Science and Technology Park Development Corporation (STPDC) – to manage the Park. The STPDC staff are SNL employees on loan to the Corporation.

The Park broke ground in 1998 and, by late 2002, there were 19 buildings located in the Park. The Park is composed of several private company buildings, SNL's Federal Credit Union, an Early Childhood Center that serves the employees of SNL and Park tenants, an International Programs building that hosts VIPs to Sandia, a privately developed office building that leases space to companies including SNL and conference center. The Park Director, Jackie Kerby Moore, described the Park as a "pedestrian oriented campus style" and said that one goal is to make the Park "employee and family friendly."

By late 2002, there were 13 companies located in the Park, all having some connection with SNL. In order to locate in the Park, a company is required to have a relationship or potential relationship with SNL, or a relationship with another firm in the Park that has an existing link to SNL. The Park Director said that a major advantage of the Park is its easy access to SNL's 4,000 scientists and engineers. SNL provides technical assistance to many of the businesses in the Park. Additionally, SNL has developed CRADAs, user facility agreements, and personnel exchanges for businesses in the Park. The Small Business Assistance Program has close linkages to the Park. One of Park's residents, EMCORE a fibre optics company that employs 250 people, started out in SNL's TPP program (now the Small Business Assistance Program). Another firm in the Park – Team Specialty Products – also was helped by the Small Business Technical Assistance Program and will be the first "TQ1 certified" company to work with SNL.

In late 2002, a fiber optics building was being constructed in the Park using EDA funding. Plans also are being explored to build a multi-tenant building for start-ups, and the University of New Mexico (UNM) was developing a business plan for potential incubator space. The Park Director said she expects many of the companies that will occupy the Park in the next several years to be in micro-systems and nanotechnology fields. SNL plans to build, across the street from the Park, a Center for Integrated Nanotechnologies. The R&D Center will jointly involve SNL, LANL and UNM. When the Park is fully "built out" it will involve about 2.3 million square feet of space; currently 300,000 square feet are constructed. The Park's Director said that they expect the Park to be the location for about 6,000 jobs in the next 10 to 20 years.

RECAP OF SNL DISTINCTIVE FEATURES

- Through the Small Business Assistance Program, SNL provides up to \$10,000 of free assistance per firm. In two years, they have conducted over 650 projects.
- The Mentoring Protégé Program is a promising innovative program designed to strengthen local suppliers. The Program pairs successful SNL suppliers with aspiring suppliers. Volunteer business service advisors also help these firms address various development needs.
- “E-Mercado”, formed through a partnership between SNL’s Small Business Assistance Program and the Albuquerque Hispanic Chamber of Commerce, promotes Web-based teaming of small firms to compete for SNL procurement. This new program helps small firms collectively become more competitive and strengthens the Lab’s supplier base.
- SNL annually holds an Equity Capital Symposium to bring venture capitalists to New Mexico. SNL contractor TVC has helped broker about \$175 million of investment for SNL-based technologies.
- Sandia Science and Technology Park provides a corporate friendly environment for firms that want close access to SNL. The Park also directly serves the Lab through an international programs building, childhood center and other facilities.

INTERMEDIARY PROGRAMS

TechLink

State: MT **City:** Bozeman
Agency: DOD - major funding agency
Mgt: University Center
Annual Revenue: \$2 million
Geographic Characteristics: Activities focus primarily on a nine state region.

TechLink:
<http://techlink.msu.montana.edu>
INRA: <http://www.inra.org>

TechLink is an example of a cross-cutting model that involves linkages with multiple federal laboratories for regional economic development.

TechLink is involved in technology transfer, industrial liaison and entrepreneurial development activities directly with federal labs, and through the NSF Partnerships for Innovation program, the Inland Northwest Regional Alliance, the Montana Aerospace Development Authority and two Montana incubators. This model serves as an example for states and communities that may not have a major federal laboratory located in their area.

Overview: TechLink is a university center of Montana State University (MSU) in Bozeman, Montana. TechLink conducts industrial liaison and technology transfer activities with over 40 federal laboratories including 30 DOD labs, 10 NASA Centers and several USDA labs. TechLink's industry focus is primarily in a nine-state region in the Northwest: Alaska, Idaho, Montana, North Dakota, Oregon, South Dakota, Utah, Washington and Wyoming. In 2003, TechLink expects to increasingly engage in DOD licensing activities in additional states outside the nine-state region.

The majority of TechLink's overall funding is provided through a cooperative agreement with DOD for technology transfer and commercialization services; core administrative funding is provided by MSU. Additional funding is supplied by grants for complementary activities from other federal agencies. TechLink has 14 full-time employees including 10 professionals with strong technical and business backgrounds.

Technology Transfer Activities: TechLink has developed over 175 partnerships primarily through cooperative R&D, licensing and R&D funding agreements involving over 100 companies and DOD, NASA and other federal agencies. TechLink's licensing activities emphasize matching federal technologies with companies' technology needs. TechLink also helps firms register their technologies in DOD's Independent Research and Development (IRD) database to create opportunities for these firms. It has increased the number of companies in this database by over 30 percent.

TechLink is responsible for a growing percentage of new DOD licenses ... and it is impressive that they maintain the focus on contributing substantially to DOD's overall technology transfer functions.

- Cynthia Gonsalves, Technology Transfer Manager, DOD,
Arlington, Virginia

TechLink often uses a “technology pull” or “market pull” approach by assessing key technology needs of specific companies and then seeking DOD or other federal technology to address these company needs. This involves mining the US Patent and Trademark Office database and seeking technologies in federal labs. TechLink also engages in highly targeted “technology push” efforts through its experts who identify promising federal lab technologies in nine key industrial areas. These areas are: advanced materials, aerospace, agriculture, biotechnology/ biomedicine, environmental technology, electronics, photonics, sensors, and software and information technology. TechLink does not charge companies for its technology transfer services or collect royalty payments. All royalties generated from TechLink’s federal patent licensing activities go directly to the respective federal laboratories.

In FY02, TechLink was responsible for 26 new license applications to DOD and NASA from companies, with 9 patent license agreements executed and 17 pending by the end of the fiscal year. DOD reports that TechLink has been responsible for 15 percent of DOD-wide patent licenses and, in FY03, DOD anticipates at least 20 percent of the patent licenses will be attributable to TechLink. Moreover, DOD reports a more than 2:1 return on investment from the agency’s funding to this organization.

SBIR Outreach: In 2000, TechLink launched a major SBIR outreach initiative. This initiative has two components: (1) a DOD SBIR outreach program to most of the rural states in TechLink’s region, and (2) a SBIR outreach program to small technology firms in Montana through the Experimental Program to Stimulate Competitive Research (EPSCoR), managed by MSU under an award from the National Science Foundation (NSF). In both cases, TechLink helps small technology firms (a) identify SBIR topics, (b) establish contact with SBIR topic managers in federal labs, (c) partner with university researchers, (d) prepare timely proposals, and (e) receive expert review of proposal drafts. Since the launching of TechLink’s DOD SBIR initiative, regional companies have won Phase I and Phase II SBIR awards at twice the national average. In addition, TechLink has helped double DOD SBIR funding to the region.

Incubators: In 2000, TechLink established “TechRanch,” a small business incubator located at MSU’s Advanced Technology Park in Bozeman through a partnership with private-sector and local economic development leaders. As of February 2003, “TechRanch” had nine client firms, three of which were based on DOD or NASA technologies and two based on MSU technologies. “TechRanch” offers client companies access to (a) a national network of advisors,

(b) angel investors and venture capitalists, (c) federal and MSU technologies through TechLink, (d) service providers and (e) turn-key furnished offices in a high-tech facility. “TechRanch” already has graduated two technology businesses.

TechLink also played a key role in establishing the Montana Business Incubator (MBI) in Billings. A TechLink employee currently manages MBI, which has six client companies. MBI offers clients a modern turnkey facility on the MSU-Billings campus and extensive business development assistance.

Partnerships for Innovation Project: In September 2002, TechLink initiated a three-year project – Montana Business Foundry: Tech Ventures for a Rural State – supported by the Partnerships for Innovation (PFI) program of the NSF.³³ Key project objectives are to develop sustainable infrastructure in Montana for technology-business creation and to launch new start-up companies by proactively assembling technology, entrepreneurs and capital for start-ups. An important anticipated outcome is the development of new models for technology business creation in rural areas.

TechLink is partnering on this project with the Center for Entrepreneurship for the New West at MSU College of Business, the Montana Governor’s Office of Economic Opportunity and the Technology Venture Center, a private, not-for-profit organization co-located with TechLink in Bozeman’s Advanced Technology Park. As part of this project, TechLink is identifying and facilitating licensing of federal and university technologies upon which new companies can be created. The Technology Venture Center and the Governor’s Office are recruiting entrepreneurs to create the new enterprises and are locating sources of investment capital for those enterprises. The Center for Entrepreneurship is training MSU business and engineering students to be future entrepreneurs by providing hands-on experience working with technology start-ups. The project team intends to start 12 new technology companies by the end of the three-year project. Only six months into the project, the project team already had launched three new technology enterprises.

Montana Aerospace Development Authority Activities: In another initiative to foster technology-led economic development, TechLink is one of the lead members of the Montana Aerospace Development Authority (MADA) established as a non-profit organization in mid-2000 to increase aerospace-related R&D, commercialization and economic development in Montana. This initiative builds on substantial aerospace-related business already being conducted by approximately two-dozen small companies in the state.

MADA goals are: (a) to promote private-sector economic development by creating strong partnerships involving industry and the state’s university system, (b) to grow the number of aerospace-related R&D awards and contracts coming to the state, and (c) to successfully commercialize federal and Montana-developed aerospace technology in the state. TechLink’s role is to help Montana aerospace-related companies become more competitive through licensing

³³ For more information about PFI see: <http://www.ehr.nsf.gov/pfi>.

and commercialization of federal technology and technology resulting from company R&D programs.

Inland Northwest Research Alliance Activities: TechLink played a key role in assisting the eight research university members of the Inland Northwest Research Alliance (INRA) – University of Alaska-Fairbanks, Boise State University, Idaho State University, MSU, the University of Idaho, the University of Montana, Utah State University, and Washington State University – to develop a common intellectual-property management policy. This “harmonized” policy facilitates partnering among the universities and between the universities, the private sector and the region’s two DOE labs – Idaho National Engineering and Environmental Laboratory and the PNNL. To address the problem of conflicting intellectual property statutes, regulations and policies, TechLink organized a series of intellectual-property management workshops involving the INRA universities, DOE and private sector participants. These workshops led to new policies and agreements that effectively removed barriers to R&D and technology commercialization collaborations involving the universities, the federal government and commercial firms in the region.

RECAP OF TECHLINK DISTINCTIVE FEATURES

- TechLink works with over 40 federal laboratories linking their technologies to companies in nine rural Western states. They have developed 175 partnerships involving over 100 firms.
- In Fall 2002, TechLink, MSU, the state and a non-profit organization launched a PFI project to develop start-ups and foster technology-based infrastructure. Already three new start-ups have resulted.
- A new TechLink affiliated incubator – “TechRanch” – has nine client firms, three based on DOD or NASA technologies and two based on MSU technologies.
- TechLink helped the Inland Northwest Research Alliance remove R&D barriers by harmonizing intellectual property policies among universities, federal laboratories and the private sector.
- Through special SBIR initiatives, TechLink has helped double the DOD SBIR funding to the region.

Manufacturing Extension Partnership Management Services Inc.

State: ME **City:** Augusta
Agency: NIST - major funding agency
Mgt: Private non-profit corporation
Annual Revenue: N/A
Geographic Characteristics: Activities focus primarily on a six state region.

MEP MSI:

<http://www.mepmsi.org/>

MEP:

<http://www.mep.nist.gov/>

MEP Management Services Inc. (MEP MSI) operates multiple centers in the U.S. where it develops business relationships between SMEs and federal laboratories and helps these firms make commercial use of government technologies and federal R&D facilities. MEP MSI accomplishes this through partnerships it develops between state development agencies, federal technology organizations and industry to support related technological innovation and commercialization opportunities for manufacturers. MEP MSI is part of a network of 400 independent and non-profit centers sponsored by NIST across the nation that provide business solutions and technology services to manufacturing related small enterprises. MEP MSI's innovative approach using MEP to conduct technology transfer and business development activities with federal labs is the subject of this discussion.

Overview of Services: MEP MSI operates the largest multi-state consortium of independent MEP Centers. Starting in Maine, MEP MSI quickly expanded services to other New England states, and now operates programs in six states: Arizona, Florida, New Hampshire, Maine, Massachusetts, and New Mexico. During this time, MEP MSI has further expanded through national supply chain development initiatives with major corporations and DOD in additional states.

MEP MSI's core services focus on meeting the immediate "shop floor" needs of manufacturers with new solutions in productivity, process, and quality, and helping firms develop expanded supply chain opportunities. MEP MSI also has a long history of integrating technology solutions for SME product development and process modernization with an emphasis on federal laboratory partnerships. For example, Maine MEP's first federal laboratory project involved helping a local supplier evaluate new materials for L.L. Bean's famous hunting boot through a CRADA with the Navy's Clothing & Textile Research Facility. Today, MEP MSI provides technology transfer services in two broad areas: technology development and technology commercialization.

First, MEP MSI addresses the technology development needs of SMEs and helps fill internal capacity gaps in research, development, design, engineering, testing, and simulation. It does so by linking the firms with federal laboratories and other resources including universities, private research institutions, professional consultants and business partners. Second, MEP MSI identifies and fills internal gaps in the firms' technology commercialization capabilities by helping them with: (a) business strategies, (b) business development, (c) competitive research, (d) marketing, (e) joint ventures, (f) debt and equity financing, (g) grant writing, (h) intellectual

property, (i) technology maturation, and (j) supply chain sourcing. Services may be performed by MEP staff alone or in conjunction with external service providers from private and public sectors.

We've found that overcoming technology commercialization challenges often are more critical than solving specific technology development problems. Moreover, we've found that developing technology commercialization opportunities is best played as a 'team sport', involving multiple collaborators.

- Nicholas Karvonides, Vice President for Technology Transfer, MEP MSI

To make these services accessible to small firms, MEP MSI has creatively used state and federal partnerships to develop and help fund assistance programs leveraging industry investments with public support. For example, MEP MSI has worked with state governments to make funding available to firms from state R&D grants in Maine, investment returns from local development bonds in New Hampshire, sales tax credits in New Mexico, job training grants in Florida, and industry cluster development funds in Arizona. MEP MSI has also helped states create new technology transfer initiatives by leveraging federal funds through teaming agreements with state agencies. Related efforts have involved program opportunities from EDA, Experimental Program to Stimulate Competitive Technology, PFI, SBA's FAST and New Markets Venture Capital program, DOE Industries of the Future, and EPA's Jobs Through Recycling Program.³⁴

Federal Laboratory Activities by State: The following provides examples of MEP MSI activities involving federal laboratories and related SME assistance programs in specific states.

Maine – Under a new \$18 million R&D grant fund administered by the Maine Technology Institute (MTI)³⁵, MEP serves as the fund's fiscal agent, supporting 80 to 100 grantees annually, and is a leading provider of business assistance to portfolio firms including helping firms locate and develop technology partnerships with federal laboratories. For example, NIST labs helped a manufacturer of industrial fiberglass pipes re-invent a product line of "smart pipes" developed with sensor technologies from DOD's SBIR program at the Missile Defense

³⁴ For more information on NSF Partnership for Innovation see: <http://www.ehr.nsf.gov/pfi>; SBA FAST program see: <http://www.sba.gov/sbir/indexfast.html>; SBA New Markets Venture Capital program see: <http://www.sbaonline.sba.gov/INV/NMVC>; DOE Industries of the Future see: <http://www.oit.doe.gov/industries.shtml>; EPA Jobs Through Recycling program see: <http://www.epa.gov/jtr>.

³⁵ For more information on MTI, see: <http://www.mainetechnology.org>.

Agency, and the Naval Research Laboratory in Washington helped an inventor of a radar reflective life vests used for sea kayaking, evaluate the products' material characteristics.

Although Maine does not host a federal laboratory, and its local R&D capacity is limited, MTI's ability to "virtually" import these resources through MEP provides small businesses with unique competitive advantages in product development and commercialization. This is especially important given Maine's rural makeup and geographic distance to national laboratories.

- Janet Yancey Wrona, Director, Maine Technology Institute

Several other federal laboratories have supported MTI related projects including the Army's Soldier Systems Center at Natick, the Army Research Laboratory in Adelphi, and the Portsmouth Naval Shipyard. Additional federal lab partnerships with Maine's small businesses have been supported by NIST's polymer materials and optics researchers as well as product testing facilities at NASA Glenn. In addition to being the most active laboratory with Maine SMEs, NIST also helped the state design MTI by sharing "lessons learned" from the national Advanced Technology Program.

New Mexico – At SNL, MEP has "embedded" two on-site economic development professionals with hands-on manufacturing experience. These professionals work with the laboratory, on behalf of small firms, to identify and link researchers to help firms solve technical problems and take advantage of technology transfer opportunities. Through this arrangement, SNL and MEP jointly serve about 100 small businesses annually. This case represents one of the few in the nation in which external economic development professionals are on-site at a federal laboratory. SNL and MEP also jointly deliver an array of manufacturing improvement services such as Lean Manufacturing and ISO quality training. These activities not only support the core MEP mission of improving the manufacturing base but also enhance SNL's supplier base.

New Hampshire – In a pilot program, the New Hampshire MEP used investment returns from a state development bond fund to help small firms cost-share federal laboratory resources and external commercialization support services. Of the estimated dozen companies enrolled in the program, a number of firms were supported with testing and evaluation services for new product development and process innovation ranging from assessing forestry management software to improving thin film coatings for semiconductor materials. Federal laboratories also assisted firms in expanding opportunities by assisting SMEs with SBIR Phase II proposals to the Missile Defense Agency and pursuing government procurement opportunities in advanced ceramics with the U.S. Army. This program targeted assistance to SBIR firms, a strategy of which was later replicated in Florida. Federal agencies and laboratories involved in this demonstration were from DOD, DOE, NASA, NIST, U.S. Forestry Service, and Bureau of Land Management.

Florida – Florida’s MEP technology transfer program began in 2002 and, although still new at the writing of this report, benefited from earlier lessons learned in other states. As elsewhere, the Florida MEP first established key local partnerships with state R&D organizations beginning with the state Technological Research & Development Authority (TRDA)³⁶. The legislature created TRDA to help Florida use NASA’s Kennedy Space Center (KSC) to spawn local aerospace and related technology clusters. MEP and TRDA activities focused on helping SMEs’ leverage federal technologies, related procurements and SBIR opportunities. MEP and TRDA initially targeted firms already collaborating with regional universities, KSC and companies associated with other locally-based federal technology organizations as well as military and dual-use government procurements in aerospace and defense. To support federal technology partnerships and related commercialization projects with local firms, MEP and TRDA received matching grants from the state’s workforce investment board (WIB). These new program funds are being used to support SBIR, R&D commercialization, and government supply chain opportunities for local small businesses linked to Florida-based federal technology organizations such as KSC.

In an effort to facilitate new ways to institutionalize economic development and industry partnerships in support of the nation’s space program, KSC developed a novel business model around its “one-stop-shop” Cryogenics Testbed facility. This relatively new GoCo facility is located at KSC. It has diverse cryogenic technology capabilities involving the development, engineering, testing and evaluation of related products for not only space applications but also dual uses in semiconductor, medical, energy and industrial sectors. TRDA provided the Testbed state funding to help develop the facility incorporating a performance based royalty return from future industry customers.

TRDA’s aim is to leverage the Testbed as a virtual incubator helping to grow cryogenics-related firms locally and at the same time marketing the facility as a business attraction tool to draw similar companies to the state. To support the development of related marketing and business development opportunities for the Testbed, MEP undertook a comprehensive commercialization feasibility study identifying markets, customers, and business partnerships to support future government-industry collaborations at the Testbed. TRDA and MEP have established a small business innovation assistance program and financial incentives to support future small business interactions with the Testbed in areas including SBIR, R&D collaboration, and commercialization opportunities.

In conclusion, MEP MSI has integrated a variety of innovative and entrepreneurial intermediary programs for manufacturers and technology firms that meet the common goals of federal laboratories and state development agencies. In so doing, these initiatives have provided novel and value-added technology transfer opportunities for small firms while offering increased economic benefits for communities and states that may have previously experienced difficulty in accessing some of the more distant federal labs. Of equal importance has been MEP MSI’s effort to pursue related opportunities that provide added benefits for federal labs to meet

³⁶ For more information on TRDA see: www.trda.org.

government missions by leveraging synergistic partnerships in economic development and business collaboration.

**RECAP OF MEP MSI
DISTINCTIVE FEATURES**

- MEP MSI “embeds” on-site professionals at Sandia National Laboratories in New Mexico to help identify and link lab researchers with almost 100 small firms annually. This activity is funded through a state tax credit program.
- MEP MSI and Florida’s TRDA utilize workforce funds to develop small business commercialization and SBIR programs, and to provide linkages with the state’s federal R&D organizations – NASA KSC.
- MEP MSI leveraged state investment bond returns in New Hampshire to develop a federal laboratory-small business matchmaking and commercialization pilot program.
- MEP MSI integrates federal laboratory technical assistance and commercialization services for firms funded by the Maine Technology Institute’s R&D grant and investment fund.

IV. SUMMARY OF FINDINGS AND CONCLUSIONS

CONCLUSIONS

Federal laboratories are pursuing a variety of economic development related activities that benefit the communities and states in which the laboratories are located, and at the same time, benefit the laboratories themselves. The laboratories' presence benefits local development by directly attracting highly educated scientists and engineers to the area and creating an attractive atmosphere for entrepreneurial development and growth. By adding physical infrastructure, such as incubators and research parks to the area, some federal laboratories provide additional incentives for entrepreneurs. Federal laboratories, such as those featured in this report, have gone a step further by sponsoring technical and business assistance, seed capital, business networking, education and training, and information dissemination that promotes the growth and advancement of high-tech and other enterprises. In addition, many DOE labs provide entrepreneurial leave programs that allow laboratory employees to "test the entrepreneurial waters" without risking loss of long-term job security and benefits.

As laboratories contribute to local economic development, they receive a return on their investment in several ways. Laboratories are able to attract more qualified employees when the area in which it is located becomes more economically attractive, when the spouses of lab employees are able to find employment, and when the school systems are attractive for their children. Labs directly benefit from helping local suppliers improve their quality and meet standards needed for the lab's sophisticated R&D. Labs also benefit when technologies stemming from lab R&D are developed and adapted for dual use by lab employees. This added value benefits the lab, the community, and ultimately the nation.

Some economic development related programs go hand-in-hand with technology transfer activities. Entrepreneurial leave programs at some of the DOE laboratories, for example, have promoted technology transfer by encouraging lab employees to start their own businesses that mature and adapt lab technologies for commercial use. Several labs covered in this report cited successful businesses started by former or current laboratory employees.

Business assistance programs facilitate and add value to technology transfer programs. Programs such as the business assistance and Mentor Protégé programs at SNL enable technology enterprises' ability to commercialize technologies started at SNL. Moreover, these programs advance the number and quality of suppliers to the Lab. Programs conducted with universities such as PNNL's use of MBA students to conduct marketing studies on lab technologies and LANL's use of university students as technology scouts, leverage university and federal laboratory strengths, benefiting students who learn about R&D processes and benefiting laboratories that need business and marketing expertise to identify and commercialize lab technologies.

Incubators and research parks add another dimension to federal lab R&D. Research parks attract major suppliers and research corporations that conduct work with the labs, allowing them to be close to the source of federal research. Some incubators, such as DOD's Center for Entrepreneurship in Camden, New Jersey and the Tri-Cities Enterprise Center that is associated with PNNL in Washington are adding value by providing business assistance as well as technical support.

Networking activities sponsored by federal labs and community organizations also provide valuable intermediary services by linking labs with outside business, education and economic development resources. Activities sponsored by the Patuxent Partnership in Maryland, for example, have brought the Naval Air Warfare Center Aircraft Division and the Naval Air Systems Command closer to regional sources of suppliers, other businesses, universities, and local and state policy makers.

Federal lab sponsorship of, and participation in seed and venture capital activities are particularly useful in attracting potential investors and adding credibility to regional events. SNL's contractor brings venture capitalists to New Mexico to participate in an annual Equity Capital Symposium that showcases entrepreneurs, some of whom are commercializing lab technologies. PNNL helps prepare entrepreneurs showcase their technologies to venture capitalists by critiquing technology presentations.

Intermediary organizations can play a particularly important role in linking labs, especially those remotely located, with enterprises and leveraging resources that benefit enterprises working with labs. WTN and MEP MSI have "embedded" technical specialists in labs to identify and transfer technologies. These specialists can add value through their dual understanding of federal laboratory and commercial perspectives and goals. WTN also actively works with aspiring SBIR enterprises to help them hone proposals and links proposing enterprises and awardees with experts at federal labs. TechLink, a center of Montana State University, brings distant federal lab technology and know how to enterprises in Montana and other rural states.

Federal, state and local government and organizations can partner with federal labs to leverage resources. Examples include special funds to help enterprises access federal laboratory technologies and programs designed to identify and promote working relationships with laboratories. For example, in Ohio, GLITeC identifies minority and disadvantaged enterprises and provides grants and assistance to help them work with NASA Glenn and AFRL. In Maryland, the state technology organization – TEDCO – provides grants for firms to work on technology commercialization of federal laboratory technologies. In New Mexico, through a special legislated return of gross tax receipts from SNL, the Lab is able to provide technical assistance to small and minority-owned businesses. Based in Maine, MEP MSI leverages MEP and state resources to apply federal lab expertise to advance manufacturing and other enterprises in Maine and several other states. In Florida, the legislature created TRDA to help Florida use NASA's Kennedy Space Center to spawn local aerospace and related technology clusters. In a pilot program in New Hampshire, the state used investment returns from a state development

bond fund to help small firms cost-share federal laboratory resources and external commercialization services.

Federal lab activities with educational institutions, from K-12 to community colleges and universities, are well supported in some labs. Mobile lab units and lab tours of R&D facilities provide unusual hands-on opportunities for students and teachers. Programs such as the SEMAA sponsored by NASA Glenn provide academic enrichment and career awareness programs to encourage K-12 students to pursue math and science careers. Lab employees also contribute to curriculum development at all levels of education. Special apprentice programs such as the Pre-Apprentice Machining Program at NASA Glenn provide innovative workforce development that serve the technical labor needs of the Lab while also contributing to the community.

In conclusion, strengthening the business communities in which the labs are located makes good economic sense for the communities and states in which labs are located and for the federal laboratories. Building stronger, higher quality businesses provides better suppliers for the labs; contributing to math and science curriculums and stimulating interest in students develops a stronger scientific and engineering pool of future laboratory workers; and working in more effective and flexible ways with business and industry insures that federal laboratory-inspired technologies and knowledge will be transferred and commercialized. Moreover, fostering maturation and commercialization of the labs' technologies through business assistance and other activities also adds value to the original lab technology, contributing back to the lab a higher quality technology and raising the scientific and engineering bar higher for all.

ISSUES

Several issues affect the ability of the federal labs to contribute to economic development, help determine the ways in which labs engage in economic development, and impact the return on investment to the labs and the benefit to the communities and states in which labs are located. This report addresses several of these issues that were derived from: (1) responses to the IA/OTP questionnaire about policies that affect that laboratory's ability to conduct economic development and related activities³⁷; (2) on-site visits to federal labs for case studies; (3) discussions with additional professionals in federal laboratories, federal agencies, state technology programs, and state and local economic development programs; and (4) input from the project's National Advisory Group.

³⁷ Responses to the questions (a) Are there federal government policies that hamper the laboratory's ability to conduct economic development and related activities; if yes, please describe; (b) What federal policy changes could help the laboratory conduct or participate in economic development, university collaboration, and assistance to business and industry; (c) Are there state or local policies that hamper the laboratory's ability to conduct economic development and related activities; if yes, please describe; and (d) Has the laboratory experienced budget cuts in the past five years; if yes, have these cuts affected the laboratory's ability to provide assistance to business and industry or perform economic development services?

The Laboratory’s Mission: When asked what government policies hamper the laboratories’ ability to support economic development and related activities, most federal laboratory representatives answered “lack of mission” and “lack of funding”. The general perception among lab representatives and economic developers alike was that, in most federal labs, support for local economic development was a low priority or no priority at all. Most lab representatives suggested that in order for economic development and business assistance to become a greater priority, it had to be better established as part of the federal laboratories’ mission. In order to do so, federal lab representatives believed that it was important for Congress to clarify its intent for federal laboratories to actively participate in economic and business assistance activities and for policy makers and agency administrators to reflect this intent through funding and programmatic incentives.

While we believe that ‘economic development’ is desirable, it is not officially recognized as a primary laboratory mission in the same sense as ‘basic research’ or ‘technology transfer’ ... Lacking agency authorization and funding, it is difficult to make a successful case for hiring dedicated economic development personnel or for supporting them with scarce non-programmatic funds.

- Richard Todd Zdorkowski, Program Coordinator, Office of Industrial Outreach and Technology Administration, Ames Laboratory, Iowa

Managers of some labs said that they were concerned about performing economic development activities because agency inspector generals might scrutinize and cite their activities as “unallowable” or “outside of mandated activities.” Laboratory representatives also expressed concern about their roles on boards of economic development organizations and participation in state development working groups. One laboratory representative commented: “Unless the activity is specifically authorized by the agency, then costs associated with providing support may be deemed as unallowable.”

Moreover, laboratory representatives were concerned that providing business assistance might be viewed as competing with the private sector. One laboratory representative reported: “We must assure (the agency) that we are not giving preferential treatment ... This can be difficult when the number of requests for assistance exceed the resources available to provide services.” Some intermediary organizations that facilitate linkages between enterprises and federal laboratories solve the equitable-treatment issue by implementing a “triage” system that targets firms with the greatest potential to utilize federal laboratory resources, and may additionally factor in other priorities such as minority and small enterprise status.

If you want to know where the priorities are look at the funding and the metrics ... a contract to operate the lab may have 100 metrics and only a couple have anything to do with technical assistance to business or economic development.

- Victor Chavez, Manager, Regional and Small Business Partnering, Sandia National Laboratory, New Mexico

Some lab's that perform economic development such as the GoCo's SNL and LANL have business assistance and economic development activities cited as part of their management and operating contracts with DOE. Specific activities are clearly defined in appendices to those contracts. Moreover, these GoCo labs have metrics that include business assistance and economic development goals. Without metrics, some lab representatives say, economic development has no "teeth" within the lab and personnel who work on economic development are not credited for achievements. On the other hand, some say that the metrics established by labs are not appropriate for labs and are not understood by personnel. One laboratory representative commented: "Performance metrics such as 'numbers of jobs created' or 'number of firms created' effectively preclude participation of laboratory research scientists in economic development because this is not an outcome scientists or lab employees can reasonably hope to achieve." Federal laboratory personnel often do not understand how to capture or calculate such measures. If support for local economic development is to become a greater part of the lab's mission, laboratory personnel need be educated on economic development objectives and goals in order to better understand how to direct activities and capture results. Laboratories can work with economic development organizations to develop appropriate metrics and to help lab employees understand and meet economic development metrics.

There should be a better feedback mechanism and reward system to encourage people in the labs to work, not just through formal contracts, but in partnership with businesses, and to provide a sufficient incentive structure that will pay the lab people for their hard work and the all extra they do on behalf of the community.

- Martin Fairclough, Director, Patuxent Partnership, Maryland

Little Recognition and Reward for Economic Development Activities: One result of federal labs not having a clear and consistent mission in economic development is that laboratories often do not sufficiently reward employees who work on business assistance and economic development activities as other activities. The laboratory employees who perform business assistance and economic development activities often view their activities as a public duty and a contribution to their communities. For the most part, they are aware that laboratory management does not view their activities as equally important as other activities in the lab and their reward, in terms of promotion and salary increases, is often consistent with this view. Business and community leaders who work with the federal laboratory representatives are aware of the attitude by lab managers and are concerned that laboratory employees who work diligently external organizations, and who often contribute long hours after the normal business day, are not being sufficiently recognized and rewarded.

Lack of Funding for Economic Development Activities: Lack of funding for economic development activities goes hand-in-hand with the lack of mission for these activities. A number of laboratories reported that there was a lack of dedicated agency funding and that laboratories normally used administrative funds to support these activities.

Recent budget cuts to federal labs has exacerbated already meager funding for business assistance and economic development. In response to the IA/OTP questionnaire, all but one federal lab representative said that recent budget cuts had adversely affected their “ability to provide assistance to business and industry or perform economic development services.” Laboratory representatives said that when budget cuts hit the laboratory, business assistance and related activities were “the first to go”.

After everything else has been committed, (business assistance and economic development) get what is ‘left over’.

- Anonymous Manager, business assistance and economic development, DOE federal laboratory

Laboratory representatives also reported that because of a general lack of funding for technical assistance to businesses and related economic development activities, it skewed the

types of businesses with which they could work, in favor of larger businesses. (This is because the marginal cost of working with small firms is generally greater.) One laboratory representative said: “Extremely lean budgets in (the agency) have limited the capabilities of the laboratory to interact with developing companies that do not have the monetary resources to pay for services”.

Because of the uncertainty in Congressional funding of (agency) budgets and in particular special ‘line item’ projects, it is becoming harder and harder to convince corporations, particularly smaller ones, to participate in R&D projects with federal labs ... You can not conduct development projects in fast-moving fields by ‘starts and fits’.

- Anonymous Project Director, R&D Consortium sponsored by a NASA laboratory

In addition, uncertainty over annual budgets because of Congress’ difficulty in passing budgets has necessitated laboratories to work under multiple “Continuing Resolutions” (CRs). Working under CRs has disrupted activities, and has placed particular pressure on those activities that are not part of the “core mission”. Moreover, programs funded as special projects (“line item” programs in agency budgets) such as those federal lab projects involving corporations in multi-year R&D consortia were especially affected by Congressional delays.³⁸ One laboratory representative said that because of Congressional delays in passing the agency’s budget in recent years, some major R&D projects had been halted and restarted several times. This not only disrupted the flow of R&D, which in fields requiring rapid development was highly detrimental to the commercialization potential but also, according to the lab representative: “caused corporations to drop out of (major R&D projects) and added to the already prevalent skepticism among corporations about working with federal laboratories”.

Developing Partnerships with Industry: Business and economic development leaders generally said that federal laboratories were not flexible enough to work effectively with local business and industry, particularly small enterprises that do not have the internal structure to work with major bureaucracies. They said that often businesses do not know “how to get started with federal labs”.

³⁸ These special projects considered as “line items” in agency budgets are not covered in Continuing Resolutions and therefore funding ceases until the agency’s budget is approved.

Federal labs know how to do contracts, but what is really important is being able to partner in less formal ways with industry ... that is where real work gets done and real things happen.

- David Goldheim, Corporate Business Development and Partnership, Sandia National Laboratories, New Mexico

Several laboratory representatives said it was difficult to form real partnerships with industry because of overly strict legal frameworks. Economic developers and business organization representatives said that the federal laboratories were too restrictive on the use of their technologies. The Director of the Tri-Cities Enterprise Center in the state of Washington said: "For a company to get licenses is a problem; (the federal laboratory) needs to loosen up ... What happens is that an entrepreneur goes for funding, and a venture capitalist says forget it, you don't own the technology ... it takes too much time and trouble to get licenses out of the labs."

By contracting with private and non-profit intermediary organizations, some federal lab representatives feel they are facilitating more effective technology transfer and business assistance. Representatives from labs that employ external business specialists, particularly those "embedded" in labs, believe that these specialists add value because they understand both the lab and business cultures. These external specialists also sometimes are better able to advocate on behalf of small enterprises. Although GoCo's and GoGo's operate under the same rules, representatives from some corporate-operated GoCo's also contend that labs operated by the private sector are inherently more knowledgeable about and responsive to private sector needs because they understand corporate cultures and goals.

In order to strengthen the ability of the federal laboratories to work with businesses and to provide technical assistance, numerous lab representatives advocated support for the former DOE Technology Partnership Program or programs with similar intent. One laboratory representative suggested that a percentage of the R&D budget for the laboratories be set aside for work with industry, focusing on small enterprises, and cited the SBIR program as precedent for such a program. Others suggested that one or more pilot programs could be tested, that might include state matching as a requirement.

There is also wide recognition that the "valley of death" remains a major obstacle to the private sector adapting federal laboratory technologies for use in commercial markets. The "valley of death" refers to the gap between the new ideas and "proofs of concept" resulting from originating research and their development into marketable products and services. This gap is more likely to occur when R&D is not mature, making private investment too risky, and when technical and business input is not sufficient to carry the R&D through to market. It also can occur when products and processes have been developed for non-commercial purposes, requiring additional resources and expertise to adapt them for "dual-use". Although this problem is

common in various research venues including universities, it can be more pronounced in federal labs that have a narrowly defined government mission and in labs that focus on early-stage research. This issue persists despite federal policy and agency efforts aimed at lowering the barriers to innovation, and promoting rapid transfer and commercialization of new technologies emerging from federally funded R&D. Nevertheless, questions remain about how best to bridge the gap and what role(s) the federal government can or should play in achieving a solution.

Some federal laboratory, economic development and state technology representatives who provided input to this study suggested that a special program or fund be established to directly support technology maturation and bridge the “valley of death” between federal laboratory R&D and commercial application. Some suggested that a national institute or “virtual” institute be established for this purpose. Regardless of the method, the federal lab and economic development representatives almost all agreed that there needed to be more flexibility in federal laboratories to work effectively with the private sector, particularly small enterprises, and that mechanisms to bridge the “valley of death” should be established and funded.

Business Assistance and Technology Transfer Are Interrelated: Technology transfer, in order to be effective, is a process that involves a full range of business and technical assistance such as marketing, corporate partnering, seed capital investments, and other assistance. In previous work conducted by Innovation Associates on the needs of small technology firms, it found that in order to commercialize technology products and processes, firms most often needed assistance with patenting and licensing, corporate partnering, commercialization planning and market assessments.³⁹ It is commonly accepted in the investment community that business expertise is a more important determinant than the quality of the technology in successful high-tech commercialization. Many promising technologies never reach the commercial market place because of weak business expertise. Federal laboratory technology transfer, without accompanying business assistance often is insufficient to realize the full commercial potential of the federal laboratory technologies. Lack of business assistance to SMEs in particular can arrest the commercialization process mid-stream.

Universities successful in technology transfer have long understood the importance of business assistance in the technology transfer process. Stanford, MIT, UCSD and other universities known for effective technology transfer either offer business assistance in tandem with technical assistance or coordinate with external sources of assistance. The difficulty of providing business assistance may be one of the reasons that federal labs have been less successful in commercialization of lab products and processes than many major research universities. Policy makers influencing technology transfer activities in federal labs have lagged behind universities in their capacity and support of the technology transfer and commercialization process. One might argue that business assistance is not the job of the federal labs. But if Congressional intent is to facilitate more laboratory support of regional and local

³⁹ *Commercialization Needs of SBIR Firms*, Innovation Associates, December 2001. This work can be downloaded from <http://www.InnovationAssoc.com>.

economic development activities, then greater financial support for business assistance will likely be necessary.

Policy makers may want to assess federal laboratory technology transfer in comparison with university procedures, taking into account differences in mission and national security restrictions and consider ways to adopt some of the effective university practices for federal laboratories. Many federal laboratory representatives and economic developers agree that in order to optimize technology transfer in federal labs, there must be business services and/or links to those services. These services should be supported and also incorporated into any future mechanisms focusing on technology maturation and commercialization.

Federal Procurement from Local Business and Industry: One of the major complaints from business and economic development organizations is that labs procure too little from the businesses in communities and states in which they are located. In defense, some labs claim there are few businesses and industries in the communities in which they are located that provide the sophisticated products and services needed by labs. Some labs are growing more sensitive to this issue, and are beginning to work on developing programs to increase local suppliers. These programs include ISO and other competency-focused workshops and training. Other programs discussed in this report are technology assessments and recommendations given to small enterprises by WTN and Mentor Protégé Programs started by SNL.

Laboratory management should be aware of the concern in communities and, as a first step, should be able to answer community inquiries; at minimum: (a) what percentage of the laboratory's procurement goes to local business and industry in the communities and states in which the lab is located; and of that, what percentage (b) is potentially continuous as opposed to one-time procurement, (c) is high wage production and service; and (d) is contracted to small businesses. Once these factors are known, labs can meet with local business groups and economic development organizations to discuss measures that might increase local procurement.

The SBIR-Federal Laboratory Connection: There has been much controversy regarding federal labs accepting payment for services to SBIR firms. A SBA directive states: "a federal agency shall not issue an SBIR funding agreement that includes a provision for subcontracting any portion of that agreement back to the issuing agency or to any other federal government agency or component thereof."⁴⁰ However, the Policy Directive allows for deviation for special SBIR projects where the use of federal resources: "(1) is absolutely essential to the successful conduct of a project that is vital to the mission of the agency, and (2) equivalent resources are not available in the private sector."⁴¹ Federal lab representatives are concerned about this directive and contend that federal labs can be an indispensable resource for SBIR firms, offering laboratories and equipment that are not available elsewhere or too expensive for most SBIR firms. Moreover, federal labs have the expertise to assist small technology firms on high-level scientific and engineering problems. Lab representatives believe that if the federal government limits access to this expertise, they have constrained the full R&D potential of the

⁴⁰ Small Business Innovation Research Program Policy Directive, June 2001.

⁴¹ Ibid.

SBIR firms and the technology transfer potential of the federal laboratories. Moreover, they contend that limited access to federal labs runs counter to the Congressional intent of technology transfer legislation.

SBA representatives, however, contend that they issued the restrictions in response to some abuses of the system, and in response to Congressional concern regarding potential further abuses involving favoritism of SBIR awards that benefit an agency's laboratories. Moreover, when the proposed SBIR Policy Directive was posted in the Federal Register (June 2001) for public comment, the SBA received strong support from Congress and small business advocates in support of the prohibition. In 2001, in order to facilitate selective use of federal laboratory services by SBIR firms, the SBA Assistant Administrator for Technology inserted the waiver provision to the original 1997 prohibition.⁴² A SBA representative said that the SBA fully supports the use of Federal labs by small business participating in the SBIR program, providing that the services required to conduct the research are not obtainable in the commercial market place. The representative said that the format of the waiver is clearly identified in the SBIR Policy Directive, that all requests are submitted to the SBA Assistant Administrator for Technology by the federal agency, and that the SBA reviews and responds to all waiver requests within three business days of receiving those requests.

We encourage no-cost CRADA's for SBIR firms; unfortunately more and more facilities are going the industrial funding route to replace lost (public) funding, so the no-cost CRADA opportunities are dwindling.

- Anonymous SBIR Manager

Many labs work with SBIR firms by developing CRADAs, funded by the firms with non-SBIR funds. Some of the labs covered in this report actively work with SBIR firms, free to the firm, to help them prepare SBIR proposals and if awarded, provide technical assistance supported by the lab's administrative funds. However, as funds become increasingly constrained, federal lab representatives warned that they may not be able to continue assisting SBIR firms at present levels.

Because there is much confusion among the federal lab representatives about what is allowable and under what circumstances, SBIR sponsoring agencies⁴³ should make clear to the federal laboratories what activities fall within acceptable limits of a waiver and the procedures for issuing the waiver. The SBA should work with SBIR sponsoring agencies to develop a universal form for businesses to complete and issue universal instructions on how to apply for

⁴² SBIR Program Information Notice (SPIN 97-01).

⁴³ SBIR sponsoring federal agencies are: DOAG, DOC, DOD, DOE, DOED, DOT, EPA, HHS, NASA, and NSF. Links to these sites are found at <http://www.sba.gov/sbir/indexprograms-otaagency.html>.

the waiver. In addition, there should be a brief standard statement in agency proposal packages to firms regarding the waiver process. In order to lay this issue to rest, SBA may also consider meeting again with SBIR stakeholders; that is, representatives from sponsoring agencies, federal labs, and small business advocates to determine if any further policy or programmatic revisions are warranted.

Entrepreneurial leave programs can improve the labs' ability to recruit and retain productive employees, who may be attracted to other research organizations such as universities which provide more flexible opportunities for researchers to carry their research through to practice applications.

- Phillip Singerman, Executive Director, Maryland Technology Development Corporation

Entrepreneurial Leave-of-Absence Programs: Entrepreneurial leave programs are designed to foster technology transfer and technology maturation of laboratory technologies by laboratory scientists and engineers who create new businesses or add value to existing businesses based on laboratory-acquired expertise and technologies. These programs potentially can help bridge the “valley of death” gap in technology transfer and promote commercialization of technologies that might otherwise not be commercialized. If properly promoted and executed, these programs can contribute substantially to economic development in areas surrounding the labs. The programs may contribute to building a broader and stronger supplier base for the laboratory. In several case studies we discuss entrepreneurial leave programs and in a few cases we site examples of successful firms started by laboratory scientists and engineers under this program.⁴⁴

Although popular among economic developers, federal laboratories appear to give half-hearted or mixed support to entrepreneurial leave programs. Some managers, off-the-record, said that the program has caused problems. In one laboratory, for example, a manager who was about to lose two top scientists to the entrepreneurial leave program, said that he was not pleased since these scientists would be difficult to replace, and believed that the program was detrimental to the core mission of the lab. It also can be problematic for the scientists and engineers who leave to start businesses under the program and return to the lab. One laboratory manager said that the returning scientists and engineers are sometimes treated as “lepers” and do not receive top assignments and promotions.

⁴⁴ See case studies on Los Alamos National Laboratory, Pacific Northwest National Laboratory, and Sandia National Laboratories.

Because of these issues, it would be useful to have a study of the costs and benefits of the entrepreneurial leave programs to federal laboratories and economic development. If policy makers consider the potential economic benefit worth the cost to the laboratory, then they may want to consider strengthening and expanding the presently limited entrepreneurial leave programs and find ways to make them more internally workable.

A large percentage of the workforce in the federal labs will be retiring in the next 10 years; (the labs) will not have enough skilled personnel to replace them. This is why it's critical for labs to actively improve education in their communities, starting with elementary grades through all levels of vocational and higher education.

- Gary Spanner, Manager, Economic Development, Pacific Northwest National Laboratory, Washington

Education Outreach and Workforce Development: A major motivating factor for federal laboratories to engage in economic development is the need for qualified scientists and engineers now and in the future. As part of the effort to insure a skilled pool of workers, many federal labs have undertaken education outreach initiatives to K-12 schools, vocational schools, universities and other institutions of higher education. Some of these included sponsoring field trips to labs, dispensing mobile labs to schools, and lab employees giving guest lectures, judging science fairs, and contributing to curricula.

Laboratory managers view these activities as a contribution to the community. Education outreach appears to be acceptable to lab management without the same concerns as business assistance and related economic development activities. Federal labs also engage in workforce development activities, particularly those labs that have experienced layoffs. Some labs have used economic adjustment funds to support these activities and therefore many of these activities are short-lived. Some labs, such as NASA Glenn, have pro-actively sought funding sources, such as DOL's welfare-to-work programs, to support innovative apprenticeship initiatives, that ultimately serve the lab by providing skilled laborers now in short supply. Other laboratories and agencies may want to explore government programs and foundation sources to support innovative workforce development initiatives that will train future skilled workers for their labs. Policy makers and federal agency administrators may find it useful to identify opportunities for cooperation between federal labs, economic development organizations, workforce development, and employment and training programs aimed at developing a scientific and engineering workforce to meet future public and private demand.

Comments on the Federal Laboratory Role in Economic Development by Vice Admiral Dennis V. McGinn

Dennis McGinn is Battelle's new Vice President for Strategic Planning and until October of 2002 he was a Vice Admiral in the U.S. Navy and served as the Navy's executive agent for requirements, technology experimentation and rapid prototyping. Vice Admiral McGinn is on the Executive Committee of the Patuxent Partnership. He provided Innovation Associates with the following comments on the federal laboratory's role in economic development.

Federal laboratories have a key responsibility of being a good neighbor. The presence of a federal lab will always have an effect on the community in which it is located. In most cases, this is a positive social and economic effect. Sometimes, however, if long-term community relations are not a key priority for the laboratory leadership, it is perceived by the community that the lab presence 'pain is not worth the gain'.

The gain to federal labs from their participation in economic development is evident; it can raise the level of technical proficiency within the lab; 'spin-in' technologies which raise technology proficiency; increase the potential recruitment base; and enhance the laboratory's ability to innovate. It is also a key element of establishing and maintaining good community relations.

Working with small businesses is particularly important. Small businesses tend to be more innovative and have less 'imagination constraints'. There is more direct visibility in technological innovations for the lab as a result of working with small businesses and because they have fewer constraints than larger firms, small firms often can respond more quickly and flexibly.

There can be a clash of cultures between federal laboratories and private businesses. There is a 'tribalism of federal labs'; it's manifested in the 'not invented here' and 'we need to compete for more programs and funding' dynamics. There can also be a culture of purely academic-type research, with virtually no connection to the need to add value and solve real problems. Federal laboratories are also not generally geared to do quick turnarounds; they are not adept at the speed and efficiency of entrepreneurs. It's important that labs look for people with both sets of characteristics. An outside panel of both business and academic resources can be valuable to achieve this.

In addition, organizations like the Patuxent Partnership (in Maryland) are very helpful in bringing the two cultures together. These organizations are 'organic networks' and serve an important function. They offer an open meeting place and 'marketplace of ideas' where people come together who would not normally have occasion to do so, share perspectives and collaborate on partnership initiatives.

The major barriers of labs working more with business, particularly small businesses are time and money. Federal labs' rhetoric is that they work with small businesses; the fact is they don't have sufficient people and dedicated funds to do so. We need to back the efforts with funding. There should be some small business venture funds to support small business partnering with labs.

I believe that federal labs partnering with business is part of the federal laboratory mission. If it is not part of the mission, let's stop talking about it as if it were. If it is part of the mission, let's 'put our money where our mouth is' and make funds and people available to pursue small innovative business partnerships. While this type of activity may not be considered part of the labs' primary mission, it certainly enhances, supports and sustains the direct mission – it is 'mission enabling'.

HIGHLIGHTS OF LESSONS LEARNED

The following summarizes some “lessons learned” for representatives of federal laboratories, federal agencies and state economic development organizations/agencies, and policy makers:

- **Federal laboratory programs would benefit from better articulation of Congressional intent with regard to federal lab participation in business assistance and economic development.** Although intent is implied in legislation, it is not clearly defined nor understood at federal agencies and laboratories. If Congressional intent is to promote economic development goals through federal laboratory activities then legislators may need to better articulate this goal to agencies. Moreover, this intent will need to be supported by dedicated and consistent funding.
- **Leadership from agencies and laboratory directors is key to setting a tone that supports economic development activities within the laboratory.** Support “from the top” for economic development varies considerably among agencies and labs, but almost always appears to be a factor in labs that exhibit effective economic development programs.
- **Business assistance, now a peripheral activity for most labs, can be indispensable to maximizing the effectiveness of the federal lab’s technology transfer mission.** Policy makers and agency administrators may want to review the history of programs such as DOE’s former TPP program and programs with similar intent at particular labs, and consider the feasibility and value of such programs. Business and technical assistance programs may be useful in achieving technology transfer goals. They can add value to technology transfer, help develop supplier chains available to labs, and promote other mission-oriented goals of the labs.
- **There is wide recognition that the “valley of death” – the gap between laboratory research and its application in the private sector – is a major obstacle to maximizing economic development outcomes of federally funded R&D.⁴⁵** Despite decades of federal policies and programs that have addressed technology transfer, questions remain about how to bridge the gap and the extent of federal government responsibility in bridging the gap. Because of the pervasiveness of this issue, policy makers may want to consider reviewing a range of possible options, in greater depth than done to date, and may want to test some of those options.
- **Programs such as the Mentor Protégé Program and partnering conducted by SNL and others designed to encourage partnering may help strengthen suppliers,**

⁴⁵ For more explanation on “valley of death” see pages 72-73.

benefiting both communities and federal labs. Evidence suggests that there may be benefits to expanding these programs to other labs.

- **A number of labs have developed research parks, and even more have developed small business incubators at or near laboratory facilities.** Proximity of firms in the parks and incubators to labs, however, is often not sufficient to insure linkages; representatives of labs and economic development organizations should facilitate these linkages. The synergy created can be beneficial to the firms and the laboratories.
- **By sponsoring and/or participating in entrepreneurial, seed and venture capital, and business networking events, federal laboratories add credibility and visibility to these events.** Sponsoring, participating in, and contributing in other ways to networking and venture capital events promotes technology transfer and helps develop supplier chains.
- **Entrepreneurial leave programs are potentially valuable mechanisms for promoting commercial use of laboratory technologies and know how, but are limited and receive mixed support from most labs.** Entrepreneurial leave programs should be studied to determine return-on-investment to the labs and economic contribution to the communities and states. If validated through research, policy makers should encourage agencies now conducting technology transfer to institute these programs and encourage expansion of existing ones.
- **Education programs are popular among lab managers and employees as well as the communities in which the labs are located.** Programs aimed at encouraging young students to pursue careers in math and science, lab input to technical curricula at academic institutions, and other activities help grow a future pool of scientists and engineers available to public and private sectors.
- **Information dissemination activities of labs, once limited to publicizing scientific and technological research at the labs, now often cover broad areas of interest to technology firms.** These areas include procurement, SBIR/STTR, seed/venture capital linkages, and business networking activities. Dissemination through the Internet has made it possible for laboratories to reach larger and more diversified audiences. Internet-based activities also can be used to provide on-line tutorials, facilitate third-party evaluations, and promote technology transfer. Expanded use of Internet-based activities by labs should be explored and encouraged.
- **In near future years, labs may experience difficulties in filling technical and scientific positions.** Workforce development activities at labs now tend to be short-lived and focus on reemployment of laid-off lab workers. Lab representatives, economic developers, and education and training specialists should examine future supply and demand for lab employment and coordinate their efforts to insure a continuing supply of skilled workers. Policy makers should also take notice of a potential short fall in skilled lab workers and consider policies aimed at filling the gap.

- **Federal lab representatives are confused about allowable work with SBIR firms.**
Representatives of federal labs and intermediary organizations involved in the study felt it would be helpful for the SBA to work with SBIR sponsoring agencies to clarify the conditions for firms to work with labs and to clearly communicate the waiver process to firms, intermediary organizations, and federal laboratories.

- **Congressional funding cuts have adversely impacted business assistance and economic development activities disproportionate to other activities in some labs.**
These activities tend to be “the first to go” when there are budget reductions. Moreover, inconsistent and uncertain funding of lab activities that involve private sector firms can fuel further reluctance of firms to work with federal labs.

APPENDIX

**NATIONAL ADVISORY GROUP
MEMBERS**

(in alphabetical order)

Dan Brand, former Chair, Federal Laboratory Consortium and former Associate Director, National Center for Toxicological Research, U.S. Food and Drug Administration

Jay Brandinger, President, JA Brand Associates, Inc., and former Director, New Jersey Science and Technology Commission

Victor Chavez, Manager, Regional and Small Business Partnering, Sandia National Laboratories, New Mexico

Marianne Clarke, Director, Washington Office, Battelle Technology Partnership Practice

Beatrice Droke, Technology Development Officer, U.S. Food and Drug Administration

Cynthia Gonsalves, Technology Transfer Program Manager, Office of Technology Transition, U.S. Department of Defense

Steve Ferguson, Deputy Director, Division of Technology Development and Transfer, Office of Technology Transfer, National Institutes of Health

Jeffrey Finkle, President and CEO, International Economic Development

Robert Heard, President, National Association of Seed and Venture Funds

Philip Singerman, Executive Director, Maryland Technology Development Corporation, and former Assistant Secretary, U.S. Economic Development Administration

**FEDERAL LABORATORY-BASED ECONOMIC DEVELOPMENT
ACTIVITIES**

**Sponsored by
Office of Technology Policy, U.S. Department of Commerce**

Laboratory: _____
 Your Name: _____
 Position: _____
 Mailing Add: _____

 Telephone: _____ Fax: _____
 Email: _____

Please answer as many questions as possible. Innovation Associates will not publicly attribute answers to individual laboratories if you so indicate (see question #23.) If you need more room to answer a question, please attach a separate sheet and note the question number. The questionnaire should take about 20 minutes to complete. Upon completion, please send to: **OTP Questionnaire, P.O. Box 2893, Reston, VA, 20195-2893.**

1. What agency and department funds the laboratory? _____

2. What category describes the laboratory?
 - Government-owned, government-operated
 - Government-owned, contract-operated
 - Administered by university
 - Administered by non-profit organization
 - Administered by private industry
 - Other
Please specify: _____

3. What was the laboratory's operating budget for FY 01?
 - \$1-50 million
 - \$51-100 million
 - \$101-250 million
 - \$251-500 million
 - \$501 million +

4. In what type of area is the laboratory located? [Check all applicable.]
 - Rural area
 - Military base
 - Empowerment/enterprise zone or other government designated area to promote business

5. Does the laboratory conduct or participate in economic development activities?
 Yes No

If no, why not? [Check all applicable.]

- Not a priority
- No staff/funding
- Not appropriate because of classified or non-transferable work
- Other

Please specify: _____

[Please proceed to question #9.]

6. Does the same laboratory office that administers technology transfer activities also administer economic development and related activities?
 Yes No

If yes, what office?

If no:

a. What office administers economic development and related activities?

b. What office administers technology transfer activities?

7. What economic development activities has the laboratory conducted or participated in within the past five years? [Check all applicable.]

- a. Participated in meetings with local/state/region economic or technology development organizations
- b. Participated in meetings with local business and industry associations
- c. Contributed to economic development planning at local or state levels
- d. Initiated or participated in development of small business incubator and/or research park
- e. Provided services to businesses in incubator and/or research park
- f. Sponsored or participated in seed/venture capital activities
- g. Sponsored or participated in other business networking activities
- h. Assisted local/state government with technical problems
- i. Loaned laboratory personnel to state or local government
- j. Served as a resource for organizations participating in:
 - Small Business Innovation Research (SBIR) program
 - Small Business Technology Transfer Research (STTR) program
 - Experimental Program to Stimulate Competitive Research
 - Experimental Program to Stimulate Competitive Technology
 - Manufacturing Extension Partnerships
- k. Other

Please specify: _____

8. For each item checked in question #7, please very briefly describe the economic development activity and outcome of the activity. [Please reference the letter(s) in question #7.]

9. In what ways has the laboratory assisted businesses and industries during the past five years? [Check all applicable.]

- Issued Cooperative R&D Agreements or Space Act Agreements
- Issued patent/technology license agreements
- Conducted "work for others"
- Provided consulting by scientific or technical personnel
- Provided technical assistance
- Conducted testing
- Performed demonstrations
- Participated in consortia
- Made available laboratory facilities
- Hosted tours
- Exchanged personnel
- Sponsored/participated in SBIR/STTR activities
- Conducted small business outreach
- Assisted business through intermediaries
- Formed laboratory industrial advisory committee
- Sponsored workshops and conferences for business and industry
- Disseminated technical information
- Other

Please specify: _____

10. Approximately what percent of the assistance cited in question #9 is conducted with businesses and industries located in:

(Total should equal 100%.)

- _____ % Community (in which the lab is located)
- _____ % State (in which the lab is located)
- _____ % Region (bordering states, not including state in which lab is located)
- _____ % Other states
- _____ % International

11. Approximately what percent of the businesses and industries that received assistance were small businesses (under 500 employees)? _____ %

12. What activities has the laboratory conducted or participated in with universities and other academic institutions during the past five years? [Check all applicable.]
- None [Please proceed to #14.]
 - Conducted cooperative R&D agreements
 - Conducted educational partnership agreements
 - Conducted partnership intermediary agreements
 - Sponsored internship programs
 - Contributed to curriculum development
 - Provided students/professors access to laboratory facilities
 - Conducted lectures or taught courses by laboratory personnel
 - Involved in development of, or provided services to university incubator or research park
 - Other
Please specify: _____
13. What portion of the activities in question #12 were conducted with universities and other academic institutions in the state in which the lab is located?
- All
 - Majority
 - Some
 - None
14. What K-12 educational activities did the laboratory conduct or participate in during the past five years? [Check all applicable.]
- None
 - Conducted lectures or demonstrations in schools
 - Sponsored or participated in “science camps” and similar activities
 - Sponsored or participated in science fairs or competitions
 - Conducted tours for students or teachers
 - Other
Please specify: _____
15. What workforce development activities has the laboratory conducted or participated in during the past five years? [Check all applicable.]
- None
 - Sponsored/participated in high-tech job fair
 - Conducted career counseling or workshops for displaced lab workers
 - Worked with local/state government to develop workforce strategies
 - Contributed to specialized training for local residents/businesses to upgrade skills
 - Other
Please specify: _____

16. What laboratory activities not already addressed have contributed to the economic development of the community, state, or region in which the laboratory is located?

- a. _____
- b. _____
- c. _____

17. Very briefly describe any obstacles encountered in conducting economic development and related activities.

18. Are there federal government policies that hamper the laboratory's ability to conduct economic development and related activities?

- Yes No

If yes, please describe. [Please be as specific as possible.]

19. What federal policy changes could help the laboratory conduct or participate in economic development, university collaboration, and assistance to business and industry? [Please be as specific as possible.]

20. Are there state or local policies that hamper the laboratory's ability to conduct economic development and related activities?

- Yes No

If yes, please describe. [Please be as specific as possible.]

21. Has the laboratory experienced budget cuts in the past five years?

- Yes No

If yes, have these cuts affected the laboratory's ability to provide assistance to business and industry or perform economic development services?

- Yes
 No

22. Please write any additional comments here.

23. Are there any answers that should not be publicly attributed to the laboratory? [Please check the question number below.]

- | | | | | | |
|----------------------------|----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| <input type="checkbox"/> 1 | <input type="checkbox"/> 5 | <input type="checkbox"/> 9 | <input type="checkbox"/> 13 | <input type="checkbox"/> 17 | <input type="checkbox"/> 21 |
| <input type="checkbox"/> 2 | <input type="checkbox"/> 6 | <input type="checkbox"/> 10 | <input type="checkbox"/> 14 | <input type="checkbox"/> 18 | <input type="checkbox"/> 22 |
| <input type="checkbox"/> 3 | <input type="checkbox"/> 7 | <input type="checkbox"/> 11 | <input type="checkbox"/> 15 | <input type="checkbox"/> 19 | |
| <input type="checkbox"/> 4 | <input type="checkbox"/> 8 | <input type="checkbox"/> 12 | <input type="checkbox"/> 16 | <input type="checkbox"/> 20 | |
- do not publicly attribute any answers to the laboratory

24. Would the laboratory like to receive the results of this questionnaire?

- Yes
 No

Phillip J. Bond
Under Secretary of Commerce for Technology

Benjamin H. Wu
Deputy Under Secretary for Technology

Bruce P. Mehlman
Assistant Secretary for Technology Policy

Chris S. Israel
Deputy Assistant Secretary for Technology Policy



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